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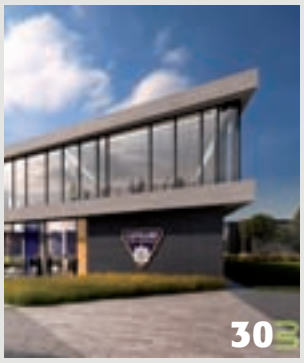
IWMA International Water Mist Association

CONTENTS



Front cover
Darren Small: www.smallphoto.co.uk

Editor's comment

Welcome to this our 100th issue of Industrial Fire Journal and my, what a bumper issue it is too, coinciding quite fortuitously with the biggest fire exhibition in the world, Interschutz, taking place 8-13 June in Hanover, Germany.

We will of course be there (hall 27, stand M26) to sift through all the latest developments in fire safety and bring to you the technology and practices that can truly make a difference in creating safer working environments in high-hazard facilities.

IFJ has a long history of keeping its finger on the pulse of fire safety trends and this issue is no different. One such significant development is a public consultation by the European Chemicals Agency (ECHA) on a proposal to restrict PFOA-related substances that could conceivably result in a ban on the use of fluorinated foams (ie aqueous film-forming foams) in the European Union.

As ably argued by Tom Cortina in this issue ('A step too far?' p44), fluorinated foams are the most effective agents currently available to protect life and property, and such a restriction would have an extremely negative impact on fire safety in Europe. The Fire Fighting Foam Coalition is urging all those that could potentially be affected by such a ban (both manufacturers and end users) to submit their comments to ECHA prior to 17 June 2015.

Jose Maria Sanchez de Muniain, Editor.

A SHOCK TO THE SYSTEM

The US Chemical Safety Board has released a safety video detailing key lessons from the release of 14 tonnes of anhydrous ammonia that occurred at Millard Refrigerated Services on August 23, 2010.

The accident resulted in over 150 exposures to offsite workers, 30 of which were hospitalized – four in an intensive care unit.

The seven-minute video *Shock to the System* includes a detailed 3D animation of the events that led up the resulting ammonia release. The video is based on the CSB's recent safety bulletin, Key Lessons for Preventing Hydraulic Shock in Industrial Refrigeration Systems.

CSB Investigator Tyler said: "The CSB's animation details how the pressure surge ruptured the evaporator piping manifold inside one of the freezers causing a roof-mounted 12-inch suction pipe to catastrophically fail, resulting in the release of more than 32,000 pounds of anhydrous ammonia from its associated 12-inch piping on the roof of the facility."

The release resulted in injuries to a Millard employee when he fell while attempting to escape from a crane after it became engulfed in the traveling ammonia cloud. The large cloud travelled a quarter mile from the facility south toward an area where 800 contractors were working outdoors at a clean-up site for the Deepwater Horizon oil spill. A total of 152 offsite workers and ship crew members reported symptomatic illnesses from ammonia exposure. Thirty-two of the offsite workers required hospitalisation, four of them in an intensive care unit.

LNG MASTERPLAN WELCOMED

The results of a new LNG emergency and incident response study have been hailed as a big step forward in LNG safety for Europe.

The LNG Masterplan for Rhine-Main-Danube provides guidance for emergency response organisations in how to prepare themselves to manage credible LNG incidents on inland navigation along the Rhine-Main-Danube corridor.

The report was co-financed by the TEN-T Programme of the European Union and is part of the LNG Masterplan for Rhine-Main-Danube project.

Falck RISC and the Unified Fire Department co-authored the report and they were chosen due to their specific knowledge of LNG technology and incident preparedness in inland navigation.

The document highlights that the recent introduction of international carriage of LNG along European inland waterways is presenting new challenges for emergency services and port authorities.

LNG is a cryogenic gas that is stored at a temperature of -162ºC, diminishing the volume about 600 times compared to the size of its original gas volume. It requires specific handling procedures as well as a different approach in incident response.

Emergency response organisations in the entire Rhine-Main-Danube area, ranging from Rotterdam to Constanza, are expected to benefit from this study.

It can be downloaded from the LNG Masterplan website in English, German, French and Dutch: http://www.lngmasterplan.eu/masterplan/activities/16-masterplan/97-technical-evidence-safety-and-risk-assessment.

PASSIVE PROTECTION HARMONISED

A European Task Group has been established in response to a draft mandate from the European Commission on fire protective products, which calls for the creation of harmonised European product standards for a number of product groups.

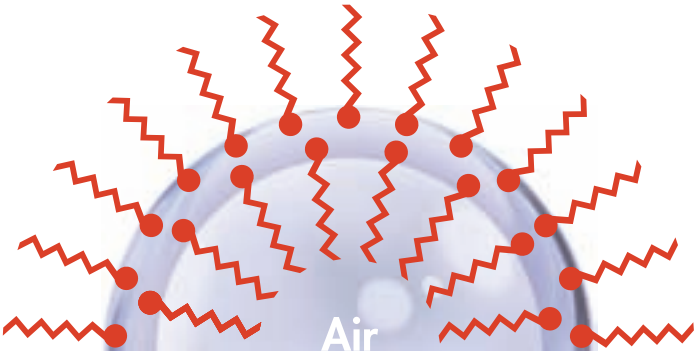
The Task Group will develop a framework to enable CEN to make a comprehensive response to the Commission and to provide a draft list of product standards for CEN to prepare.

The draft mandate calls for harmonised European product standards to be developed for reactive coatings for the protection of structural steel; fire protective boards, sprays and renders for the protection of structural steel and for other end uses; and fire stopping and fire sealing products for penetration seals and linear joint seals.

Explaining the crucial role of the new Task Group, lead member Niall Rowan said: "Under the current system it is not mandatory to have CE marking for such products. If the products are covered by a harmonised European Product Standard, then CE marking will become mandatory, which is a long term goal of the European Association for Passive Fire Protection. This is why the creation of the Task Group is so important."

The EAPFP has long campaigned to raise the standard of fire safety in buildings across Europe, and considers that mandatory CE marking for all PFP products is essential to ensure quality and consistency and to avoid market distortion.

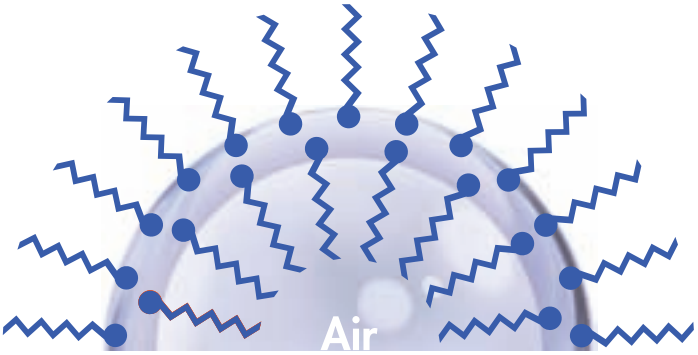
Fatal Attraction



Fluorine-free foam bubble

F3 Foam **attracts** hydrocarbon fuels

Hydrocarbon surfactant
(Hydrocarbon tails are fuel-loving)



Fluorinated foam bubble

AFFF Foam **repels** hydrocarbon fuels

Fluorosurfactant
(Fluorocarbon tails are fuel-hating)

FORCEFUL F3 APPLICATION:

- Foam attracts fuel
- Foam becomes flammable
- Foam has reduced performance
- Foam use is increased

Need proof? See F3 foams on fire:

FORCEFUL AFFF APPLICATION:

- Foam repels fuel
- Foam is NOT flammable
- Foam has superior performance
- Foam use is reduced

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NEW RULES FOR FIRE EXTINGUISHERS ARE A 'LANDMARK FOR SUSTAINABILITY'

Regulations dealing with the procedures and technical requirements for refilling portable fire extinguishers have been revised in the UK in a 'landmark for common sense and sustainability for our planet's resources'.

The revised version of BS5306 Part 9 is believed to be the first in Europe to tackle the problems of sustainability. It now allows for the re-use of fire fighting powder following extended service providing correct procedures are employed. It also allows the use of generic refills and parts providing they are correctly verified.

The Independent Fire Engineering & Distributors Association (IFEDA) has warmly welcomed the publication of the revised edition, pointing out that the previous standard made it almost impossible for any service technician to stock the myriad of components required to refill equipment at customers' premises.

The new standard allows the use of 'verified alternatives' as well as the re-use of chemical dry powder. ''Reputable fire protection companies have always sought to maintain existing equipment rather than the scandalous waste of throwing away perfectly good fire-fighting medium and equipment when a replacement is required and at the five yearly extended services. There is no longer any excuse for this environmentally bad practice and I believe this revision goes a long way in reversing a trend,'' commented Robert Catanzaro, member of the working team which spent over two years undertaking the revision.

BETTER PREPARED FOR FIRES

Worcester Polytechnic has published an introduction to how decision-makers can help their organisations avoid costly losses due to fire and explosions.

The report, *'Avoiding costly losses due to fire: who's engineering the solutions? What are their qualifications?'* has been written by Professor Milosh Puchovsky, director of corporate and professional education in the Department of Fire Protection Engineering at Worcester Polytechnic Institute, Massachusetts, US. As well as addressing misconceptions about good fire safety practices, the paper introduces the profession of fire protection engineering and the important roles these trained engineers take on. The paper is designed to educate readers on how they can put their organisations in more advantageous positions with respect to fire and explosion threats that put people, property, business continuity, the environment and cultural heritage at risk.

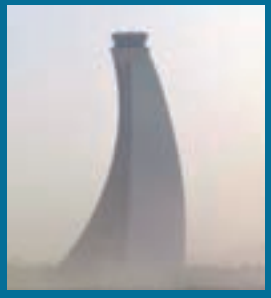
Download the paper at: www.wpi.edu/academics/fpe.html.

INSTALLATION NEWS

A Pierce Velocity pumper has arrived at its new home in the Jack Daniel Distillery in Lynchburg, Tennessee.

The industrial-strength apparatus from Pierce is the size of a typical aerial vehicle and is custom-built to meet the unique emergency response challenges of the Jack Daniel Distillery with its three fire stations and 34 firefighters. The vehicle's graphics feature Jack Daniel's signature colour scheme of black with white and gold accents. The apparatus is built on the Pierce Velocity chassis with a 600-horsepower engine. It sports six 6.35cm rear discharges that interface with an elaborate standpipe system installed throughout the Jack Daniel distillery, bottling facilities, and warehousing area. The vehicle's firefighting system also features a 11,356lpm pump, a Husky 300 foam system, a 7,570l foam tank, a 1,892l water tank, a 907kg dry-chemical system, and a 20cm Hydrochem deluge gun and nozzle.

A new jet fuel depot at Abu Dhabi International Airport is being protected by a UL864-approved system supplied by Advanced.



The Axis AX system covers control rooms, office buildings, substations and operational areas. It comprises five Axis AX 4-loop panels, BACnet BMS integration and over 300 individual components and devices.

The Axis AX panels supplied by Advanced are networked together in a fault-tolerant, ring network and then interfaced to a programmable logic circuit (PLC) using redundant communication. Optical smoke detectors were specified in the main buildings, while flame and gas detectors are being used in operational areas, interfacing directly with the PLC. The system was supplied by Telectron, Advanced's partner in Abu Dhabi.

Rosenbauer has installed fixed fire extinguishing systems at three sorting and recycling facilities of the German environmental services company Tönsmeier.

The plants are located at Porta Westfalica and Paderborn in North Rhine Westphalia, and Oppin in Saxony-Anhalt.

A total of eight systems have been installed, each consisting of a combination of monitors and infrared detectors. The monitors safeguard the areas where waste and refuse is delivered and where baled lightweight packaging and other recycling materials are stored. Tönsmeier's new systems are linked to infrared temperature detectors that monitor the areas 24/7. The detection of hotspots results in the automatic activation of the foam proportioners and the flow of foam to the source of the fire.

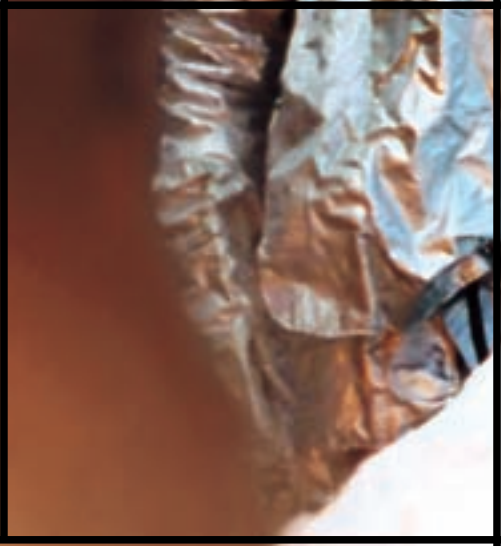
The central system consists of pressure boosters, foam proportioning systems and related tanks, as well as various valve stations. Water tanks with capacities of up to 150,000 litres have been built for the extinguishing water supply. It is the first time that a Rosenbauer RM65 turret, which has a maximum output of 6,000l/min, has been used for this type of risk.

Essex County Fire & Rescue Service in the UK has opened a new state-of-the-art command and control centre that is protected by Wagner's Oxyreduct fire prevention system.

The multi-million pound development, which is an extension to the existing Fire Service HQ based at Kelvedon Park, Witham, provides a new 999 call centre, together with training and admin facilities for over 200 staff. "OxyReduct is providing the ultimate form of fire prevention for a new server room that is at the heart of the development," said John White, ICT communications manager for ECFRS, who added: "The new server facility runs all of the software for the integrated command and control of the Service as well as a wide-area network for the region."





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Bavaria Fire Fighting Solutions has launched a portable lightweight mixing unit that enables fire fighters to tackle fires with a choice of either foam or water mist.

At the heart of the Powercafs is a multifunctional (patented) mixing chamber that generates wet or dry foam solution as well as acting as the metering chamber for water and compressed air.

The new system doesn't use premix foam solution – pure water and foam concentrate are fed separately into the cylinder – which avoids potential corrosion as a result of premix.

The backpack system is available in 6- and 10-litre versions, and according to Bavaria the system is extremely easy to use.

The components of the system (foam concentrate cartridge, 300-bar compressed air bottle, 18-bar pressure regulator, cylinder with mixing-chamber, nozzle and hose) are all mounted on a solid anodised aluminium backplate, which ensures the system is lightweight and corrosion proof. A version with an integrated BA system is also being introduced.

Another unique aspect of the Powercafs is its weight. The larger version of the Powercafs comes in at only 22kg, which Bavaria believes is around 10kg less than its nearest competitor.

The powerful extinguisher is aimed at both municipal and industrial markets, and is ideally suited for Class B fires such as liquid running fires.

FFE has been awarded a UK patent for innovative light cancellation technology used in its Fireray range of infrared beam smoke detectors.

The technology works by actively monitoring ambient light levels on the detector and 'subtracting' them away from the 'real' signal. This allows the detector to work under the most difficult light conditions, including sunlight, sodium lamps and fluorescent lighting.

"It's no exaggeration to say that this technology is unique," commented FFE research engineer Dr Daniel Waldron. "No-one else offers ambient light cancellation technology that allows the beam to cope with all manner of challenging light conditions, both natural and man-made. This means fewer false alarms and false readings."

By using infrared beams, Fireray beam detectors can identify smoke over much larger areas than traditional fire detection devices, making them perfectly suited for large indoor spaces such as warehouses, sports arenas and aircraft hangars.

Pentair's Thermal Building Solutions division has launched a new warranty programme for its Pyrotenax-branded mineral-insulated (MI) wiring cables.

Under the new warranty scheme, Pentair now offers 30 years on its MI cable range for fire-rated wiring applications for customers in Europe and the Middle East. Installed in areas where high resistance to fire is needed, these cables have been specifically designed to ensure electrical power is available in these extreme environments, and have been certified to many regulatory standards.

To benefit from this exceptional warranty scheme, the installation must be registered online to confirm that the product has been fitted and commissioned according to Pentair's instructions.

A portable methane detector that identifies leaks at distances up to 30m has been successfully trialed in a number of cities in Italy.

The Atex-certified Lasermethane Mini was tested by a leading Italian gas distributor over two years in a number of cities and under various operating environments.

The trial confirmed that the Crowcon-manufactured detector could monitor leaks even in difficult urban environments.

As well as detection in confined spaces, other remote applications include the monitoring of above-ground riser pipes which carry gas to consumer premises, and checking valves, fittings and pipes inside pressure regulating stations.

The Lasermethane Mini uses laser absorption spectroscopy to measure methane density and presents the readings in numerical and graphical formats on a clear backlit display.

Tyco Fire Protection Products has introduced conventional and addressable visual alarm devices (VADs) compliant with the latest EN54-23 standard to its Fireclass portfolio of fire detection technology.

According to Tyco, the Fireclass LX range of EN54-23-compliant VADs has been designed with the system engineer, installer and end user in mind. With an emphasis on power management and consumption, the design delivers the minimum illumination level of 0.4 lux required by EN54-23.

Other features include switches to reduce current consumption from 1Hz to 0.5Hz, and a coverage selector which enables the installer to select a pre-set area of either 7.5m or 5m. This benefits end users by reducing the power required to operate the VAD and avoids wasting current if the area covered is smaller than the designed size of the component.

"The biggest challenge for the industry in complying with the new standard is the substantial increase in power and subsequent current consumption to deliver the required illumination level of 0.4 lux," explained Eric Tassé, Fireclass product management, Tyco Fire Protection Products.

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A FORUM FOR SAFETY

An industrial fire conference has resulted in calls for a national forum where COMAH operators, regulators, emergency responders and service providers can drive forward consistency in major incident response, reports Jose Sanchez.

The one-day roundtable *Industrial Fire – Risks, Requirements & Resources* that took place in London ended with consensus that a forum was necessary to drive forward a nationally consistent approach to major incidents at high-hazard facilities operating under COMAH (Control of Major Hazards) regulations.

Industry forums do exist in the UK – the COMAH Strategic Forum is attended by COMAH operators and the Health and Safety Executive for example, and there are regional groups attended by municipal responders and local COMAH operators. However, a forum for operators, emergency services and regulators to come together on a national basis does not exist. Such a forum could play a key part in driving forward best practice on a national basis, and in particular address the issue of implementing a standard emergency response for similar industrial incidents – as opposed to different levels of locally-agreed response.

COMAH is a goal-setting regime that places the responsibility on the operator to manage the risks on their site. Regulations split sites into upper and lower establishments depending on the quantities of certain substances. In the UK there are around 900 COMAH sites, of which 350 are in the upper tier, and which result in around four major reportable accidents per year.

The regulations are based on three principles; identification of a site; control measures to manage risk; and mitigation/preparation for incidents when things go wrong, including planning arrangements.

New COMAH regulations come into play on June 1st this year. Most of the requirements around emergency planning are staying the same but some terminology is changing. 'Top tier' sites become 'upper tier' sites; 'onsite emergency plans' become 'internal emergency plans'; 'offsite emergency plans' are now 'external emergency plans'.

In terms of what's new from June 1st: some establishments will have an extra year to prepare their internal and external emergency plans. In addition, there are extra specific requirements on what external emergency plans should contain, including environmental impact and impact on neighbouring sites.

A major change regards the role of the UK regulator, the HSE, which will no longer serve as consultant for the emergency plans and instead will restrict itself to the checking of compliance through inspections.

In another change, designated authorities will have a new specific duty to cooperate in testing external emergency plans in conjunction with upper tier COMAH sites.

Also new is a requirement for certain information regarding sites – both upper tier and, for the first time, lower tier – and their hazards to be made permanently and electronically available to the public. Both tiers are now required to provide general information about how the public would be warned in the event of an incident and; if necessary, adequate information about the appropriate behavioural response.

Industry has not reacted negatively to the latest round of changes to COMAH and indeed some have voiced their support for tougher regulations.

Depending on where they are on their cultural journey operators look at managing their risk for one of three reasons; they have to; they know it makes sense; or they know it is the right thing to do. COMAH provides a useful – if tough – framework for those operators at the start of their cultural journey.

The COMAH framework is completely different to the prescriptive model used in the USA where operators demonstrate compliance by ticking boxes in a checklist – an automatic defence when things go wrong. Under COMAH operators have to demonstrate that all steps practicable have been taken, something that is difficult to do because after an event – and with the benefit of hindsight – it is always possible to find something that wasn't done.

Nevertheless COMAH's tough stance is widely respected by operators particularly because increasingly the trend is for major hazard events to potentially also become enterprise-ending events (EEVs).

A misconception around COMAH that is particularly applicable to small operators who move to the upper tier is that it is expensive. This is usually because on moving to the upper tier such sites are often inspected for the first time, revealing a number of duty-of-care issues that wouldn't have seen the light of day if it weren't for COMAH.

The UK's fire and rescue services are currently operating in a changing environment. Scotland has experienced reform with all of its eight regional brigades amalgamating into one in 2013. In 1996, 22 brigades became three in Wales. The future shape of English fire and rescue services is to some degree dependent on political will.

In contrast with operators and insurers, in the UK there is currently no forum for fire responders working within high hazard clusters to come together and discuss how to provide a consistent approach to COMAH and major hazard incidents. Cuts to funding for municipal fire brigades are not applied consistently, which means some brigades are experiencing deeper cuts than others, leading to different levels of service delivery. With these cuts likely to continue over the coming years, now more than ever it is important for all stakeholders to sit round a table and come up with a solution to a common aim.

Industrial Fire – Risks, Requirements & Resources took place on the 16th of April at the Royal Overseas League, London, UK and was organised by Cityforum and supported by Industrial Fire Journal.

FIREX INTERNATIONAL, 16-18 JUNE, EXCEL LONDON, UK

With over 100 exhibitors currently confirmed across the show floor, Firex International will showcase all the latest technology, solutions and knowledge to ensure life safety from across the industry.

Developments at this year's show include the Expertise & Guidance Theatre, offering a free educational programme across the three days covering key topics including fire doors, smart hotel solutions, IP systems and fire risk management, amongst others. Highlights include Nick Coombe, fire safety regulation manager at London Fire Brigade who will run a session on 'Enforcement and the Fire Safety Order – is it working?' exploring the lessons learned from 10 years on and also asking if there needs to be any changes made to this going forward.

Lance Ruetimann, senior manager industry affairs within the Building Technologies Division at Siemens Switzerland will present: 'Evolving Fire Safety towards Holistic Safety', discussing fire safety and the convergence of other safety measures along with the importance of evolving fire detection and alarm systems into danger detection and management systems.

The Fire Industry Association's Graham Simons will also give an update on construction products regulations.

Other exciting features at this year's Firex include the LPCB Red Book Pavilion; visitors to the show can access information free of charge about products and services that have certification from this well-known certification provider.

The Fire Protection Association info zone will provide a place for visitors to relax and network with free refreshments in addition to a wide range of presentations and seminars delivered by leading experts.

This year Firex is co-located alongside IFSEC International which re-unites the fire and security industries in one location.

For more information visit: http://www.firex.co.uk/

THIRD INTERNATIONAL TALL BUILDING FIRE SAFETY NETWORK CONFERENCE, JULY 8-10, GREENWICH UNIVERSITY, LONDON, UK

With currently more than 6,400 buildings higher than 100 metres in cities around the globe, and all of them at risk from fire, greater knowledge of tall buildings is essential. The opportunity to network with professionals from around the world who agree with this statement is also vital.

With three days of presentations delivered by a line up of international speakers, all experts in their chosen disciplines, the Tall Buildings Fire Safety Conference 2015 is an essential event in the diaries of any professional whose role encompasses the protection of people, property and assets from the devastating effects of fire.

The conference the programme will focus on challenges and solutions for tall buildings: management of fire safety, fire detection and alarm, fire escape and evacuation, fire containment and compartmentation, business continuity and resilience, security and terrorism events, and firefighting.

The keynote address is 'Fire and life safety in this the new era of the supertall building' by Peter Weismantle, director of Supertall Building Technology, Adrian Smith & Gordon Gill Architecture, Chicago, US.

A gala dinner in the magnificent surroundings of the Painted Hall will mark the end of the second day of conference. Diners will not only enjoy the soaring ambience of this beautiful hall and fine food and wine, but will also have the pleasure of listening to Sir Ranulph Fiennes, the only man alive ever to have travelled around the Earth's circumpolar surface.

For more information visit: www.eventbrite.co.uk/e/3rd-international-tall-building-fire-safety-conference-tickets-15711739235.

THE NATIONAL FIRE PROTECTION ASSOCIATION CONFERENCE & EXPO, JUNE 22-25, MCCORMICK PLACE, CHICAGO, US

The NFPA Conference and Expo, widely regarded as the most comprehensive industry event for fire, electrical and building safety, will bring together thousands of professionals, from building managers and contractors to public fire service and enforcement agencies.

The annual conference features more than 125 education sessions across 11 tracks and hundreds of product displays featuring the industry's leading suppliers. The event is a unique opportunity to learn directly from industry experts, earn valuable continuing education units, evaluate products and stay current with technological advances.

Education session topics include the testing of drones in fire fighting, green buildings' impact on firefighter safety, fire protection in the wildland/urban interface and the future of cooking equipment technology to help reduce cooking fires.

The general session on Monday, June 22 features three quick disaster response keynotes, each speaker sharing their first-hand experience with horrific devastation, inadequate response, and resourceful solutions. This keynote session with a twist will be fast-paced, informative and inspirational.

In the conference's featured presentation Wednesday June 24, 'The

Lac-Mégantic railway disaster – a town destroyed and 47 killed; lessons learned,' experts will discuss this tragic train derailment in rural Quebec and resulting fatalities, highlighting how the incident provided valuable lessons for first responders and local officials.

For more information visit: www.nfpa.org/training/conference

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FROM 8-13 JUNE THIS YEAR THE WORLD'S LARGEST TRADE FAIR CENTRE HOSTS INTERSCHUTZ 2015, AND WITH 1,400 EXHIBITORS EXPECTED IN HANOVER, GERMANY IT LOOKS LIKE THIS YEAR'S FIRE EVENT WILL BE BREAKING RECORDS YET AGAIN.

Exhibition preview – something for everyone

PPE: fire, chemical and biological protection

DuPont Protection Technologies will be presenting its next-generation range of Nomex heat and flame protection as well as its Tyvek and Tychem chemical and biological apparel offerings.

The Nomex 3DP outershell fabric that was launched by DuPont in June 2014 provides extended escape time and gives extra seconds of wearer safety in situations where every second counts, while offering high comfort levels.

It comprises two layers of fabric woven together using a weaving structure named and patented by DuPont as 'Flux Technology'.

The inner layer consists of Kevlar with an outer layer of Nomex. With different thermal shrinkage patterns, each layer reacts differently to heat flux, triggering increased levels of insulation. When a heat flux hits the outer layer of Nomex the fibre reacts and thickens to increase the insulation barrier while the inner layer of Kevlar offers high mechanical strength, providing three-dimensional protection and giving extra seconds of safety.

More innovation comes in the form of a single layer garment that protects against chemical splash, flash fire and electric arc.

Tychem ThermoPro combines Tychem with Nomex to create a multi-hazard garment for use at a number of situations including road traffic and industrial incidents.

For those wanting a more hands-on experience the company will also be conducting burn demonstrations of garments made from the new 3DP fabrics using its Thermo-Man at the outdoor demonstration site. A dedicated burn test will demonstrate the capabilities of the new Tychem ThermoPro coverall.

Hall 12, stand E37

Looking for protective fabrics?

PBI will demonstrate the full range of its protective fabrics at Interschutz this year, including PBI Gold, PBI Matrix, PBI Max, Gemini XTL, PBI Triguard, Titan 1260 and Ibena Neo.

The company's specialist next-to-skin fabrics will also be on display, including the flame resistant, no melt, no drip economical moisture wicking base layer PBI BaseGuard.

All PBI fabrics are lightweight and strong and achieve a high standard of flame resistance. Because they do not become brittle, shrink or break open when exposed to flame and high temperatures the integrity of the internal layers of the garment is protected and the transfer of any radiant heat is slower, allowing more time for firefighters to escape to safety in a situation such as a flashover.

Hall 12, stand D47

Fire trucks – can you hear the roar of the new Panther?

On the 5,000m^2 company stand and the adjacent outdoor area, visitors will be unable to do anything but be fully immersed in 'Rosenbauer world' featuring no less than 28 vehicles with a further 15 on display at other stands and in operational demonstrations.

Rosenbauer will be revealing a new generation of its Panther ARFF crash tender onto the market.

The latest Panther 4x4 and 6x6 models make their debut during Interschutz but fans will have to wait a little longer for the 8x8 version which is due to be launched in 2017.

According to Rosenbauer's Gerda Königstorfer, the latest offering continues the same design ethos as its predecessor, which received numerous awards including the iF product design award 2006, the red dot design award 2006, and the International Design Excellence Award 2008.

Key features include an improved panorama view in the cab and a newly-developed FEM-optimized cabin cell that has been subjected to extensive crash testing. The instrumentation layout in the cockpit has also been rearranged to increase ease of use. "The extinguishing technology systems has been upgraded for the new Panther. Pumps, proportioning systems and monitors are further enhancing fire fighting performance of what is already the world's most powerful ARFF," said Gerda.

Also on display will be the entire aerial and turntable ladder program from Metz Aerials, including the world's longest aerial ladder both and an ultra-compact device with a very small turntable.

The international exhibition for fire prevention, disaster relief, rescue, safety and security takes place every five years and this year will be occupying five halls and an open air site.
Interschutz 2015 is headed for an all-time record in terms of international exhibitor participation. A total of 49 nations will be represented, and there will actually be more exhibitors from outside Germany than German exhibitors. The top 10 exhibiting nations apart from Germany are China, Italy, the USA, the UK, France, the Netherlands, Austria, India, Poland and the Czech Republic.
More than 125,000 attendees from all around the world are expected, with the lion's share of the foreign visitors coming from Germany's neighbours.
New to this year's event are Partner Country Days where delegations from Italy, France and Poland organise country-specific activities at their national pavilions. The program gets underway on day two of the fair (9 June) with Italian showcase, followed by France (11 June) and Poland (12 June).
In the open-air site there will be an array of spectacular demonstrations including the Toughest Fire Fighter Alive contest.
The protection of critical infrastructure in the event of disaster will be the key focus of Hall 12 as well as the open-air site, as well as the CRI!SE (Critical Infrastructure Event) conference.
A new conference stream on preventive fire protection will take place in hall 13.

One item from the extinguishing systems range that is sure to catch the eye is a new portable pump, which closes the gap in the performance range between 750l/min (Beaver) and 1,500l/min (Fox). Visitors will be also able to experience the monitor control system as well as practice operational scenarios with the Panther Tactic Simulator and the ERDS driving safety simulator.

Hall 13, stand A48
Hall 27, stand B58
FG, K06

The 35,000 Euro Extrication Challenge

Holmatro is holding a special six-day edition of the Holmatro Rescue Experience called *The €35,000 Extrication Challenge*.

Extrication teams from all over the world have signed up to this challenge to demonstrate their skills in realistic vehicle extrication scenarios using brand new vehicles. The three winning teams will be rewarded with fantastic prizes worth €35,000 (US$40,000) in total.

Each team will respond to a unique 20-minute vehicle extrication scenario using Holmatro rescue equipment. Before getting hands-on with their scenario, each team will receive Holmatro rescue equipment familiarisation training by Holmatro instructors, including a masterclass on practical cutting techniques.

A group of experienced international assessors from Australia, England, Germany and Ireland will supervise each scenario and determine the winners. Contestants will be judged on their performance in command and on their medical and technical skills.

The best overall team will receive a Holmatro rescue tool set worth €20,000 (US$23,000); the best technical team a set worth €10,000 (US$11,500); and the best team spirit a set worth €5,000 (US$5,700).

The Rescue Experience special edition will be broadcast live on the event website – keep an eye out on http://live.holmatro.com

FG, stand L12/3
Hall 26, stand H30

Experience the future of virtual training

Dutch virtual reality company Esemble will be present at two locations during Interschutz. On one stand Esemble will be partnering up with Falk Risc and Igloo Vision to give visitors the opportunity to immerse themselves for 15 minutes in an XVR 3D scenario using a six-metre dome.

An instructor will be demonstrating the spectacular visual and aural possibilities of the impressive Igloo for supporting specific training and teaching goals (numbers are limited so visitors are advised to prebook a slot).

At the XVR Simulation stand people will be invited to explore the XVR virtual reality software platform and learn about the latest innovations and insights in simulation technology.

Early visits will be rewarded with a traditional Dutch coffee break of delicious Dutch stroopwafels (caramel waffles) every day at 10.00am.

Hall 26, stand G27

Keep foams in proportion!

Firemiks AB will present several new products including a new compact and handy Firemiks for flowing 40-400lpm and with three selectable dosing rates 1%, 2% and 3%.

The Firemiks FM 400-1-2-3-PP-F is a user-friendly foam proportioning system for fixed installations.

What makes this proportioner especially user-friendly is that as a mechanical system driven only by water flow it requires no additional energy such as fuel or electricity. In fact, there is no need even for creating a sensible pressure balance.

Two volumetric parts are the main components of the new proportioner; a water motor and a piston pump, and using ball valves they enable the selection of admixture in 1% steps even during operation of the system.

As well as being easy to install, operate, maintain and test, the foam proportioner can be supplied with a dosing return valve to enable the testing of the system without consuming concentrate – which saves costs and is good for the environment.

A portable version is available with a carrying handle, plus a marine version in bronze. For even smaller proportioning, the FM 400-0,33-0,66-1-PP is also available with a selectable dosing rate of 0,33%, 0,66% and 1%.

Hall 13, stand F30

See better in the dark with a TIC

The K45 offers 240 by 180 IR resolution and incorporates Flir's flexible scene enhancement (FSX) technology to produce ultra-crisp thermal imagery. The newest member of FLIR's K-Series family will allow firefighters to see even better in total darkness or in smoke-filled rooms.

The FSX enhances thermal images through real-time digital processing inside the camera. The result is an ultra-sharp image that shows extraordinary structural, edge, and other instantly-recognizable detail.

An intuitive and simple three-button user interface lets the firefighter access all of the camera's controls, even while wearing heavy gloves.

The K-Series is also tough – it withstands a drop from two metres onto a concrete floor, is water resistant (IP67), and fully operational up to +260°C. It comes with a two-year warranty for the entirety of the camera and a ten-year warranty for the detector component.

Hall 12, stand G74

When conspicuity is essential – go lime

A full range of fully compliant and approved reflective tapes for fire garments will be highly visible on Orafol's stand – all to ensure firefighters stand out against the emergency scene background.

The latest tape to join the Orafol range is the FTP 2100 tape which is approved to EN 469:2005, ISO 14116:2008 and EN ISO 20471:2013. This tape is a highly engineered reflective tape that uses microprismatic technology and – as opposed to the grey glass bead tapes on the market – comes in a fashionable (and more striking) lime colour.

The smooth sealed surface of the tape can be easily wiped clean and has superior abrasion resistance to ensure that the reflective elements work under all fire scene conditions.

A range of materials for fire fighting trucks that are fully compliant to industry standards will also be on show.

Hall 12, stand F65

HANOVER EXHIBITION CENTRE

The Hanover fairground is the largest exhibition centre in the world with 496,000m^2 of covered indoor space, 58,000m^2 of open-air space, 27 halls and pavilions and a convention centre with 35 function rooms, glassed-in areas between halls, grassy areas and even a heliport. Two important sights on the fairground are the Hermes Tower (88.8 metres high) and the EXPO roof, the largest wooden roof in the world.

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ARFF futures with Oshkosh

Headlining Oshkosh's open-air site booth will be the unveiling of a new Oshkosh fire apparatus that has been engineered and built for international markets by subsidiary Pierce Manufacturing. Details of the new fire apparatus are still top secret so curious readers will have to wait to find out more!

''In addition to unveiling an all-new global municipal fire apparatus, we will be sharing details on the new twin-engine Oshkosh Striker 8x8, demonstrating the amazing Striker Simulator virtual reality training system, and showcasing an Oshkosh Striker 6x6 with the Snozzle HRET from Manchester International Airport. It's going to be special,'' said Jim Johnson, Oshkosh Corporation executive vice president and president, fire and emergency.

Detailed drawings, design engineering and ARFF experts will be on hand to introduce the much-anticipated new Oshkosh Striker 8x8 configuration. Among the most powerful firefighting trucks on the planet, the Striker 8x8 will offer a range of twin-engine power plant options for unmatched vehicle performance and firefighting capabilities. The cab will set the new industry standard for ergonomics, visibility, comfort and safety features on an 8x8 ARFF vehicle.

The new Oshkosh Striker Simulator virtual reality training system will be set up for hands-on demonstrations. Already on duty at Chicago's O'Hare International Airport, the Striker Simulator system is engineered to depict a nearly endless array of training scenarios for aircraft rescue and fire fighting organizations.

According to Oshkosh the system delivers a giant leap forward in realism, with actual Striker vehicle cockpit components and controls along with a series of widescreen video monitors.

FG, stand M06/3

Win an ATEX lantern with Peli Products!

Visitors to Peli's booth will have the opportunity to participate in a daily raffle for a 3315Z0 torch and its helmet holder, with winners announced daily at 4pm. All entrants will also have the chance to win a grand prize consisting of the new 9415Z0 LED lantern.

This lantern is Peli's most powerful rechargeable lantern approved to Atex Zone 0 (Cat. 1), and compliant with the new 2015 Atex regulations. Coming in at only 1.65kg of weight and 392 lumens, the new lantern packs all the power without the weight. It features four LEDs powered by the latest generation Ni-MH batteries.

Hall 12, stand C36/1

Outsourcing industrial rescue and fire fighting

For the very first time Red One will be exhibiting its range of services for business' seeking to outsource their industrial rescue and fire fighting services.

Red One provides the tools and personnel to meet business' fire and rescue requirements, drawing upon extensive experience of fire cover provision, mobilisation, resourcing, incident command and training.

Red One can help train, resource, operate and manage fire-related services for companies in the energy sector, chemicals manufacture, aviation, petroleum or the heavy industries.

It provides specialist stand-by rescue teams for work at height, confined space rescue and boat rescue for short, medium or long term projects, as well as offering an incident response capability for situations where access into potentially unsafe areas is required.

Hall 24, stand C30

Hemming Group – come and meet the team behind *Industrial Fire Journal* and *Hemmingfire*

IFJ plus sister publications *Fire & Rescue* magazine, *Fire Trade Europe* and *Fire Trade Asia & Middle East* would be delighted to meet with contributors as well as existing readers.

Come and meet the team, collect your free 3D glasses (more will be revealed on the day) and put yourself down for a special competition prize!

Hall 27, stand M26

WHAT TO DO:
THE HERRENHAUSEN GARDENS

Misburg3014

The Herrenhausen Gardens house an internationally famous ensemble of beautiful gardens, arts and culture that rank among the most important in Europe. They encompass the Grosser Garten, Berggarten, Grotto, Conservatories and the Museum Palace Herrenhausen.
The story of Grosser Garten began in 1666 and its cultural traditions continue to this day, with the KunstFestSpiele festival of art and culture which from 29 May to 14 June is presenting a cross-genre programme that spans the Baroque and contemporary eras of artistic forms.
In the Grotto visitors can admire the work of Franco-American artist Niki de Saint Phalle. The Grotto has become a place of pilgrimage for her admirers since it opened in 2003.
The Herrenhausen Palace and Museum – the summer residence of the Royal House of Hanover – was destroyed in the Second World War but it has now been rebuilt on the original site to the original plans.
For 25 years the International Fireworks Competition has been celebrated in Hanover and during five summer evenings the world's best pyrotechnicians compete against each other in the Grosser Garten. Early visitors to Interschutz can on the 6th of June (1800-2300) experience live music, cabaret and theatre culminating with Team Spain's 25-minute pyrotechnic entry.

LANDMARKS

One of the famous landmarks of Hanover is the New Town Hall (Neues Rathaus) which was reopened in 2013 after 12 years of reconstruction. Visitors are welcome to use the truly unique parabolic elevator that climbs at an incline through the the Hall's large dome to a viewing deck that is 100m high.
At the centre of the old town are the huge Marktkirche (market church) and the Old Town Hall. Nearby are Leibniz House, the Nolte House, and the Beguine Tower.
Visitors can enjoy wondering round the tiny lanes of the Kreuz Church quarter and see the nearby old royal sports hall – now the Ballhof theatre.
On the edge of the Old Town are the Market Hall, the Leine Palace and the ruin of the Aegidien Church. Through the Marstall Gate at the bank of the river Leine are the world-famous Nanas of Niki de Saint-Phalle, part of the Mile of Sculptures which lead from Trammplatz following the river bank and crossing Königsworther Square.

LIGHTNING STRIKE!

AN INCREASING RATE OF LIGHTNING ACTIVITY HAS IMPLICATIONS FOR THE PROTECTION OF STORAGE TANKS, WRITES JOSEPH A LANZONI, DIRECTOR OF SALES ENGINEERING, LIGHTNING ELIMINATORS & CONSULTANTS.

Lightning-related petroleum storage tank fires are more common than most people think. Prior to the development of the new energy regions in North America, the number of reported tank fires was in the range of 15-20 fires per year. For example, the Brandsforsk study [Ref. 1] covered a period from 1951 to 2003 and tallied reports of 480 tank fires, with about one-third being attributed to lightning.

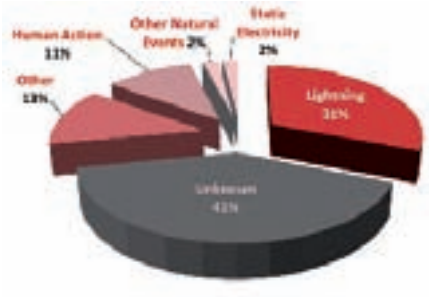

Figure 1: causes of tank fires.

The number of lightning-related tank fires is most likely greater than 20 per year owing to a confluence of factors, such as (1) increased production from hydraulic fracturing in the United States has increased the number of tanks in service, (2) the product from these new energy fields is more volatile than conventional crude oil and (3) not all tank fires are reported by a public agency.

Climate change, insurers and cost

Several recent climatology studies, including those by NASA, Stanford and Purdue, have reached similar conclusions about future rates of lightning: they all predict an increase in the global rate of lightning activity. For example, NASA researchers have predicted a 5-6% increase in lightning for every 1°C rise of earth temperature. Taken as a whole, these studies conclude that global climate change will lead to a greater number of thunderstorms.

Insurers are also facing increasing lightning-related costs. The Lloyds Insurance Institute reported a 15% increase in lightning-related losses from 2009 to 2010. In addition, the Association of British Insurers predicts that by 2040, the weather damage in the UK is likely to be double that of current years.

When a tank fire occurs, many large costs result, including costs due to lost product; damage to the physical plant; interruption of customer service; environmental harm; firefighting, cleanup and rebuilding; EPA, OSHA and regulatory fines and increased oversight; loss of community goodwill, etc. The total cost of one tank fire can easily exceed $10 million. Therefore it is imperative that lightning-related tank fires be prevented.

The lightning threat defined

A typical lightning stroke contains several components, shown in Figure 2. The fast component (Component A) is extremely brief yet contains the peak current. The long component (Component C) contains less current than Component A but lasts 500 to 2,000 times longer than Component A. Component C is responsible for the ignition of flammable vapours and therefore must be effectively managed during a lightning event.

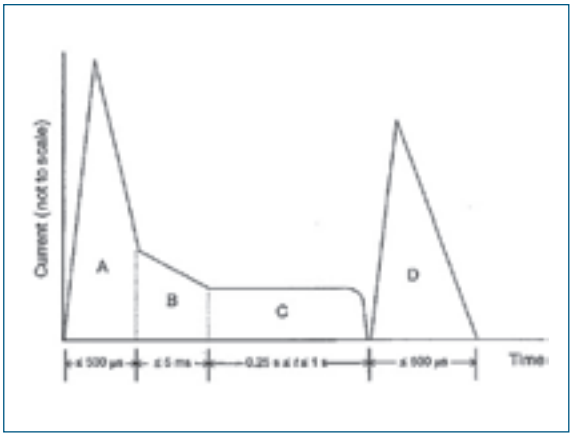

Figure 2: lightning flash components (not to scale).

Petroleum products are often stored in floating roof tanks (FRT). An FRT is a type of tank where the roof rests on pontoons that float on the product being stored. As the tank is filled or emptied, the roof moves up and down within the shell of the tank. Seals are fitted around the edge of the roof to prevent vapours from escaping. Unfortunately, these seals are not perfect and sometimes combustible petroleum vapour escapes from around the seals.

Lightning may endanger an FRT if a stroke terminates either on or near the tank. Lightning-related currents will flow across the roof-shell interface during all direct or nearby lightning strikes. If the impedance between the roof and shell is high, sustained arcing will occur across the seal interface.

Figure 3: lightning-initiated fire inside internal floating roof tank.

It is imperative that the floating roof be electrically bonded to the tank shell because the roof must be held at the same electrical potential as the tank shell to prevent sustained arcing between the two surfaces. The two most common methods to bond the roof and shell are to install (1) shunts or (2) bypass conductors. Shunts are made from spring-tensioned steel fastened to the roof and slide along the inside of the shell, as shown in Figure 4.

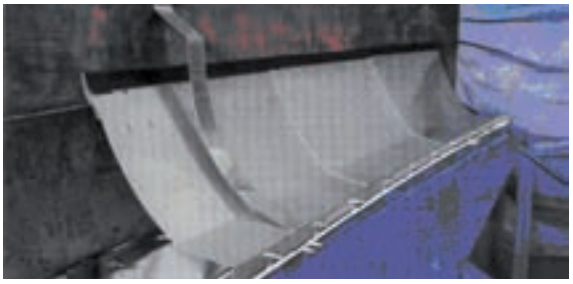

Figure 4: cutaway of FRT showing shunt above seals.

Unfortunately, shunts do not provide a low impedance bond to the tank shell because (1) heavy crude oil components may coat the inside of the tank wall, (2) corrosion may form on the inside of the shell and (3) many FRT's are painted on the inside. API-sponsored testing showed that arcing will occur between the shunts and tank wall under all conditions.

A bypass conductor is a roof-shell bonding cable installed between the top of the shell and the roof. This conductor must be long enough to accommodate the roof in its lowest position. Installation of bypass conductors is critical because they are required to conduct Component C of the lightning strike.

Figure 5: lightning-initiated tank fire at the Helling saltwater disposal site, three miles south of Alexander, North Dakota, US.

Lightning presents a different type of problem to non-conductive and lined storage tanks. If a fibreglass tank is being used in a petroleum-related operation (such as saltwater disposal) and the tank is partially full, the space above the fluid typically contains a combustible vapour. In a grounded conventional steel tank, the conductive steel allows for charge equalisation between the tank's contents, the tank itself and the ground. However, for a non-conductive or lined tank, there is no charge transfer and equalization, and thus a differential between the combustible vapour and the ground could occur, as shown in Figure 6. A direct or nearby lightning strike will cause a rise in ground potential and all grounded objects. If the potential difference between a grounded object or surface exposed to the vapour and the vapour reaches the electrical breakdown strength of the vapour space, an arc will form and disaster will follow.

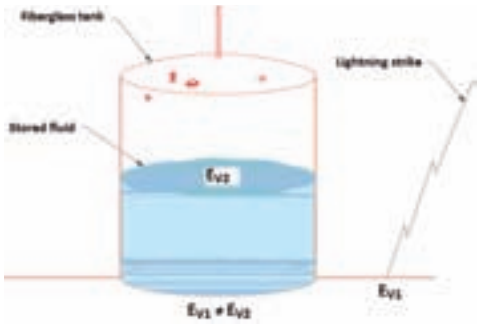

Figure 6: unequal electrical potentials from lightning strike near non-conductive tank.

Response from technical standards

Several national technical standards address the topic of lightning protection for tanks, including NFPA 780, NFPA 77, API 545 and API 2003 [Ref. 6]. As more is understood about the lightning phenomenon and how storage tanks interact with lightning, these standards have been revised to expand their recommendations. To reduce lightning-related risks and increase community safety, it is imperative for tank owners and operators to bring storage tanks into compliance with the latest versions of these standards.

Regarding floating roof tanks, both API 545 and NFPA 780 recommend installing multiple roof-to-shell bypass conductors on floating roof storage tanks. The bypass conductors will ensure that the roof and shell stay at the same potential during thunderstorms, thus mitigating the risk of a sustained arc between the roof and shell. Thousands of floating roof storage tanks are in currently use, but the majority of them lack sufficient bypass conductors, thus increasing their risk of lightning-related fires.

There are two types of bypass conductors available in the marketplace: (1) a conventional fixed length conductor or (2) a retractable conductor on a spring-tensioned reel. The conductor on a spring-tensioned reel automatically deploys and retracts as the roof moves up and down, thus keeping it as short as possible. During high-roof conditions, when the tank is most at risk, the conventional bypass conductor will be randomly splayed on the tank roof, while the retractable bypass conductor will be as short as possible, as shown in Figure 7.

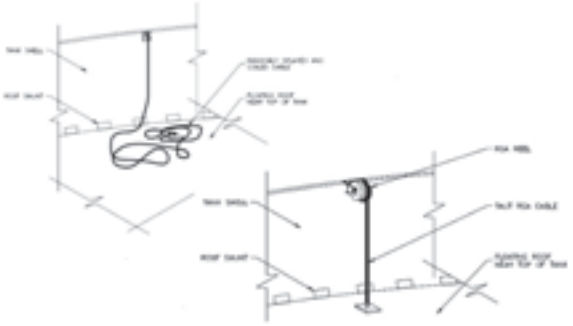

Figure 7: comparison of conventional vs retractable bypass conductor.

Regarding non-conductive and lined tanks, both API 2003 and NFPA 77 recommend against using non-conductive tanks to store flammable and combustible materials. In spite of these recommendations, many non-conductive tanks are being used in production sites. From an electrical viewpoint these tanks are unsafe because electrical charges can accumulate on the tanks' contents, but the charges are not equalized with ground potential as they would be in a steel tank.

In acknowledgement of this situation, both NFPA 77 and API 2003 recommend a grounding conductor inside all non-conductive or lined tanks. To neutralize any charge differentials that may exist between the tank contents and ground, this internal grounding conductor must be connected to the earth. In addition, all metal tank fittings, such as flanges, hatches, etc, must also be bonded and grounded.

Summary

Lightning Eliminators & Consultants manufactures a wide line of grounding and lightning protection equipment that will eliminate lightning-related risks. They manufacture the Retractable Grounding Assembly, which is a self-retracting bypass conductor made specifically for floating roof petroleum storage tanks, and also the In-tank Potential Equalizer, which is an internal grounding conductor made specifically for insertion into non-conductive or lined tanks in oilfield operations.

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4. YouTube.com/watch?v=KGlwLC_1qOI, Wynnewood, Oklahoma, 2007.
5. Photo by Karolin Rockvoy, McKenzie County Emergency Services, Alexander, North Dakota, Nation & World, July 7, 2014.
6. NFPA 780 is the Standard for the Installation of Lightning Protection Systems; NFPA 77 is the Recommended Practice on Static Electricity; API 545 is the Recommended Practice for Lightning Protection of Aboveground Storage Tanks for Flammable or Combustible Liquids; API 2003 is the Recommended Practice for Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents.

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Toxic orange

A toxic vapour cloud that resulted in the confinement of 66,000 people has revealed multiple shortcomings in hazmat preparedness in Catalonia, Spain, reports George Potter.

The toxic cloud that developed on the morning of February 12 spread rapidly over the Simar plant as well as the town of Igualada and its surrounding villages, requiring the activation of the regional emergency management plant.

Igualada, Spain, is a municipality located some 50 miles southwest of Barcelona in Spain's northeast corner. The town has a population of about 50,000, and is surrounded by several smaller towns and villages with another 20,000 inhabitants. The principal activities of the area are agriculture and diverse light-to-moderate industries, including chemicals, paper and cardboard manufacture.

One of these industries is Simar, a company dedicated to the manufacture and transformation of a variety of chemical products including desolvents. On the morning of February 12th operators were unloading nitric acid and iron chloride. During the operation a leak from one of the acid tanks mixed with other substances provoking an explosion that generated a massive nitric acid vapour cloud.

The principal hazards involved with this particular substance mix are possible corrosion and severe irritation to the human breathing system.

The cloud required not only the activation of Igualada's municipal emergency plan but also – soon afterwards – that of the regional civil protection emergency management plan and chemical incident management plan.

Igualada has a professional fire brigade which is part of the regional fire and emergency structure covering the four provinces of Catalonia (except the city of Barcelona which has its own fire and rescue service). The Igualada station covers the town itself and a number of other small towns and villages in a radius of some 15 miles. Hazards include the aforementioned industries; a major roadway; passenger and cargo railway lines; a multitude of farms and vineyards; and a forest mass that extends through a mountainous area of difficult access.

The vapour cloud of nitric acid resulted in 66,000 people being confined indoors.

Nominal staffing of the station includes a chief officer, two to three sub-officers and an average of five fire fighters, all of whom are qualified apparatus drivers. The mobile fleet includes one turntable ladder (100 ft.), two urban pumps, one tanker, one rural/forestry pump and auxiliary vehicles. Following service protocols a standard fire response is one pump, the ladder and a sub-officer – total response manning of seven. However, this specific incident was complicated by the chemicals involved, making it a full hazmat incident.

From the outset of the incident the plant's interior emergency response plan was activated, mobilising the plant's internal emergency structure. Three employees suffered minor injuries during the initial explosion, and three firefighters were injured during emergency operations. All received initial treatment on-scene and subsequently were transferred to hospitals for closer supervision, although none were hospitalised. Although no serious injuries or fatalities were reported, it was discovered very soon after the incident was controlled that the emergency plan was obsolete, not having been updated according to a specific national decree issued in 2010.

Incident response and management

On receipt of initial information on the incident, the regional emergency service immediately ordered the activation of Igualada's municipal emergency plan, with specific instructions to mobilise communications to the population throughout the area instructing all persons to remain indoors. This order was given special priority to elderly people, pregnant women, children and any and all persons with respiratory problems. Igualada and five surrounding towns were affected by the confinement, which affected some 66,000 people.

First responders from the Igualada fire station had to face the potentially major chemical hazard situation. The remaining on-duty personnel were mobilised with the corresponding hazmat PPE and materials, as well as off-duty personnel. The regional emergency services dispatched human and material resources from 14 other stations in the region, eventuallly placing 90 fire fighters, sub-officers and officers on the scene, plus two special hazmat vehicles and several more pumps. A senior officer from the regional management staff assumed the position of incident commander.

Although the explosion did not provoke a fire, it did cause some serious damage to structures and installations. During

the course of the day, the orange-coloured vapour cloud spread over several square miles of the area, diluting as it spread. The confinement order was rescinded at around 4:30pm, more than eight hours after the initiation of the incident. Many of those who had been confined to places other that habitual – shopping, cars, public transport, schools and so forth, complained afterwards, but generally accepted that the confinement had been necessary under the circumstances. No adverse effects were reported.

Lessons learned

This particular fire brigade is not accustomed to frequent major hazmat emergencies, although the Catalonia emergency service does impart training when and where needed. Several of the more than 100 stations spread around the region are well trained and equipped to face major hazmat incidents. There are specially equipped hazmat vehicles in two stations in the Barcelona province and another in Tarragona, where several vast chemical industrial parks are located.

The Catalonia emergency services face two major problems: first are serious reductions of funds for modern resources and training in numerous specialities including hazmat incidents, and second, the typical duty structure of fire response personnel. Catalonia is no exception to the national emergency services duty assignments comprising one 24-hour tour followed by four days off. Occasional adjustments are made to cover excess hours and holidays, but the average Spanish firefighter serves some 1,800 duty hours annually. Possible training programmes that 'invade' off-duty time are not regarded favourably.

Some time after the incident I met with several firefighters assigned to other stations who complained that training, specifically hazmat intervention, had been severely reduced during recent years. They also commented that no new personnel had entered the regional service during the last four years, although several dozen had retired during the same period.

The emergency plan that the company had implemented at the time of the incident was obsolete. Although it appears that the plan conformed with the requirements in existence when it was developed and implemented, it did not conform with the requirements of a 2010 Royal Decree. These included evaluation of possible effects outside of the entity, effects to the environment and specific evaluations of hazards.

Nevertheless it appears that the means of communications to the community proved to be adequate. These included radio broadcasting but primarily the use of static and mobile loudspeaker broadcasting, mostly by local police and civil protection units.

This was the most serious incident in the Catalonia region requiring public confinement, and one of the most serious on a national level. The Catalonia regional government created a specific chemical accident emergency management plan several years ago in view of the number of chemical processing, manufacturing and storage facilities in the region, principally around the port city of Tarragona. This plan was activated from the outset of the incident.

At the time of the writing of this article, several parallel investigation were underway by the local and regional governments in aspects such as the hazards in the plant, the situation of the in-plant emergency response plan and even the emergency services' response to the incident. The company may face fines and charges of negligence.

The overall negative results of this emergency were some major damage to property and installations and six minor injuries. However, the positive results were, or at the least should be:

- An up-to-date in-plant emergency response plan for the company
- Intensified hazmat training and resources for the local fire brigade, and
- the recognition by the populace that the regional emergency services are capable of responding to posible major emergencies.

NEW FOAM TRUCK FOR THIRD LARGEST OIL REFINERY IN THE WORLD

A Rosenbauer ULF 7.600/250 fire fighting truck has made its debut at the third largest oil refinery in the world.

The Ulsan Refinery in Ulsan Metropolitan City, South Korea has a capacity of 840,000bpd and produces LPG, gasoline, diesel, jet fuel and asphalt. The 8km^2 complex includes 34 large-scale crude oil storage tanks, including one that is 22m high and 86m in diameter.

The industrial facility is so large that it houses six fire stations each equipped with two fire fighting vehicles.

Due to the complex risks involved plant owner SK Energy required a new vehicle with powerful foam performance capabilities.

Rosenbauer's vehicle comprises the Hydromatic and Digimatic foam proportioning systems working with 7,000l and 600l foam concentrate tanks.

The Hydromatic proportioning system discharges up to 700l of foam per minute with a continuously adjustable rate of 0-7% at every foam outlet including the roof turret.

The Digimatic offers a continuous proportioning rate adjustment from 0.1 to 6% and in combination with the Conti CAFS WR 60 it can produce up to 7,000l of CAFS foam per minute.

Additional equipment on the ULF 7.600/250 is a RM60 roof turret with a maximum output of 7,000l/min. Onboard also are several rapid intervention systems (60m hose reel and powder hose reel); a dry powder unit that includes a 250kg powder tank; and an LED light mast and additional LED lighting.

The ULF 7.600/250 is built on a Mercedes-Benz Actros chassis and it carries a 476hp V6 diesel engine.

Going tactical with Class A

Task Force Tips' Rod Carringer shares his perspective on nozzle performance with Class A foam solutions often used for fighting deep-seated fires such as paper, tyres and wooden structures.

The use of Class A foam agents as an enhancement for an initial attack often leads to a review of handheld nozzles to determine how to gain additional effectiveness and flexibility. The problem is often these decisions are made without a complete understanding of operational needs. Before we delve into the world of application tools, it is imperative to accept some of the benefits and limitations of Class A foam agents as we integrate their use into operational guidelines.

- Class A foam is an enhancement to, not a replacement for, water. All that we have learned about the required fire flows and critical application rates must be held as the baseline for suppression tactics.
- Class A foams are not designed to effectively suppress the vapours of a flammable liquid. Much like water, the finished foam made with Class A concentrates may knock down a flammable liquid-fueled fire, but post-fire security is absent. If there is a source of ignition, expect a re-ignition of vapours even with a visible foam blanket on the spill.
- Even a 0.1-0.2% injection of Class A concentrate (soap) into the fire fighting flow provides amazing knockdown performance by simply reducing the surface tension of the water. The low cost solution soaks easily into deep seated fuels, clings to hot surfaces more effectively absorbing heat, and when expanded, offers a level of smothering or thermal insulation during exposure protection.

Before we look at nozzle choices, we now have some basic facts to use as a foundation for our assessment. Tactically, we will maintain needed and target fire flows, we will use the foam for Class A combustibles only, and we will take advantage of the soaking and penetrating characteristics of the finished foam to make fire fighting efforts more effective.

Next, as we build upon this foundation, we need to understand the importance of how different finished foams (aspirated or solution) perform in the structural firefighting environment. We are adding foam concentrate (from 0.1% up to 1%) to our water through either a direct injection system, an eductor, or simply by batch mixing in our tank and providing a foam solution at the nozzle. Sometimes the firefighter only requires 'wet water' for soaking; other times a soaking low-expansion finished foam is needed for coating and clinging as well as draining its moisture into the fuel beneath; and in some cases even a highly aspirated foam that smothers, insulates, or reflects radiant heat while protecting from exposure may be required.

Top: the Hemisphere 1,892 lpm portable initial attack monitor.

While we all enjoy seeing lots of dry, long-lasting bubbles being made, tactically on a smouldering couch, cellulose insulation or a burning hay bale it isn't the right tool for the job. Educating initial attack teams on the performance aspects of the finished foams and how to make the best choice for the task at hand is imperative.

Finally, before we move on to nozzle choices, there are several key performance characteristics of foam concentrates that ultimately can and will affect the finished foam performance the crew expects from the nozzle. Once understood, tactical actions can be taken to enhance or improve the final performance.

- Foam concentrates (in the bucket) come from many sources. Find and use foam that offers certification for acceptable environmental performance, provides outstanding bubble production throughout a range of fire ground criteria, and gives the best return on investment (not always the cheapest).
- Water quality affects finished foam performance. The 'harder' or more mineral-laden the water, the more difficult it will be to make lots of bubbles.
- Temperature affects finished foam creation and longevity. The colder it is (air and water temperature) the harder it will be to make consistently long-lasting foam.
- The injection percentage choice, typically from 0.1% up to 1%, may be varied to achieve the type of finished foam desired for your application. Lower injection percentages of up to 0.3% are ideal when just a wet soaking application is desired. Up to a 0.5% application will increase the potential to make more bubbles, and at 1% not only can you generate more bubbles, but with more soap in the bubble skeleton, it will last longer.

To summarize at this point, if you buy high quality foam, have soft water, nice warm temperatures, and turn your injection up to 1%, it is likely you will always make great amounts of bubbles. For the rest of us, we need to adjust according to our environmental and operational limitations. Using Class A foam in structural firefighting is not an exact science, and understanding all of the factors that can affect finished foam performance will ultimately lead to making good tactical choices.

The next fork in the road are the application methods. A high-energy delivery system such as a Compressed Air Foam System may incorporate an on-board air compressor system, or a low-energy delivery system will use the energy of the pressure (velocity) in the line to make finished foam at the nozzle tip. Both are Class A foam delivery systems, yet each has very unique equipment requirements, operational constraints, and training needs.

High-energy systems rely on both the energy of air flow/ pressure injected at the apparatus and the scrubbing of the

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TFT's Propak foam injection and application system has been designed for rapid vapour suppression with any Class A, AFFF or AR-AFFF.

homogenous foam mix as it travels down the attack hose line to provide a long lasting very consistent bubble structure. From a nozzle delivery standpoint, anything that is done internally to direct, shape, or straighten the fire stream typically tends to strip out some of the bubble structure turning the stream into much 'wetter' foam. As discussed earlier, tactically there is always a need to have a wetter (more soaking) foam to get into those deep seated fires and a combination nozzle on a high-energy system will accomplish that, but for dry foam, an appropriately-sized smooth bore tip does much better when a 'drier' foam structure is desired.

A two-piece nozzle offers the most versatility when using a high-energy system for Class A foam operations. The combination nozzle (fixed, selectable or automatic) provides wet soaking foam with additional straight stream and fog pattern capabilities for interior suppression tactics. When dry foam is needed for applications such as exposure protection or pretreatment of fuels, removing the combination nozzle and using the integrated, and unrestricted, smooth bore provides maximum foam aspiration, reach and longevity.

The other fork in the road are low-energy or nozzle-aspirated foams; for most structural firefighters these are little more than a variation of the foam equipment and tactics used during Class B foam operations. By its basic waterway design, a standard combination nozzle provides great reach and penetration as well as a wide protective fog pattern, but provides little in the way of foam aspiration. From an initial attack standpoint though, this is ideal with the enhancement of wet soaking foam providing better suppression and elimination of rekindles over 'water only' applications.

The G-Force series of nozzles includes stainless steel slide valve and inlet debris screen.

If the tactical need for wetter foam providing both smothering and soaking capabilities is critical, a low-expansion attachment offers the easiest and most cost-effective method. Additionally, the low-expansion tip is quickly removed, even during initial attack, to allow for a wide protective fog pattern if needed. From a stream performance standpoint, while you can expect an increase in foam aspiration, a decrease in reach and penetration will also be realized. In all low-energy finished foam (or nozzle aspirated applications), the energy at the nozzle tip can be easily characterised as a sliding scale from maximum reach and penetration at one end to maximum foam expansion at the other. The available energy will be used in some manner to provide the required foam expansion for the tactical need.

At the far end of this sliding scale is the medium or multi-expansion foam attachment.

From a performance standpoint it maintains the same flexibility as the low expansion attachment as it is easily removed from or added to the combination nozzle during operations based on tactical foam expansion needs. The multi-expansion attachment, being larger in size to allow for more air entrainment into the fire stream, often includes an integrated screen to enhance aspiration even more. Tactically, reach will be very limited, often only 15-20 feet, but expansion ratios of the finished foam may be substantial – up to 35:1 in many cases.

Having discussed many of the aspects of foam applications, only one component is still needed to integrate Class A foam into operational guidelines – safety. Water with foam in it does react differently in the fire fighting environment. Following are some initial observations that do require consideration during training.

- While water's high surface tension often makes fire streams less than effective by simply draining away, the injection of Class A foam and the corresponding reduction of surface tension found in the solution adds water weight to places often unnoticed. Dropped ceiling tiles, drywall, furniture, cellulose insulation will all now hold water and weight that in the past would have been shed. Increased weight brings with it a higher probability of the building infrastructure coming down on an interior crew. With nearly 1t/m3 now soaking into - and being held in - fuels, additional vigilance needs to take place.
- Class A foams are designed for Class A combustibles, and Class B foam such as AFFF and AFFF-AR are designed chemically for flammable liquids.
- The use of Class A foam in an interior structural attack often leads to foam solution or bubbles getting on an SCBA face piece. Natural instinct in the heat of battle is to wipe it off with a dirty leather glove. The results are a black foaming mess that truly inhibits vision during an operation.
- Bubbles visually conceal what is beneath them. Holes, debris, of uneven footing will all be hiding under the foam blanket. Step cautiously. Also, foam on tile floors, smooth concrete, or wood floors can also be a challenge with rubber soled boots. Again, step cautiously.
- Mother Nature is very clear about required fire flows. A fire will usually not go out if more thermal energy is being generated in a fire space than you can provide water or solution to absorb. Foam has little effect on the formulas for initial attack fire flows. It is an enhancement, not a replacement for water. If Class A foam is being used in a surround-and-drown defensive operation, the only smiling face may be the local foam salesman.

Many considerations are required prior to the use and integration of Class A foam into operational procedures, including the foam agents, the method of application, equipment, tactics and safety considerations. And even after all the facts have been reviewed, the use of Class A foam, much like all firefighting, is still a very in-exact science. What is known and proven however is that the use of Class A foam as an enhancement to initial attack fire fighting streams is a major benefit.

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On track at TEEX

TEEX Emergency Services Training Institute is building a new rail transportation emergency facility at Brayton Fire Training Field in College Station, Texas writes Dennis St. John, Program Director.

The new project will consist of three 111 general service rail cars and one gondola car, and will simulate a crude oil train derailment with multiple flammable liquid leaks.

This project will allow participants from municipal departments, industrial brigades, and rail car companies to experience train car derailments within industrial or remote areas where fixed fire water systems are unavailable. The nine possible leaks on the rail cars consist of dome flange leaks, bottom valves leaks, and blister and relief valve leaks, which will provide a great deal of training variety.

The rail cars were donated by BNSF and were placed on an 1,022m^2 concrete slab to simulate the rail car scenarios. Both BNSF and Union Pacific are providing technical assistance in planning of the new project, and ESTI's construction and maintenance crews are doing the actual construction.

New curriculum is also being developed for this prop. The first course addresses firefighter safety, establishing water supply for cooling and controlling, cooling with fixed and portable monitors, proper hand line approach for capture and control, hazardous material concerns, and dealing with large-scale flammable liquid spills and fires.

The overall objective is to offer training that will enable first responders in the industrial and municipal sectors to safely size up and mitigate multiple rail car derailments. The class offering can also be customized to fit the training requirements for any public and private sector department. The new project is slated to be completed and in service by July 2015.

Brayton Fire Training Field is the main training facility for Texas A&M Engineering Extension Service (TEEX), Emergency Services Training Institute (ESTI). It comprises 1.2km^2 in College Station, Texas, making it the world's largest, most comprehensive campus for first responders. More than 75,000 students participate in ESTI's rigorous, hands-on training in firefighting, hazardous materials response, rescue, incident command, and specialized programs. Staffed by hundreds of experienced instructors, technicians, and support personnel who represent more than 130 specialty areas, ESTI offers approximately 200 different courses to students from across Texas, the US, and around the world.

First responders are now able to train on multiple rail car derailments.

Investing in the future

CRITICAL ASSET PROTECTION SPECIALIST CFB RISK MANAGEMENT IS EMBARKING ON A US$16M INVESTMENT THAT WILL DELIVER NEW TRAINING SERVICES FOR THE HIGH-HAZARD INDUSTRY.

The new investment in infrastructure and training facilities in Teeside, north-east UK is described by CFB as a major step forward towards fulfilling its strategic vision of being an internationally-recognised risk management company.

Work has already started on the US$16m state of-the-art Training and Technical Hub (TTH) based on the current Queens Meadow Complex, which will include a new training and administration centre, external training facilities and a technical resources centre.

'We are excited to be able to share our vision of the facilities we will have available in the near future as we continue to expand and improve our business and portfolio of services in the high hazard markets', comments technical director Gary Cawley: 'We also welcome any feedback or suggestions from industrial operators within the high hazard sectors as to what training resources and facilities they would like to be available in the development to help maintain workforce competence now and in the future'.

The design for the training and administration centre includes a crisis management training suite; standby emergency control centre; 24/7 secured emergency fire control room; clean training environments across two floors; external work spaces; gymnasium and restaurant.

The external training facilities cover over 5,600m^2 and will be available seven days a week 365 days a year. High-hazard operators seeking to enhance their industrial emergency preparedness should be mightily impressed by the facilities that will be on offer at the new Training and Technical Hub.

A multi-level industrial training resource comprises 'real' process structures used in the renewable/chemical and oil and gas industries. It offers live burn capability for confined space, working at height and industrial hot fire training.

The hot fire facility uses multiple types of fuel and enables the use of foam without the environmental impact via foam interceptors. Hot fire training facilities range from vertical and horizontal storage tanks, process equipment, pumps and condenser, to distillation tower, reflux tank and reboiler heat exchanger. Live fire training scenarios include distillation tower spill, condenser tank leak and relief valve, piping manifold, horizontal tank, high elevation tank and bullet tank fire with high pressure relief valve/pump seal/flange fires amongst others.

The RTA/hazmat spill response training resource is designed to train and maintain the competence of personnel likely to be dealing with emergency situations involving hazardous materials (radioactive, flammable, explosive, corrosive, toxic etc). For simulating road traffic accidents involving HGV tankers CFB Risk Management will be building a purpose-built scale replica of a major road.

Compartment fire behaviour training has not been left out either, and an interior live fire burn facility is being built that will offer both flashover and backdraught simulations. To make the training experience as real as possible an additional non-burn training facility has been designed to produce a physically and psychologically stressful environment for search and rescue training. It aims to improve performance stress management/orientation while sharpening reactions prompted by non-visual senses. Its multi-configuration enables a variety of effects including darkness, heat, carbonaceous smoke, humidity and glare.

Lastly, a technical centre will house all maintenance and equipment including fleet/emergency equipment workshops; PPE and equipment stores for one of the largest COMAH complicit workforces in the UK; and a vehicle/portable operational deployment mobilisation resource centre. The latter facility gives CFB Risk short-notice access to a wide range of resources including fire appliances, 4x4, pickup, van, car and other types of vehicles as and when necessary. 'Our vision for the future reflects our capacity to supply innovative and high quality services designed to meet the increasingly challenging logistical and workforce training requirements in the high hazard sectors in the UK and further afield,' concludes Gary.

First in – last out

Prior to the closure of Afghanistan's Camp Bastion the UK Royal Air Force Fire & Rescue Service not only trained Afghan firefighters but was also involved in fire fighting operations whilst under Taliban attack. David Oliver looks at the wide-ranging roles, duties and experiences of one of the last RAF units to leave Helmand Province.

Camp Bastion Aerodrome in Afghanistan's Helmand Province was at its peak the third busiest British airport after Heathrow and Gatwick, with a 2,350m runway built in 2007 that allowed the largest transport aircraft to fly in at any time of the day or night.

Combat operations, medical evacuations and logistics sustainment flights all operated from this vital hub for military operations in southern Afghanistan. Bastion's air traffic control handled some, on average, 600 aircraft movements per day at its peak, or 18,000 a month.

Contained within Camp Bastion's 10km perimeter were the airfield, heliports, ammunition and fuel depots, vehicle parks, repair workshops, stores, offices and accommodation for 21,000 multi national personnel including around 2,000 contractors and 14,000 United States troops. The protection of these assets against fire was the responsibility of Royal Air Force (RAF) Fire & Rescue Service (FRS).

The RAF FRS is the deployable fire fighting capability of the Defence Fire Risk Management Organisation (DFRMO). DFRMO comprises of military, civil servant and contracted manned fire stations each providing prevention, protection, response and training to the UK Ministry of Defence (MoD). DFRMO HQ is located in Andover Hampshire and delivers its professional fire training at the Defence Fire Training and Development Centre at Manston in Kent.

Above: in 2010 RAF FRS personnel assisted USMC firefighter tackle a massive blaze at Camp Leatherneck. (US Navy.) Right: Bastion's RAF FRS Fire Crew One with their Major-Foam Vehicles. (Crown copyright.)

RAF firefighters are aligned to the same standards as their civilian counterparts within the aviation rescue fire fighting service and local authority fire services. Generally employed on RAF air bases within the UK these personnel are deployed on four-month operational tours worldwide. The typical working pattern consists of a 24-hour airdrome/structural fire duties followed by 24 hours which will encompass a rest period, immediate response team standby and force protection duties.

DFRMO also deploy a theatre fire officer responsible for planning approval, review of all major works projects and the provision of specialist advice to the joint force commander. RAF-commissioned fire officers who the RAF introduced in 2009 undertook this role.

As the deployable force, RAF firefighters are invariably amongst the first UK military personnel to deploy in support of air operations, and at Camp Bastion, were initially deployed in Operation Herrick in April 2006 as part of 904 Expeditionary Air Wing (EAW) before it became 903 EAW in November 2009.

The RAF FRS at Camp Bastion numbered 40 firefighters providing the full spectrum of aviation and structural FRS capabilities across the base, which at its peak was equivalent to the size of the city of Reading, UK. Equipped with specialised fire vehicles the crews were required to provide a 24-hour airfield and structural cover, attending aircraft incidents, on the airfield, within two minutes.

One of the many challenges for the RAF FRS was acquiring and maintaining the competencies associated with the many different aircraft types based at Bastion. These ranged from remotely piloted air systems to strategic transport aircraft and helicopters operated by both coalition military and civilian contractors.

Bastion's FRS personnel with full body armour and personal weapons for operating 'beyond the wire'. (Crown copyright.)

RAF FRS crews reacted to all incidents within the perimeter at Bastion, which contained the Afghan National Army at Camp Shorabak, the US Marine Corps (USMC) at Camp Leatherneck and the US Army at Camp Barber.

Operating two fire stations, the RAF FRS was equipped with five Carmichael/Unipower Major-Foam Vehicle (MFV) fire vehicles, two Alvis Unipower rapid intervention vehicles (RIV) and two Volvo Saxon structural fire vehicles. As part of a US$7.5m (£5.25m) deal with the MoD to refit 74 MFVs in 2009, Amdac Carmichael produced 10 modified vehicles specifically for the high temperatures and austere conditions experienced at Camp Bastion during Operation Herrick.

In addition to the Fire Stations, the RAF FRS provided two specialist teams. Firstly, an IRT was equipped with breathing apparatus, hydraulic rescue etc and remained at 10-minutes readiness 24/7, capable of deploying to the scene of an incident by helicopter or protected mobility vehicles in order to provide emergency response throughout Helmand Province.

For FRS personnel that were also required to operate 'beyond the wire', outside the confines of Camp Bastion's perimeter, they were fully equipped with the latest state-of-the-art body armour and personal weapons together with their fire fighting clothing and safety kit from the fire station. Throughout the life of Camp Bastion, RAF and USMC Firefighters transferred every military and civilian casualty evacuated to its Role 3 Hospital by helicopter from the aircraft. The IRT consists of three firefighters, carrying specialist rescue equipment, who were to be ready to

SAC Garner from RAF Brize Norton was one of the RAF firefighters who were awarded the Afghanistan Operational Service Medal following the Taliban attack on Bastion in September 2012. (Crown copyright.)

board a medical emergency response team Chinook helicopter within 15 minutes of receiving the call.

As fire was one of the biggest risks outside of combat operations within the austere, and at times tinder dry environment of Helmand Province, a forward fire safety team provided pragmatic specialist advice to tactical bases within combat areas.

In 2010 the RAF F&RS personnel assisted their US colleagues tackle a massive blaze at Camp Leatherneck. The fire broke out in a storage yard and with a severe dust storm that increased the fire to an area the size of two football pitches. This blaze took more than 16 hours to bring under control, during which one USMC Oshkosh P19 ARFF vehicle was lost. For their levels of bravery, courage and professionalism, those involved received both military and state awards ranging from commanding generals commendations with one RAF firefighter receiving the Queen's Gallantry Medal.

The widely publicised Taliban attack on Bastion in September 2012 saw the RAF FRS initially tasked to extinguish a fire involving a bulk fuel installation. The firefighters involved were armed when they responded, so therefore continued to operate while under small arms fire. The firefighters were confronted by flame fronts engulfing six soft-skin aircraft hangars braving the risks of exploding ammunition. The Americans lost six USMC Harrier AV-8Bs during the attack. Although no RAF firefighters were injured, the USMC suffered the loss of two of its personnel and a number of RAF Regiment personnel were wounded by small arms fire.

The drawdown at Camp Bastion that began in 2012 was a huge undertaking and was part of the intricate plan to make sure that it was left in the best possible condition as the UK armed forces closed Camp Bastion's doors for the final time at the end of October 2014.

Since 2009, RAF firefighters had been training their Afghan counterparts to develop command and control elements that were crucial to a modern fire service. A key development was the aviation firefighting capability to support the increased use of the Afghan Army's helicopter landing site within Camp Shorabak.

Operation Anvil, the name of the operation to redeploy the British Forces' equipment or return it to the UK was overseen by Logistics Commodity Services Forward teams who were deployed to assist with the in-theatre reverse supply chain during redeployment for Afghanistan. Just as kit and equipment were flown and shipped in to Camp Bastion to build it during Operation Herrick, items that were to be redeployed to the UK were cleaned up and serviced before being returned home by land, sea and air.

The bio-wash, where vehicles are scrupulously pressure-washed to rigorous DEFRA (Department for Environment, Food and Rural Affairs) standards, ridding them of any contaminated soil that they may have picked up during their time in the sand, worked round the clock, on a three-shift system. It could take up to 12 hours to thoroughly clean a large military vehicle. Seconded to 903 EAW during this period, were teams of mechanical and electrical technicians from No 4 School of Technical Training based at RAF St Athan that supported a wide range of equipment. This included the airfield fire and rescue vehicles, air cargo handling equipment, and passenger x-ray machines, all of which were vital to keeping the air bridge open during the drawdown. In addition to this task they were responsible for equipment to enable the redeployment of personnel and equipment from Camp Bastion, as well as the support equipment for the helicopters of all three services.

As the RAF FRS was one of the first units to be deployed to Camp Bastion, it was also one of the last to leave as air operations continued until 20 October, 2014, the day after the end of operations in south-west Afghanistan, when the final RAF aircraft took off from Camp Bastion marking the end of the biggest UK airlift in recent history.

Although some 130 military support vehicles were sold off in Afghanistan, a total of 3,400 vehicles were repatriated during Operation Anvil including all of the RAF FRS fire vehicles and associated equipment which were transported back to the UK by a roll-on roll-off ferry to Marchwood military port in Southampton earlier this year.

The RAF's frontline operations have now moved to RAF Akrotiri in Cyprus where Tornado GR4 two-seat, all-weather, day/night attack and reconnaissance aircraft and Reaper RPAS are operating against the Islamic State in Iraq, as part of UK's Operation Shader, supported by another deployed RAF FRS unit.

STRIKING POPULAR NOTE IN MEXICO

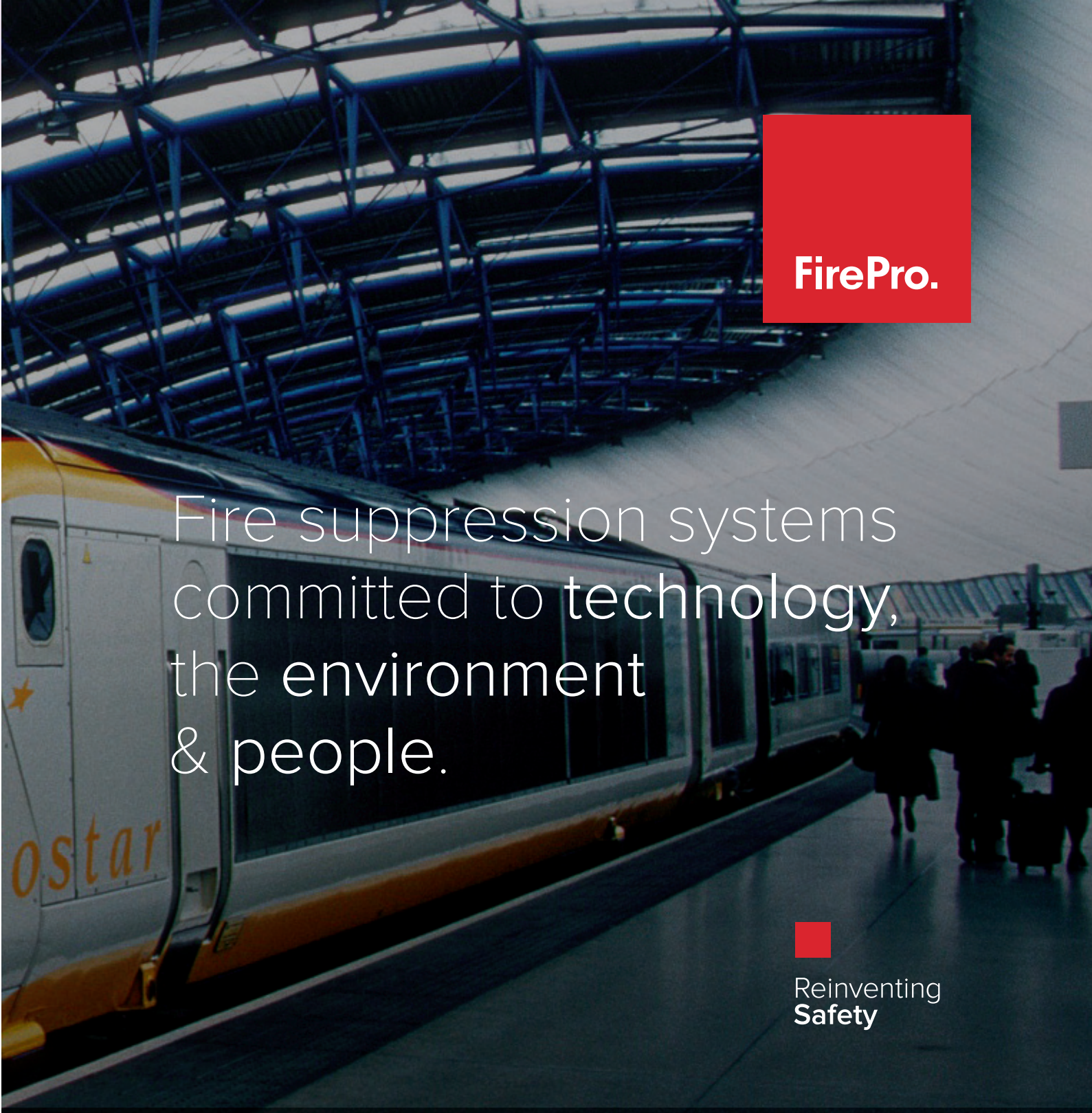
An Oshkosh Striker 6x6 ARFF vehicle outfitted with a Snozzle high-reach extendable turret is now operational at Cancun International Airport – one of the busiest airports in the Caribbean and the point of entry to the Mundo Maya region.

Other airports in the southeast of Mexico region that have recently received Strikers include Manuel Crescencio Rejón International Airport, Cozumel International Airport and Veracruz International Airport. The vehicles were purchased by Grupo Aeroportuario del Sureste de CV (ASUR), a major airport operator in Mexico.

The vehicle for Cancun International features a 6x6 axle configuration, with Oshkosh TAK-4 all-wheel independent suspension for a smooth ride and off-road capabilities. The fire fighting system includes an 11,356l water tank, a 1590l foam cell, and a 249kg dry chemical system for multiple agent fire suppression capabilities.

The Oshkosh-exclusive Snozzle HRET – equipped with a hardened carbide steel tip, a perforated nozzle, and a forward-looking infrared camera – enables firefighters to discharge from 6.1m below grade to elevations as high as 19.8m. The Striker's engine power pack components are readily accessed through walk-in doors on either side of the engine compartment for easier servicing.

"We are extremely proud to have new generation Oshkosh Striker vehicles selected by ASUR for frontline duty at four of its key airports across southeastern Mexico – including Cancun International," said Jeff Resch, Oshkosh Airport Products Group vice president and general manager, who continued: "It illustrates the ever-increasing popularity of the Striker ARFF brand in Mexico and throughout Latin America. The Striker is a proven, state-of-the-art emergency response vehicle and an excellent match for these airports."



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Foam concentrates for

JAVIER CASTRO, TECHNICAL DIRECTOR, AUXQUIMIA REVIEWS THE MOST SIGNIFICANT DEVELOPMENTS IN THE FOAM SECTOR IN THE LAST DECADE INCLUDING TESTING STANDARDS, ENVIRONMENTAL REGULATIONS, FUELS, FOAM CONCENTRATES AND FIRE FIGHTING SYSTEMS.

Javier Castro, technical director, Auxquimia.

The last 15 years have seen a number of advances in foam for fire fighting. Since 3M announced in 2001 that it would cease to manufacture surfactants and fluorinated AFFF foams due to the ban on PFOS (perfluorooctyl sulphonates), a flurry of developments has been carried out by manufacturers of fluorinated derivatives and foams.

The removal of PFOS as required by European directive 2006/122/EC; the decreasing of chain length (from eight to six carbon atoms) in fluorinated components; and the introduction in some countries of regulations on the use of halogenated organic compounds, all have driven the fire fighting foam market to react dynamically through the development of new products.

Fluorine-free foams particularly have recently come to the forefront, in some cases as substitutes for AFFF agents, and have become a subject matter of controversy and discussion through international forums.

In addition to new formulations and types of foam, new testing standards have been developed and modified with the aim of creating test conditions as representative as possible of real life risks. Examples of this are the widely accepted LASTFIRE protocol of tests becoming the standard requirement for foams in the petroleum industry, as well as changes in the ICAO standard for airports. The European standard EN-1568 was revised in 2008 with new testing fuels that differed from the previous 2001 version.

Other challenges have been the increase in use of new fuels such as ethanol or the addition of polar solvents to gasoline (eg ethanol, MTBE, ETBE, etc). These additives have had the effect of transforming a specific type of hydrocarbon fuel into a complex mixture of hydrocarbons and polar solvents whose behaviour in contact with a foam solution have different characteristics.

CAFS (Compressed Air Foam Systems) and electronic foam proportioning systems have been a major technological breakthrough in the industry of fire fighting. These systems are more efficient and allow a precise control of dosage, even at very low proportions rates (0.1-1%).

Throughout this article we will briefly review the changes in the foam sector to fight fires in the last decade, especially in testing standards, environmental regulations, fuels, foam concentrate and fire fighting systems.

Testing standards

Before 2001, when European Standard EN-1568 unified the criteria for approving and evaluating foam concentrates, each country used its own standards. This made it very difficult to compare the quality of foam concentrates manufactured in different countries.

After 2001, the reference standard in Europe for testing and qualification of foam became standard EN-1568, which consists of four parts:

- EN-1568-1: *Fire extinguishing media. Foam concentrates. Specification for medium expansion foam concentrates for surface application to water-immiscible liquids.*
- EN-1568-2: *Fire extinguishing media. Foam concentrates. Specification for high expansion foam concentrates for surface application to water-immiscible liquids.*
- EN-1568-3: *Fire extinguishing media. Foam concentrates. Specification for low expansion foam concentrates for surface application to water-immiscible liquids.*
- EN-1568-4: *Fire extinguishing media. Foam concentrates. Specification for low expansion foam concentrates for surface application to water-miscible liquids.*

In 2008 a new version replaced the original 2001 edition and the most significant changes were:

- Definition of the material for the testing pans (stainless steel).
- Clarification of the requirements for a product to be classified as IA according to EN-1568-3, especially in the French version of the standard.
- Introduction of a new fuel on the fire tests of Part 4 (isopropyl alcohol).

the 21st century

All manufacturers were required to have their products adapted and certified to the new version of the standard four years after publication of the new standard.

It must be noted that standards EN-1568-1: 2008 and EN-1568-2: 2008 do not establish classifications for products, only the fulfilment (or not) of the standards themselves. However, parts 3 and 4 (EN 1568-3: 2008 and EN 1568-4: 2008) do establish a classification of products according to their performance on the fire, both in extinguishment and in re-ignition. For this reason, specifying compliance with these standards alone is not enough – the minimum classification required for each individual part of the standard applicable (3-4) should also be indicated. A summary of the possible classifications follows.

EN 1568-3: 2008:

- I: Extinction capacity by forceful application to hydrocarbons.
- II: Extinction capacity by forceful application to hydrocarbons when the application of the foam is interrupted (slow extinction).
- III: Extinction capacity with hydrocarbons by gentle application.

EN-1568-3: 2008: gentle application over heptane.

EN-1568-3: 2008: forceful application over heptane.

Once the extinction test has been carried out, a burn back test is performed to measure the level of protection that the foam can provide after extinguishment. There are four classifications (A, B, C and D); A indicates the highest level of resistance and D the lowest.

A product that meets the standard EN-1568-3 can be classified between class IA (maximum) and class IIID (minimum), it can be also classified in the intermediate range of classes between class IA and class IIID.

EN-1568-4: 2008 – acetone test.

EN 1568-4: 2008:
On polar solvents, tests are performed only with a gentle application, and the classifications are as follows:

- I: if extinction time is below 3 minutes.
- II: if extinction time is above 3 minutes.

In this case a burn-back test is also carried out to determine the resistance of the foam, where 'class A' refers to foams with longer burn-back times and 'class D' for the shortest.

In addition to the acetone test, the 2008 version incorporated a test with isopropyl alcohol (IPA). Some foams with good behaviour on acetone perform very poorly in other polar solvents such as IPA. For this reason it was decided to keep both fuels in the standard in order to have a more realistic range of foam behaviours. It must be pointed out that the rankings may be different for both fuels, eg the same foam can be rated as IA with acetone and IIB with IPA.

Note that users who require premium quality products with a guaranteed capability of dealing with any liquid fires should specify products rated IA or IB according to EN-1568-3/4:2008.

Until the appearance in May 2009 of standard EN 13565-2 (*Fixed firefighting systems. Foam systems, design, construction and maintenance*) the different classifications of test standard EN-1568 had no impact on the design of fire fighting systems.

The new fire fighting systems standard EN 13565-2 'rewards' foams with higher performance at lower application rates (ie the higher quality foams as classified by EN-1568), and decides the application rate to be used. It also takes into account the type of system being used (eg foam monitors) in the ultimate operating conditions.

The LASTFIRE test protocol was designed for the oil industry, where the greatest fire risk comes from the storage of liquid fuel product. The LASTFIRE test protocol simulates the difficult conditions that occur during a storage tank fire such as the longer pre-combustion time, hot metal tank sides as well as the various types of foam application that can be used to extinguish the fire (aspirated/non-aspirated monitors and fixed systems). The protocol sets three types of tests:

- Semi-aspirated: simulates foam application with non-aspirated monitors.
- Aspirated: simulates foam application with aspirated monitors.
- Fixed system: simulates foam application with foam chambers.

For each test the foams obtain scores depending on fire control time, extinguishing time, vapour suppression and burn-back resistance. Then as a result of the scores the products are classified as fire performance 'good', 'acceptable', 'reduced' and 'poor'. For the petrochemical industry, compliance with the LASTFIRE protocol usually translates as specifying foam classified as 'good' or 'acceptable' in all three types of application.

Additionally, if the fire protection installation uses seawater, the good performance of the product must be also demonstrated with this type of water.

Airports have also actively updated their foam testing procedures through the International Civil Aviation Organization (ICAO), the latest changes taking place in 2013. Up to then, two levels of foam quality had been established: Level A and Level B, which depend on an airport's category.

As a result in the increase of risk due to the increase in aircraft size, a new level in the certification for foams has been created, Level C, which enables fires with larger surfaces to be extinguished with the same equipment.

In addition to the introduction of Level C, the test protocol has changed slightly and movement of the nozzle is no longer allowed throughout the tests, making extinction more challenging. On the other hand the standard now allows a longer time for extinguishment (two minutes as opposed to one minute): small flickering flames are allowed at the end of the first minute as long as they are extinguished by the end of the second minute.

LASTFIRE protocol – system and aspirated tests.

Environmental regulations

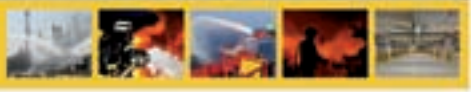
Foam concentrate is a mixture of different raw materials such as solvents, salts, corrosion inhibitors and mainly surfactants.

There are two types of surfactants: hydrocarbon chains, which are primarily responsible for the foaming capacity and foam stabilization; and fluorinated surfactants in which part of the hydrogen chain atoms are replaced by fluorine atoms.

The fluorinated surfactants are the key component in AFFF agents because they bring repellence and resistance to hydrocarbons. They add also the ability to form an aqueous film only a few microns thick on hydrocarbons.

Fluorinated surfactants can be manufactured in one of two processes, electro-fluorination or telomerisation. The first process (no longer used) generated products derived from

SIMPLICITY



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PFOS (perfluorooctyl sulphonate), whose use in Europe is limited to proportions smaller than 0.005% by weight of finished products, according to European Directive 2006/122/EC.

Currently there are no specific regulations covering fluorinated surfactants produced by the telomerisation process, and they are commonly used as the raw materials for the manufacture of AFFF agents. It is important to bear in mind that only AFFF products made with a specific type of fluorinated component are banned.

The other fluorinated product which is subject to a special control by some environmental authorities is PFOA (perfluorooctanoic acid).

PFOA is not prohibited and it is not a raw component used in foam manufacturing. However, some fluorinated products degrade into PFOA in the environment. This led the US Environment Protection Agency to set up the 2010/2015 PFOA Stewardship Program, which encouraged leading manufacturers of fluorinated products to eliminate by 2015 the production of fluorinated surfactants with chains of 8 atoms or more, and replace them with fluorinated surfactants with chains of 6 carbon atoms (C6) or less. This was seen as a way of ensuring that degradation would not generate PFOA, an organic chain of 8 carbons.

In addition to these international initiatives and regulations, some countries are also restricting the use of any organohalogen components that are likely to discharge into open waters. This is forcing many facilities to search for alternative solutions to AFFF agents, mainly in the form of fluorine-free foams.

Foam stocks and operators: frequently asked questions

Do we have to renew our stock of foam concentrate?
First it is necessary to ascertain whether the AFFF contains PFOS. If it predates 2000, it will be necessary to have a sample analysed to ascertain the fluorine compounds within.

Does the foam still retain its characteristics and properties?
Some foam concentrates experience a reduction in effectiveness over time. It is recommended to verify periodically the quality of the product.

Is our product certified according to standard EN-1568: 2008 with the required classification?
EN-1568-3: 2008 is the reference standard in Europe and users should know the foam's classification both with hydrocarbons (EN-1568-3: 2008) and with polar liquids (EN-1568-4: 2008). The classification of the product will inform the most suitable fire fighting equipment.

Is the proportion rate the most adequate for our risks?
Foam concentrates have evolved towards a reduction in the proportion rate, from the traditional products 6% to most modern ones 0.5%. In some cases the foam concentrates have only a single proportioning rate for hydrocarbons and polar solvents (1%, 3% and 6%), but in other cases the proportioning rate will vary depending on the fuel (0.5x1, 1x3 and 3x6). If it is necessary to protect against both hydrocarbon and polar solvents fires, the most convenient option is to have a product with a single dosage rate to avoid mistakes during fire fighting. This applies especially in the case of a fire brigade that responds to different types of emergencies.

Is our product effective with all the fuels and risks we have to attend?
Most standards use heptane as the reference fuel for hydrocarbons fires, and acetone and isopropyl alcohol for polar liquids fires. Moreover, they generally use aspirating nozzles (with the exception of UL-162). Thus, it is possible to compare the effectiveness of different products in constant conditions. However, it is likely that any 'real' fires will involve other fuels such as diesel oil, gasoline, kerosene, ethanol, methanol, etc. or even a mixture of these fuels, hence users should be confident that their foam will be capable of extinguishing and protect effectively against their hazards, and with the fire fighting equipment available.

How compatible is our foam concentrate with our fire fighting equipment?
It is important to know the real performance of your foam concentrate when it is used with your fire fighting equipment, therefore you must verify that the proportioning system is suitable for that foam concentrate. This is especially relevant for pseudoplastics such as AFFF-AR or fluorine-free products, due to their high viscosity at low temperatures. Also crucial is knowing the foaming capacity of any foam generators (low, medium or high expansion) in the facility.

Fuels

Nowadays a growing amount of polar additives are being added to gasoline. While hydrocarbons can be extinguished with some foams by violent application, polar solvents dissolve the foam when it is applied directly onto the fuel. The mixture of hydrocarbons and polar liquids is an issue that should be considered by users because - depending on the type and quality of foam – the foam application techniques may be different.

Demand for ethanol has grown strongly in recent times, both as a gasoline additive as well as in its own right, leading to larger ethanol-containing storage tanks. When designing a fire fighting system for ethanol, the fuel must be regarded as a polar liquid. There are a number of problems associated with extinguishing fires in large ethanol storage tanks. On the one hand fixed fire fighting installations may have been knocked out by an initial explosion, and on the other the usage of portable systems such as monitors lead to a forceful application of the foam on the fuel, which in turn may lead to the foam mixing in the fuel and not be capable of film forming.

Liquefied natural gas is another fuel that has gained importance in recent years, with large amounts being stored and transported by sea worldwide. Traditionally LNG tanks have been protected with high foam expansion systems, but recent trials have suggested that low expansion systems could be just as effective where high-performance foams are used.

Foam concentrates

As a result of changes in regulations, raw materials and fuels, foam concentrate manufacturers have developed or modified their products accordingly.

The most significant R&D efforts of manufacturers have been spent on reformulating AFFF agents whose fluorinated surfactants are mainly C6 and on creating the foams that are commonly described as being 'fluorine-free'.

Another trend has been the development of more concentrated products, and these are now common in the petrochemical industry at 1% – a long way from the traditional 6%. Some AFFF and AR-AFFF foams can even be proportioned at 0.5%. The logistical advantages of these type of products where there is a potential demand for large quantities of foam is clear.

The market is also increasingly demanding synthetic-based products (AFFF and AR-AFFF) rather than the traditional protein (FP, FFFP and FFFP-AR), due to the better fire fighting performance, better burn-back resistance and the lack of degradation over time.

Fluorine-free foams have increased in popularity because of environmental restrictions in some countries. Foams without fluorinated components have existed for many years in the market (eg protein, multi-expansion foams, Class A forest retardants), but in the last decade we have seen synthetic fluorine-free products being developed for fighting Class B fires, the goal being to create a valid alternative to AFFF agents but with less environmental impact.

Until the appearance of this new generation of fluorine-free products the forceful application of foams on hydrocarbons was only effective when AFFF products were used. However, some manufacturers of foam concentrate still remain sceptical regarding the behaviour and efficiency of fluorine-free foams compared to the tried and tested performance of AFFF, especially when used with non-aspirating nozzles.

Despite the significant progress reached in the development of this product range, some manufacturers recommend that AFFF or FFFP foams should not be replaced with fluorine-free foams without prior evaluation ie ensuring that the new solution

has the same certifications and ratings as the existing product; carrying out a comparative fire test using both products; evaluating the effectiveness of both in different applications with realistic resources (ie proportioning, nozzles, etc); and avoiding a simple document comparison exercise.

Fire fighting systems

Traditional proportioning systems are based on mechanical principles and they are designed for fixed working conditions (flow, pressures, etc). This is the case for Venturi-type inductors, membrane tanks, around the pump systems etc. In addition to a low flexibility in terms of flow rates and proportioning rates, these systems are not particularly precise in their proportioning. For this reason their use is not recommended for highly concentrated foam concentrates (less than 1%), where a small error in the injected amount of product can represent a significant error in the proportion rate, which could lead to serious consequences in terms of efficiency, autonomy and economy.

Although foam concentrates at 0.1-1% concentrations have been commonly used in Class A fires (solids), new developments have enabled the use of AFFF and AR-AFFF products at very low dosage rates (0.5%).

In order to use these products with accuracy, the use of electronically controlled proportioning systems is strongly recommended. Typically these comprise a flowmeter in the water line that sends data to a control unit, which in turn controls the foam injection system, accurately adjusting the amount of foam required for each water flow. Often seen on fire trucks, this equipment can also be used in fixed installations.

An important development in the sector is the implementation of compressed air foam systems (CAFS), where compressed air is injected into the foam-water solution producing foam with uniform fine bubbles and excellent adhesion and cooling capacity. As the foam is produced by the injection of compressed air, no air-intake restriction is necessary at the nozzle, which results in an excellent foam quality with a high reach. Better drainage times, faster extinctions, better burn back resistance and less water consumption are some of the characteristics of CAF systems.

Compressed air foam system and electronic foam proportioning system.

TRANSATLANTIC PARTNERSHIP

In May 2014 foam manufacturer Auxquimia became part of the US group ICL Performance Products. *IFJ* speaks with Auxquimia global sales manager Alberto Menéndez to find out what's next for the Spanish company.

Alberto Menéndez, Auxquimia.

Why did ICL buy a class B foam manufacturer?

ICL's aim was to enter the market of Class B firefighting foam concentrates. The company's best-selling Phos-check range was already the world market leader in fire retardants and class A foam concentrates for wildfires, and by purchasing Auxquimia the company wanted to offer a more comprehensive range for the fire fighting industry.

What brought Auxquimia to ICL's attention?

A few reasons. Auxquimia has been in the market for the last 30 years and its headquarters in the north of Spain include laboratories, manufacturing facilities, fire testing areas and offices. Both its reputation and business have recently grown rapidly as a result of the state-of-the-art foam concentrates it has developed in the company.

What is your most active business sector?

Growth has mainly been driven by the oil and gas sector, which requires demanding approvals such as LASTFIRE batch testing in which only premium products are able to attain the maximum classifications – especially when testing with sea water becomes necessary.

How important is research and development to Auxquimia and ICL?

R&D was one of the key points also for the acquisition. A number of years ago Auxquimia began to develop formulations with C6 fluoro-compounds, thereby fulfilling the 2010/2015 EPA PFOA Stewardship Program. Our aim has been to produce top-performing products with minimum environmental impact, including a premium AFFF-AR range with Newtonian low viscosity and low proportioning rates at 1x1%, 0.5x1% or even 0.5x0.5%.

Auxquimia has also developed premium fluorine-free foams in compliance with the standards and recommendations required currently for AFFF concentrates such as UL, EN 1568 or LASTIFRE.

What's next for the new partnership?

One of the main targets for ICL is to approach the North American market. To achieve this we have now listed most of our range – as mentioned above – according to UL 162 under the Phos-Chek brand. This name will continue to be the trademark used in the US for class B foam concentrates manufactured in Spain.

What are the main differences between the European and US markets for foam concentrates?

The main difference comes from test protocols. Europe and America test foam concentrates differently so it makes difficult to compare performances properly.

In addition, airports are subject to different regulations. In the US you have to comply with military specifications while ICAO is compulsory in the rest of the world. Some manufacturers are forced to develop different products for the same application depending on the area of influence of the standard.

Another difference revolves around new proposals to regulate foam concentrates containing fluorine compounds in their formulations. Europe and Australia are currently leading this initiative and manufacturers are researching new raw materials to comply with a potential regulation in the horizon. This matter is currently quite controversial, mainly in the heavy industries where the risks around large storage of flammable liquids are potentially very high, and there is still no real experience with the new fluorine-free formulated foam concentrates.

In the short term this issue is still not foreseen in America.

What do you think will be the next drivers for fire fighting foam R&D?

We would say that currently R&D is very focused in changes on current standards.

As mentioned before, regulations are currently setting limits and prohibitions in raw materials in order to protect the environment with more biodegradable products.

Foam manufacturers will eventually have to reformulate all their products to comply with these restrictions and the challenge is to achieve the same performance without the properties in firefighting that fluorine compounds have given to foam concentrates up to today.

To make it more difficult, risks in the industry remain the same and safety recommendations request an even higher performance for specific sectors such as oil and gas where large storage atmospheric tanks require specific testing protocols to guarantee a proper extinguishment in case of a major event (LASTFIRE protocol). These tests in salt water become a handicap for many products.

Lastly, we believe that the market is moving to more concentrated products. Years ago a product to be proportioned at 6% was quite common. Currently many industries are already using 1% products and even 0.5%, to optimise logistics without losing safety.

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A step too far?

As the US Government reinforces the EPA PFOA Stewardship Program with regulations on long-chain perfluoroalkyl substances the European Chemicals Agency is holding a public consultation on much stricter regulations that are causing serious concerns in the fire industry, writes Tom Cortina of the Fire Fighting Foam Coalition.

As voluntary measures to eliminate the production of long-chain perfluoroalkyl chemicals (LCPFACs) such as perfluorooctanoic acid (PFOA) become fully effective at the end of this year, environmental authorities in the United States and Europe are proposing regulations to reinforce these voluntary programs. Fluorochemical and foam manufacturers generally support these regulatory proposals as long as they allow for the use of short-chain (C6) fluorotelomers as alternatives. While LCPFACs such as PFOA are considered to be persistent, bioaccumulative, and toxic (PBT), short-chain fluorotelomers have been shown to be low in toxicity and not bioaccumulative.

In the US, the Environmental Protection Agency (EPA) has proposed a Significant New Use Rule (SNUR) that would act as a ban on the manufacture, import or processing after 2015 of LCPFACs for any new use and any existing uses that are not ongoing. The SNUR is intended to provide a regulatory backstop to the US EPA 2010/2015 PFOA Stewardship Program. Under that program eight fluorochemical manufacturers voluntarily agreed to work toward elimination of PFOA, PFOA precursors, and related higher homologue chemicals by year-end 2015 from both plant emissions and product content. EPA reports that all eight manufacturers are on schedule to meet their commitments.

As proposed, the SNUR would be expected to have minimal impact on the production and use of fire fighting foams. Once all current foam manufacturers have fully transitioned to the use of only short-chain (C6) fluorochemicals, the SNUR would effectively stop anyone else from manufacturing or importing fire fighting foams that contain LCPFACs by requiring them to notify EPA prior to undertaking the activity. The SNUR would therefore provide protection for manufacturers that are expending significant resources to reformulate all of their fluorinated foam products in order to complete this environmentally beneficial transition.

In the European Union, the European Chemicals Agency (ECHA) is currently holding a public consultation on a restriction proposed by Germany and Norway on PFOA, its salts, and PFOA-related substances. Similar to the EPA SNUR, the proposed restriction would cover the manufacturing, use, and placing on the market of LCPFACs as a substance, as a constituent of other substances, or in mixtures. Unlike the SNUR, the proposed restriction would also cover articles (products) containing LCPFACs.

The public consultation on the proposed restriction ends on 17 June 2015. Within three months after the public consultation closes, the ECHA's Risk Assessment Committee (RAC) will adopt its opinion on whether the suggested restriction is the appropriate measure to reduce risk to human health and the environment. The ECHA's Committee for Socio-Economic Analysis will also publish an opinion on the proposed restriction that is subject to a 60-day public consultation. ECHA then forwards the opinions of the two committees to the European Commission. Based on these opinions, the Commission will draft an amendment to the list of restrictions (Annex XVII of REACH) within three months for review by the European Council of Ministers and European Parliament.

The proposed restriction currently includes an extremely low concentration limit of 2 parts per billion (ppb) for PFOA and PFOA-related substances that cannot be achieved in the production of fire fighting foams and would result in a de facto ban on the use of fluorinated foams in the EU. As fluorinated foams are the most effective agents currently available to protect life, high-value property and the environment from the risk of flammable liquid fires in military, oil and gas, municipal, and aviation applications, such a result would have an extremely negative impact on fire safety in Europe. Not surprisingly, foam manufacturers and users have very serious concerns about the impact of this proposed limit and have expressed them to ECHA in early submissions on the consultation. We would urge all foam manufacturers and users that could be impacted by this proposed limit to submit comments to ECHA prior to the June deadline.

The limit on PFOA and related substances may have been purposely set at a low level initially to draw from industry information on what levels can be technically achieved and measured for different applications. It appears that the proposal was not intended to restrict the use of short-chain fluorochemicals, as it refers to them as important substitutes for LCPFACs. The unavailability of short-chain alternatives would drastically change the cost and feasibility of the proposed restriction and lead to a large number of possible derogations (exemptions). Thus, it is likely that the 2 ppb concentration limit for PFOA and related substances will be re-evaluated as the regulation moves through the evaluation process.

The environmental impact of fire fighting foams has been drastically reduced over the last decade with the elimination of PFOS foams, an increased focus on minimising foam discharges, and the ongoing transition to short-chain (C6) fluorotelomer surfactants. Regulatory proposals such as those described above are important steps to reinforce these gains by ensuring that there can be no move back into the use of long-chain fluorochemicals. Industry fully supports these proposals as long as they don't have the unintended consequence of also restricting the use of critical short-chain alternatives.

Taking responsibility

Fire destroys lives and may cause environmental impact while foam saves lives but harms the environment. Uday Shroff, general manager of KV Fire Chemicals in Navi Mumbai, India explains the Catch 22 situation.

Foam has undergone tremendous changes moving from initial protein foams to synthetic foams and then to AR-AFFFs with good spreading and sealing properties. We have also seen usage levels reducing from 6% to an amazing 0.5%. All these developments have provided a very powerful tool for firefighting.

The development in foam has been achieved through the invention of fluorosurfactants and high-performing short carbon-chain hydrocarbon surfactants. Environmentally harmful characteristics of fluorosurfactants such as bio-accumulation, bio-persistence and presence of telomers with carcinogenic potential coupled with high oxygen demand for degradation are all serious issues related to disposal of foam solutions and foam concentrates.

Technology has overcome some of these problems with new manufacturing routes and chemical structures that do not involve harmful intermediates in manufacturing or degradation processes. However, the issue of bio-persistence and bio-accumulation has not been resolved.

Research has established that the shortening of carbon-chain length in fluorosurfactants can reduce these drawbacks, if not eliminate them completely. This finding has led to the introduction of a new generation of shorter carbon-chain length, the so-called C6 fluorosurfactants.

Most fluorosurfactant manufacturers have achieved this changeover and C8-based fluorosurfactants will not be manufactured in the US after 2015 as per EPA, SNAP guidelines. This changeover has thrown challenges in the development of foams with C6 fluorosurfactants as regards meeting or exceeding the performance level of the C8-based fluorosurfactants.

Testing and approvals/certifications for the new formulations has been a Herculean task. Approval and certifying authorities and agencies have been hard-pressed to establish methodology for ascertaining the performance level of new formulations within a reasonable cost and time. Most of the work in this direction is now being completed and the new generation of foam concentrates with C6 fluorosurfactants are now being listed by various approval agencies including FM, UL, US MILT.

The drawback of fluorosurfactants has pushed for development of foam concentrates with much lower – or even nil – fluorine levels. Nevertheless few fluorine-free foam concentrates with reasonable extinguishing capability have been introduced, and their performance in large-scale real fires is yet to be established. Moreover they do have adverse characteristics that are detrimental to aquatic life such as very high COD and BOD values.

It is a Catch 22 situation. On the one side fire destroys lives and properties and may cause adverse environmental impact; on the other hand, foams save lives and properties but harm the environment. The need of the hour is to develop environmentally sustainable foams with good fire fighting capabilities; to improve application equipment; and to establish effective disposal and clean-up techniques.

Let us take the responsibility to make this world a fire-safe place with due care for the environment through proactive measures at all stages – be it in fire prevention, protection, detection or extinguishment.

Expansion strategies

Research by foam manufacturer Dafo Fomtec has revealed some major differences in performance when comparing AFFF and fluorine-free foams in low expansion ratios, writes chief chemist Dr Jan-Erik Jönsson.

The change to the new C6 fluorosurfactants has meant a lot of effort and been a huge step for all formulators. We finalised the changeover in 2014 after years of testing and re-certification.

As a part of this work we looked deeper into how fire performance was affected by different expansion ratios and in this context we compared C6 foams with fluorine-free foams, using UL 162 Type III as the test standard. It was amazing to see the high performance of a good AFFF-foam at very low expansion ratios combined with the low application density that is allowed by UL 162 during only 3 minutes of application time. However, we found the situation to be very different when using a fluorine-free foam at a very low expansion – even when the application density was 1.5 times higher and application time 5 minutes.

Both the AFFF and fluorine-free foam had expansion ratios of around 4. They reached 90% control time at more or less the same time, around 1 minute of application time. But after this time the result of the extinction process was different. The AFFF foam decreased the fire quickly and extinction was accomplished after about 2 minutes. On the other hand, the fluorine-free foam struggled with the fire and its thin foam layer did not provide enough protection to take out the flames. Due to the lack of film formation, we saw the fire spread easily over to already-extinguished areas, and final extinction was reached at 3:30 minutes.

Both foams passed the torch tests without problem, but there was a huge difference in burnback behaviour.

The AFFF passed the burnback test safely while in contrast the fluorine-free foam failed completely.

When the pot was lifted the fire spread over the pan and after about 30 seconds the whole tray was re-involved in flames. Fluorine-free foam needed over twice more premix to reach extinction, indicating a limited performance of fluorine-free foams at very low expansion ratios.

Having presented this poor performance at low expansion ratio, it is important to emphasise that the fluorine-free foam as well as the AFFF type passed the same test without any problems when using higher expansion ratios at about 7. It is important to keep this in mind when using fluorine-free foams in equipment providing very low expansion ratios. Moreover, our investigations demonstrated that our C6 re-formulations will work as perfect plug-ins and replacement for the older C8 versions.

Are fluorine-free foams or AFFFs the best answer?

Many people seem to think fluorine-free foams are the way forward in fire fighting – including some regulators – but others take a different position[1], writes Mike Willson of Willson Consulting, Tasmania, Australia.

AFFFs originally entered the market decades ago to replace fluorine-free foams that could not stand up to the growing risks and life safety challenges due to inferior performance. AFFFs and other fluorinated foams made current fire fighting techniques possible and safe. What has changed?

Perhaps it is the plethora of small-scale approval tests for fluorine-free foams that provide the evidence that they are more reliable fluorinated alternatives.[2,3,4]

More tests have been added over several years but I have yet to find one documented successful fluorine-free major event. And yet there is substantial evidence in social media channels, specialist magazines and anecdotal reports of failed fluorine-free demonstrations and tests by manufacturers;[5,6,7] independently witnessed fluorine-free testing;[8,9] and inferior fluorine-free foam performance in a significant incident.[10]

Some people may have been urged down this path because fluorine-free foams claim no harm or persistence in the environment, as some environmental regulators contest.[11,12]

I question whether fluorine-free foams are actually less impactful for fire fighting emergencies in the future, when the UK's Environment Agency confirms all foams pollute1. Fluorine-free foams can have high aquatic toxicity and may require three times more agent for a given sized fire[13, 8, 10] than AFFF, and I wonder whether responders have the extra resources, systems and manpower available to deal with these issues in an emergency.

Many fluorochemicals have different chemical and physical characteristics, behaving very differently in the environment, and PFOS foams are a legacy issue since 3M ceased foam manufacture in 2002.

The US EPA's (Environmental Protection Agency) PFOA stewardship program[14] volunteers fluorosurfactant manufacturers to meet strict purity compliance by developing short-chain C6 fluorotelomer surfactants which can provide equivalent fire performance without more chemical.

During a fuel release incident in Sydney (2013) a fluorine-free foam failed to control a large gasoline vapour release[10]. Fifteen minutes was its vapour control limit, before topping up the foam blanket – plainly unacceptable. Subsequent fluoroprotein use provided vapour control for 50 minutes (three times longer) before topping up was required. Why did that fluorine-free foam fail in both situations? Research published in a trade magazine reported that some fluorine-free agents have no fuel shedding capabilities[9,16] to prevent fuel incorporation into the bubbles during forceful application.

My questions are as follows: are we ignoring the key objective of fire fighting foams – namely to save lives and property by fast control and extinction? And do the perceived environmental benefits of fluorine-free foams outweigh the sacrificing of life safety, incident escalation, increased damage and increased business interruption?

In my opinion AFFFs, AR-AFFFs and other fluorinated foams use less agent, extinguish faster, reduce atmospheric pollutants, increase post fire protection, minimise firewater run-off, reduce the time and cost of remediation, and provide better outcomes for the environment while maintaining the best agents for life safety and property protection.

We have seen five decades of successful extinguishments of major incidents and the saving of countless lives and property with fluorinated foams. Surely these AFFF agents should not be replaced until an equivalent-performing proven viable option exists?

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Challenging environment

Inconsistency in foam standards is distorting the market and could lead to fewer suppliers, writes Manuel Acuña of VS Focum in Asturias, north Spain.

The market of fire fighting foam concentrates is extremely conservative, which may seem ironic for a sector that is based on emergencies and constant improvement. Every day we face new challenges, new fuels, new fire scenarios, and the market remains inconsistent: UL does not list any lower than 1%; MIL spec does not allow concentrates below 3%; ICAO takes kerosene fires into account but MIL only accepts gasoline fires in the aviation sector… and the list goes on.

No matter how many times one explains that protein-based foam has serious problems such as minimal shelf life and sedimentation compared to synthetic foam, the requests keep on coming.

We have taken a look into the future, adapting innovative fluorine free-foams into our catalogue, taking into account the importance of maintaining an excellent performance while respecting the environment: nevertheless people are still not regarding them as replacements for AFFF/AR – for now.

And sometimes, the cure is worse than the disease, as is attempting to replace fluorinated surfactants with silicon-based ones. Still, ghost flames in hydrocarbon fires and fire performances in polar solvent fires remain a constant challenge.

However, we believe that we are heading towards a highly-concentrated, newtonian fluorine-free-foam future.

VdS? UL? FM? ICAO? IMO? LASTFIRE?

There are endless contradictions in these standards. UL lists a foam that is based on a type of application and a type of container. Any variation voids the listing. LASTFIRE only certifies a certain batch: ISO 9001 ensures that all batches are of the same quality: ICAO tests are run only with fresh water, even when on off-shore platforms only sea water is used: IMO only tests gentle application foams (are there any vertical surfaces on the sea?).

The constant evolution of the fire fighting foam market is getting more expensive day by day, as standards collide. It is driving the market towards a worst-case scenario where only companies with the deepest pockets can access certain markets, leaving small companies behind without a chance to participate.

Fortunately for VS Focum, imagination does not rely on money so each day we open new paths towards new products, improving fire performance, environmental responsibility and logistics.

The goal is not to follow the path others have created, because that would only get us where they are already. We continue looking for solutions to problems in the most creative and original ways.

From strength to strength

As Solberg gears up for the launch at this year's Interschutz of new fluorine-free foams designed for fighting polar solvent fires, Dave Pelton explains why flourine-free foams are not all the same.

Dave Pelton, vice president of global marketing, Solberg.

In today's industrial market sector which uses fire fighting foam it has repeatedly been stated that, while fluorine-free foams may garner some level of market acceptance, they are not capable of achieving the same level of fire fighting performance as their fluorinated counterparts. While this type of statement may be true of some of the commercially available fluorine-free foams, blanket statements that group all fluorine-free foams into the same level of performance are not appropriate, just as grouping all fluorinated foams into the same level of performance is similarly not appropriate.

Re-healing foam concentrates from Solberg are an innovative, high fire performing environmentally sustainable fluorosurfactant and fluoropolymer-free firefighting foam used to effectively extinguish Class B fuels with no environmental concerns for persistence, bioaccumulation or toxic breakdown.

The Re-healing foam concentrates are formulated using a new high performance synthetic foam technology designed to replace traditional AFFF and AR-AFFF foam concentrates and older fluoroprotein foams. Concentrates available include 1%, 3%, 6% and 3x6% ATC formulations. Since the product's commercial introduction in 2006, significant research and development advancements have been made (and continue to be) including obtaining multiple product certifications on various Re-healing foam concentrates.

An example would be Re-healing RF3 3% foam concentrate which has achieved multiple product certifications. These include Factory Mutual (FM) approval and Underwriter's Laboratories listing.

Above: burn-back resistance test (note the self-sealing capability of the Re-healing foam). Below: industrial storage tank fire prop and Re-healing foam.

The product certification that RF3 holds is not a minimal certification but rather an extensive and complete certification requiring multiple fire tests as well as testing of foam hardware such as proportion hardware including bladder tanks, foam proportioners (ratio controllers) and in-line eductors as well as discharge devices such as foam makers, foam chambers (foam pourers) and hand-line nozzles (branchpipes).

Re-healing RF3 3% achieved FM Approval and UL Listing certification with standard (non-air aspirated) automatic sprinklers at the same application rates (densities) as the fluorinated counterparts. These sprinkler certifications are particularly significant as no other fluorine-free foam commercially available has been able to pass these stringent and difficult fire tests. In addition to FM Approval and UL Listing, Re-healing RF3, 3% foam concentrate is also Underwriter's Laboratories of Canada (ULC) listed, EN1568 approved and ICAO certified.

Now the company is poised to introduce two new Re-healing foam concentrates at the upcoming 2015 Interschutz Exposition in Hanover, Germany, 8-13 June (hall 13, stand D02). Re-healing RF 3x3 FP ATC and Re-healing RF 3x6 FP ATC are freeze-protected concentrates intended for use on Class B hydrocarbon and polar solvent fuel fires. ''We're elated to have reached this level of product development and fire performance with our Re-healing product line,'' said Luc Jacobs, Global Product Manager of Solberg. ''Both type concentrates can be used to prevent re-ignition of a liquid spill, control hazardous vapours, and will improve extinguishment in deep-seated fires.'' Product certification for both the new concentrates include EN1568 (Parts 3 and 4), International Maritime Organization, and they meet the quality and performance test requirements of LASTFIRE.

''Re-healing concentrates are very effective fire fighting foams for flame knockdown, fire control, extinguishment, and burn-back resistance,'' added Fredric Pettersson, sales director, EMEA Region: ''Control, extinguishing time, and burn-back resistance are paramount to the safety of firefighters everywhere. Re-healing foam concentrates have shown excellent performance in each of these categories.''

To find out more about the new foams visit hall 13, stand D02 (Amerex Group) at Interschutz.

SMART FOAMS ARE HERE

RECENT BREAKTHROUGHS IN CHEMISTRY ARE PAVING THE WAY FOR THE COMPLETE REMOVAL OF FLUORO TECHNOLOGY, WRITES GARY MCDOWALL, MANAGING DIRECTOR OF 3F.

At the last Reebok International Foam Conference in 2012 one of the speakers – Dr Thierry Bluteau from LEIA laboratory – addressed some of the issues raised about so-called 'green' foams.

Bluteau emphasized the fact that the attention had only been given to the debate between the pros and cons of perfluorocompounds (PFCs) – while other ingredients in foam formulations had been forgotten in the discussion. He announced the rise of a new generation of fire fighting foams, so-called 'smart' foams.

Progressing this debate 3F is proud to announce the release of its Smart Foam (SF) technology at the Intershutz exhibition in Hanover this coming June.

These foams represent a major improvement for the fire industry. Smart Foam encompasses a range of new products that have been designed by carefully selecting components with a global 'green' benefit. They are completely free of solvents and include a Class A foam, a high-expansion foam, an AFFF, a fluorine-free alcohol resistant foam and an additive for extinguishers.

What makes these products so special? Firstly, let's look at the additive for extinguishers Freedex SF. The Freedex range does not contain PFCs or solvents. It is the first product of its kind in the world to achieve 21A-113B-34B (AR) in a six-litre extinguisher, a performance for extinguishers that had previously been thought impossible. This leads the way to the complete removal of AFFF in extinguishers and replacement with a fully 100% biodegradable product.

A further innovation is Freedol SF, which is also 100% free of PFCs and solvents. This product has been tested to EN 1568 (*Fire extinguishing media. Foam concentrates. Specification for low expansion foam concentrates for surface application to water-immiscible liquids*) and has been confirmed as a 3x3, Class 1 on both acetone and isopropanol fire tests. In recent fire tests undertaken in Germany to compare fluorine-free foams and a well-known AFFF-AR 1x3, Freedol SF outperformed the other fluorine-free foams and performed as well as the 'classic' AFFF-AR product.

3F believes these innovations are a major breakthrough for foam technology and that they will lead the market for the next ten years, paving the way for the complete removal of fluoro technology. The next decade and the years beyond that will be headed by a new generation of smart foams.

Holistic protection

Jean-Philippe Roisin, EMEA business development manager, explains how FM Approvals' holistic approach ensures the performance of three leading special protection technologies: foam, water mist and clean agent.

When it comes to industrial fire protection, loss prevention specialists need a wide range of tools to meet the daunting and varied challenges possible today. Ignitable liquids and chemicals, business-critical data and electronics, precision processes and irreplaceable archives are just some of the situations that call for special protection systems.

While traditional sprinkler systems are still the first line of defense when it comes to structure protection, many protection challenges call for alternative extinguishing systems such as foam, water mist or clean agent. But with sophistication comes complexity. How do these special protection technologies work and are they reliable?

FM Approvals, an independent third-party certification agency, has approved foam, water mist and clean agent extinguishing systems for decades. These standards are often based in part, or in synch with, best-in-class national and international standards. For all types of special protection extinguishing options, FM Approvals' standards require examination of the complete system, including the structural and functional integrity of all components, fire performance tests for any agents or foam concentrates, and full system tests.

Fixed foam extinguishing systems

Approval Standard 5130, *Foam Extinguishing Systems*, covers only fixed systems and is used to accommodate a wide range of foam fire extinguishing systems and components. The complexity of these systems is typically dependent on the type of foam proportioning device used to maintain the correct volume proportion of concentrate in water over the specified range of flows. Typical concentrations of 0.5%, 1%, 2%, 3% and 6% are tested in accordance with Standard 5130 to ensure that accurate volumetric proportioning ratios over all conditions are compatible with the other system components.

Standard 5130 is unique in its evaluation of both the minimum foam application rates and maximum water application rates for foam-water sprinkler extinguishing systems. FM Approvals tests foam-water sprinkler systems at the actual installed application rate, and subsequently applies water at the maximum foreseeable rate to test the integrity of the foam blanket.

Figure 1: special protection extinguishing system – high-expansion foam in an airplane hangar.

Another critical performance factor that Approval Standard 5130 measures is the minimum and maximum height from which a foam-water sprinkler, for instance, can extinguish a fire. This is important for occupancies where surfaces may vary greatly in elevation, such as warehouses, turbine halls and other industrial settings. The proximity of the foam discharge device to the fire surface can have a dramatic effect on the foam's extinguishing effectiveness.

Under Standard 5130, all foam extinguishing systems – eg foam-water sprinklers, monitors, CAFS, etc – must produce foam that can withstand a five-minute sprinkler deluge of at least 12.2mm/min. Another unique feature of the standard is required testing of the air inlets and vents associated with high-expansion foam systems (see Figure 1). Manufacturers must demonstrate that these critical system components will continue to function under wind and snow loading, as well as icing conditions.

Foam concentrate is evaluated along with its corresponding system – including proportioning and discharge devices – and must be marked with the 'FM Approved' certification mark and the following must be noted on the concentrate container: ''This concentrate is only FM Approved in conjunction with the specific proportioning and discharge devices as shown in the Approval Guide.''

It is important to note that the foam concentrate does not attain a stand-alone FM Approval that is separate from the system with which it was tested and certified. The intention is to eliminate the perception that the use of the concentrate carrying the 'FM Approved' mark bestows the FM Approval on that particular system merely by its use.

All fixed foam extinguishing systems must be tested upon installation and retested annually. This and other instructions are contained in the manufacturer's design, installation, operation and maintenance manual. This manual must be submitted to FM Approvals as a prerequisite to examination of the foam extinguishing system.

FM Approvals provides an alternative methodology for the annual testing of fixed foam extinguishing systems, requiring far less foam than conventional techniques. Because many fire fighting foams must be treated as hazardous waste after use, testing with actual foam concentrate can be costly. Assessment Standard 5138, *Proportioning testing*, establishes a relationship between the actual concentrate and a surrogate liquid (eg water or other liquid) allowing annual retests with little or no foam solution disposal costs.

Water mist extinguishing systems

At nearly 300 pages, Approval Standard 5560, *Water mist systems*, is a comprehensive standard for water mist fire protection testing. The standard provides test requirements for specific occupancies and applications, each covered in a

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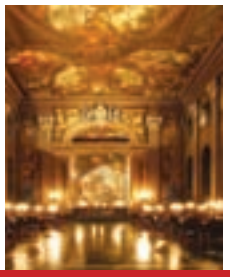
Booking is now open for the 3rd International Tall Building Fire Safety Conference which takes place at the University of Greenwich between Wednesday 8th and Friday 10th July 2015.

We are proud to introduce **Sir Ranulph Fiennes** as the speaker after the Gala Dinner on the Thursday evening. Diners will enjoy the soaring ambience of the Painted Hall, fine food & wine and also the pleasure of listening to world class speaker **Sir Ranulph.**



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Quotes from last year's Tall Building Fire Safety Network Conference delegates

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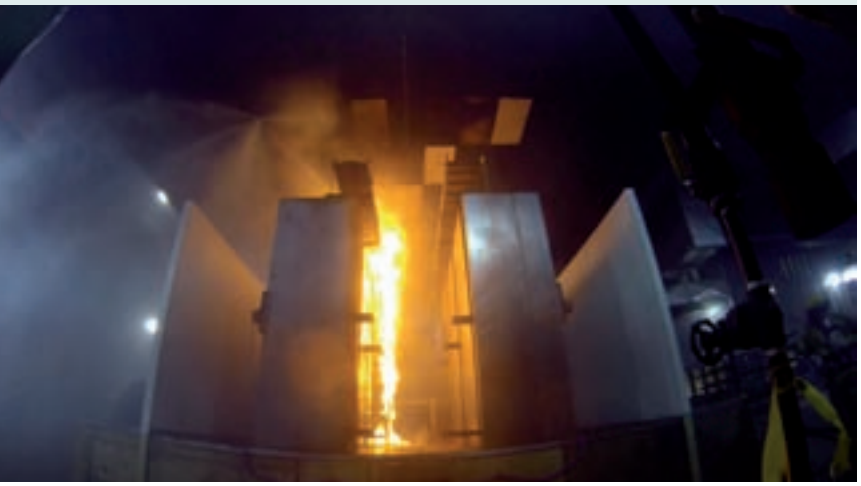

Figure 2: a water mist fire extinguishing system is tested in a data centre mock-up at the FM Global Research Campus in West Glocester, Rhode Island, USA.

separate appendix, including:

- machinery spaces and special hazard machinery spaces;
- combustion turbines enclosures;
- industrial oil cookers;
- non-storage and non-manufacturing areas (eg residential, offices, meeting rooms, hotels, museums, restaurant seating areas, institutions and schools);
- wet benches and similar processing equipment;
- local application occupancies;
- computer room subfloors; and
- continuous wood board presses.

FM Approvals tests only complete water mist systems, not just nozzles or other individual components. As with other special protection systems, water mist fire extinguishing systems can be quite complex and therefore the functionality and effectiveness of the whole system is the only allowable basis for Approval.

As with all FM Approvals standards, Standard 5560 is a 'living document' that is continually evaluated and refined based on actual field experience and ongoing research programs. This year, for instance, Standard 5560 will be updated to introduce two new test protocols for water mist systems intended for the protection of above and below raised floors in data centers. In addition, a new test methodology will be added to the standard that enables scaled-down fire testing of water mist systems to simulate full-scale volumes.

The new scaled fire testing methodology is for total flooding applications only – eg turbine and machinery enclosures – and is intended to help reduce the time and costs associated with test programs. The scaled testing can help determine, for instance, which full-scale tests are worth the investment or to eliminate the need for full-scale tests in some circumstances. Our researchers conducted validation tests involving half-scale nozzles and half-scale pool and spray fires in a half-scale enclosure. The results were comparable to full-scale results for all scenarios tested.

FM Approvals developed two new test protocols for the use of water mist systems to protect data centres in direct response to the needs of data center clients. The new data centre test protocol for protection of above raised floors (see Figure 2) addresses the specific needs of these special occupancies, including the need to provide protection within hot/cold aisle containment areas, with active forced ventilation, significant amounts of power and telecom cabling, metal cable trays and an interlocked dry pipe/pre-action system.

The new test protocol for below raised floors is intended to evaluate water mist systems in the face of active forced ventilation, single- or double-tiered cable trays, and using an interlocked dry pipe/pre-action configuration. Water mist systems may be tested as wet systems only under these new data center protocols, and will be noted as such in the Approval Guide.

Clean agent extinguishing systems

FM Approvals evaluates vaporising liquid and inert gas clean-agent systems for total flooding protection under Approval Standard 5600, *Clean agent extinguishing systems*. As with all other special protection systems, this standard requires the examination of the complete system, as well as design, installation, operation and maintenance instructions.

Clean agent fire extinguishing systems are widely used to protect ignitable liquids and materials, electrical equipment and ordinary combustibles in areas where surface burning is anticipated. These systems are not effective or appropriate for hazards that may produce deep-seated burning or those that involve chemicals containing their own oxygen, metal hydrides, or reactive metals such as sodium, magnesium or uranium.

FM's Property Loss Prevention Data Sheet 4-0, *Special protection systems*, and Data Sheet 4-9, *Clean agent extinguishing systems*, provide guidelines for the use of clean agent extinguishing systems.

Standard 5600 requires testing of the clean agent itself, individual system components and the total system. Depending on the complexity of the system, component testing may include high-pressure discharge integrity, cycle operation, 30-day minimum and maximum temperature leakage, hydrostatic integrity, resistance tests, corrosion, strength, vibration and compatibility testing.

Clean agent systems must undergo Class A and Class B extinguishment tests. The system must successfully extinguish Class A fires within 600 seconds after the end of system discharge, with no signs of re-ignition. For Class B (ie ignitable liquid) fire tests, extinguishment must occur within 30 seconds after the end of system discharge.

For engineered clean agent systems, FM Approvals also evaluates the flow calculation software provided by the manufacturer to ensure that it can accurately predict discharge time, nozzle pressure and distribution of the clean extinguishing agent within established limiting parameters.

All clean agent systems must also undergo a series of nozzle distribution verification tests to ensure that they can adequately distribute the agent throughout a hazard to reach the minimum extinguishing concentration within 30 seconds after the end of system discharge. These tests are run in various enclosures at worst-case system conditions, including minimum and maximum ceiling height, maximum area of coverage, maximum discharge time, minimum nozzle pressure and minimum storage temperature.

As with all FM Approvals programs, manufacturers of clean agent systems must meet certain operations requirements, including demonstration of a quality control program, participation in initial and ongoing surveillance audits, installation inspections, and a design, installation, operation and maintenance manual.

Special protection technology will need to keep pace with the innovative industries it serves. From vast data centers supporting global enterprises to petrochemical and pharmaceutical manufacturing to semiconductor fabrication and aircraft hangars – many commercial and industrial protection scenarios present unique fire risks. Ensuring these systems perform – and protect – is critical.

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Atomised futures

New IMO requirements for the use of water mist technology onboard container ships is just the latest chapter in the long history of water mist, writes Bettina McDowell, secretary of the International Water Mist Association.

Some people think that the water mist technology is still quite new and in some ways that may be true. However, water mist systems are well established and have been in use for well over 20 years in their present stage of technology and there is more to the history of water mist than meets the eye.

The idea of using small water droplets to fight fires is by no means new. As early as 1880, the concept already existed. Back then the US company FE Myers had developed a backpack system to fight small forest fires. However, the idea needed to mature.

It wasn't until the late 1970s that two men – one might call them 'water mist pioneers' – re-introduced the initial idea, which was: put away the bucket and take a thimble full of water to extinguish a fire. The two men were Krister Giselsson and Mats Rosander and in 1978 they wrote a book called *Fundamentals of Fire*. They believed that, ''in the future a liquid, eg water, atomised to drops smaller than powder grains, will be the most important extinguishing agent against flames indoors, so-called fine mist.''

However, more than a decade passed between the publication of their book and the first big significant leap for water mist. It took two incidents to put the technology on the world fire fighting stage.

Water mist systems can be installed in new and existing buildings.

The first one was the execution of the Montreal protocol on substances that deplete the ozone layer. The result was that halon, which up until then had been used as a fire extinguishing media, was banned.

The second incident was a devastating fire on the ferry Scandinavian Star in the early hours of 7th April 1990. The fire killed 158 people – nearly half of all passengers on board. Due to the fact that there had been a good deal of development relating to high-pressure water mist in Sweden between 1975 and 1990, the first solutions were on the table on 20th June 1990 – two months after the disaster.

The ban of halon left a gap that water mist could fill. The fire on the Scandinavian Star led to an improvement of the International Maritime Organization's (IMO) fire safety requirements and installation guidelines. In addition, fire test procedures for alternative sprinkler systems were developed.

But how does water mist work? And where can it be applied? The idea behind water mist is quite simple and it is based on the fire triangle of combustible material, heat and oxygen. If there is a fire, water mist fire fighting systems remove the heat and the oxygen – while traditional sprinkler systems only remove the heat. And it is the size of the droplets that makes the difference.

Water mist systems work at low, medium or high pressure, ie between just under 12.5 and up to 120 bar. They atomise water using nozzles especially designed for the purpose and the higher the system pressure the smaller the droplets. As the size of the droplets decrease the overall surfaces increases. The result is a steam that has the ability to reduce the heat and the oxygen. Consequently energy is subtracted from the fire and the additional cooling effect prevents re-ignition.

When it comes to applications water mist systems can be integrated into new but also existing buildings. The list of possible applications is impressive: tunnels, ferries and ships, oil rigs, data-centres, archives, escalators, atriums, nuclear plants and offices as well as cable tunnels – are only some of the items on that list. We can also add hospitals, saunas, stations, museums and heritage buildings, wooden churches as well as brick cathedrals, cooking areas, commercial fat fryers and so on. Indeed some say that the only applications where water mist systems are still lagging behind are storage areas and warehouses.

One of the reasons for this vast range may be the flexibility that this kind of fire suppression system has to offer. Rüdiger

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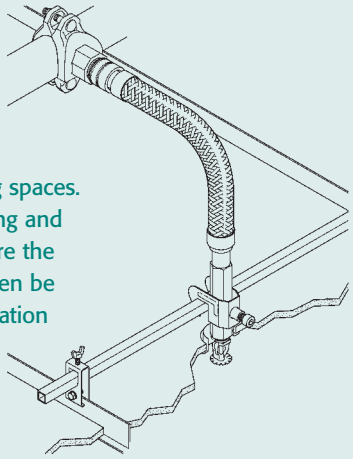
YOUR FLEXIBLE SPRINKLER FRIEND

Tyco Fire Protection Products has introduced the new Fastflex model FB – a flexible braided hose that is part of a unique sprinkler drop assembly for installation on wet-pipe pendent sprinkler systems in tight or false ceiling spaces. The VdS-approved hose allows for testing and charging of the system with water before the ceiling grid is installed. The hose can then be repositioned to fit the final sprinkler location without draining the system of water, saving installation time and costs.



The Fastflex model's flexible design provides easier manoeuvrability around ducts and trays in congested spaces, offering additional positions to install the sprinkler. Its versatility also makes the hose ideal for tight and unusual ceiling types and curved plasterboard ceilings. Moreover, the product eliminates the need for measuring, cutting and threading pipes, as well as the use of elbows and fittings, contributing towards further reduced costs and project timeline.

Comprising a stainless steel flexible hose, a swivel inlet nipple, a sprinkler reducer, and lightweight ceiling bracket components, the unit easily connects from the branch line to the sprinkler. Offering flexibility and simplicity benefits, the Tyco Fastflex Model FB is suited to a variety of applications including offices, schools, libraries, hospitals and retail complexes.

Tyco Fire Protection Products's Wouter Bossink commented: "Investing in approvals and focusing on overcoming user challenges enables us to develop effective solutions that offer customers design freedom, reliability and cost-effectiveness in challenging installation environments."

Kopp, general manager for fixed systems at Cologne-based Fogtec, explains: ''There are many guidelines when it comes to water mist systems. But it is in fact these guidelines that give us so much freedom. Thus water mist solutions are often applied when it comes to special-purpose solutions and unusual hazards.'' He continues: ''The core of water mist is the engineering approach. We do not set prescriptive standards. We find solutions via a performance-based approach for completely new and out-of-the-ordinary projects.'' Looking at a picture of the new Elbphilharmonie concert hall in Hamburg, which is fitted with one of Fogtec's high pressure systems, this becomes quite clear.

The IMO requires container ships built after 1st of January 2016 to carry water mist lances.

One the other hand water mist systems can also be very much down to earth and indeed with low-pressure systems the customer may be just as happy. Alex Palle, CEO of VID Fire-Kill, remarks: ''With low pressure it is possible to use more conventional system components that can be sourced locally and which in the end reduce cost and save time.''

Marco Pesaola, Technical Manager at Eusebi Impianti, reports that in recent years there has been a growing interest in water mist systems from nuclear power plant operators. He explains: ''Interestingly, some are retrofit projects in facilities that are between 20 and 30 years old.''

In any case water mist fire fighting systems use less water than traditional sprinkler systems. This may be of importance in areas such as data centres or rooms where valuable artifacts are kept or exhibited. Here damage caused by water can be just as disastrous as damage caused by a fire. Also in regions like the Middle East where water is precious it makes sense to choose a system that uses less water.

Next to the fixed water mist systems there are also mobile water mist systems such as water mist lances or nails, extinguishers and other mobile units. One field of action here is the marine sector. The IMO has introduced new requirements for fire protection on board of ships and it becomes mandatory to carry water mist lances on board new container ships that are constructed on or after 1st January 2016.

The list of characteristics of water mist is impressive and, apart from being versatile and able to cope with small amounts of water, the technology is reliable, environmental friendly and – unlike some gaseous fire fighting systems - does not harm human beings. Ann Micheli, managing director at Ultra Fog, says: ''In hospitals and residential buildings, the advantage of water mist is that you do not have to evacuate people before activating the fire system.''

In summary there are situations where water mist is the better choice because of the way it interacts with fires (eg deep fat fryers), and in other cases because of its limited requirements for water (eg projects in the Middle East). For all applications, however, its use is based on full-scale fire test which ensures that the water mist produced by any particular system is able to deal with exactly the type of fire that may occur in specific buildings or industrial plants.

As far as standards are concerned water mist has become well established. The first body to work out a standard was the National Fire Protection Association with its NFPA 750 *Standard for water mist fire protection systems* (first published in 1996 and revised in 2015). In addition there is the CEN/TS 14972 – currently a technical specification – which is also available from the European Committee for Standardization as draft norm prEN 14972.

The International Water Mist Association represents manufacturers, insurance companies, independent consultants and institutes dealing with water mist. Founded in 1998 the IWMA today plays a part in promoting but also improving the technology. IWMA liaises with CEN and also supports the European Commission – as the Expert Group on Marine Safety – and the IMO in their work.

''Water mist technology has long been considered to be a black art'', concludes Rüdiger Kopp: ''But planners, consultants, surveyors, public authorities and also fire brigades are increasingly trusting the technology as they see guidelines becoming more and more transparent."

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Smarter & safer

Developments in technology are creating smarter buildings where fire and security systems are moving closer together to offer even greater levels of protection, explains René Jungbluth, Building Technologies Division, Siemens.

Siemens is promoting itself with the slogan 'Investments in fire safety and security pay for themselves every day' – what does this mean exactly?

Today fire detectors and video cameras are omnipresent. They are permanent fixtures in many buildings and support smooth business operations – unnoticed by most of the building's occupants. But research and product innovation are constantly moving forward. Now we can intelligently combine technologies, for example fire safety with alarm systems or security and building technology. Modern information technology thus permits holistic safety and security approaches, allowing building operators and occupants to focus completely on their core business. For our customers, this pays for itself day in and day out.

Is the willingness of building operators to invest affected by the fact that fire safety is regulated by law, but security is not?

Fire safety is regulated by law in most European countries and operators are aware of the need to invest in this area – at least when it comes to new construction. But things are different in the security field. It's our job to make the customer aware of possible weak spots and demonstrate the necessity as well as the economic sense of comprehensive safety and security solutions.

To what degree have physical security and IT security merged in modern building technology?

Not all customers are yet aware of the relationships between physical and IT security. The CIO is usually responsible for IT security, whereas the facility manager takes care of building security. Organisationally they are often in separate departments with separate budgets.

The fact is that building security is increasingly IT-based. For example, access control and state-of-the-art video surveillance systems are communicating more and more over the IP protocol, which allows data transmission over standard IP networks. While fire detection requires a dedicated network, there are no comparable regulations for access control and video surveillance. But because the security industry depends on standardisation, it is pushing toward IT industry standards. Personally, I think that the security industry is currently under-regulated.

What is easier: IT experts taking on facility tasks, or facility experts taking on IT tasks?

In a traditional corporate building of a medium-sized business, the facility manager is often the driving force. In international companies, however, where safeguarding sensitive data is a main concern, it is the head of IT who is the decision-maker.

We at Siemens have a major advantage here. As users of holistic IT-based safety and security solutions across numerous locations, we know first-hand the many challenges our customers face. This allows us to advise our customers in facility management as well as IT matters, and as a manufacturer, to build a bridge between physical security and data security.

How do international companies with subsidiaries around the world currently address security?

In today's business world, different security systems are typically used. For the most part, they are managed separately at each location. These isolated solutions are often implemented without considering the enterprise-wide security concept and the impact on operations. Employees may need different ID cards for access to different locations and applications, which slows down processes and increases vulnerability to risk.

This is where our One Card concept comes in, which manages all identities and authorisations through a standardised, centralised software approach. Cardholder data is collected just once and automatically synchronised with the company database in real time. That saves time and money and allows the customer to establish an enterprise-wide security culture and enforce security policies. Physical identity access management will play a significantly greater role in the future.

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Let's stay with access control systems where data from different systems has to be managed. How does that work?

You must have the expertise to implement interfaces between the systems and to capture the extensive access control information. That's the only way to centralise the data on a uniform, cross-location platform. That brings us back to the IT world. I'm sure that enterprise-wide security, especially in critical infrastructures, will move much closer toward IT security in the future.

The industry currently favours 'intelligent' security. What does Siemens understand that to be?

In the past, and to some extent even now, the different security systems – access control, intrusion detection, video surveillance – have been viewed and operated as separate disciplines. Intelligence means developing comprehensive scenarios for these disciplines that offer real added value to the customer.

Let me give you an example. An access control system reads the badge of an employee who works on the seventh floor. The lighting and room climate is then adjusted based on the employee's workstation profile – just for his or her workstation, not everywhere. In this case, intelligence connects security with comfort. For example, if a fire alarm goes off late in the evening, the lights are turned on, and not just at the emergency exits, but everywhere along the escape routes.

For this type of intelligent security, we have developed Desigo CC, an open platform that integrates the different disciplines in the building. By enhancing the functionalities of existing disciplines to boost the comfort and security of people in the building, we create added value for our customers. And we do that without the need for additional investments.

How open is the building technology industry to that kind of innovation?

Actually our industry tends to be conservative. Integrated management of multiple disciplines is not yet the norm. But increasing IT penetration – just think of the ubiquitous smartphone and everything it can do – also helps our industry become more modern. It helps as well as demands it.

How important are services in the security field?

Security as a service begins with developing an optimal security concept for the customer. First I need to know what is important to the customer, and then I need to conduct an overall risk analysis. Then I need to have the expertise to assess which measures might help minimise these risks and which of the current technical solutions will be useful in achieving this goal. Siemens has both the consulting expertise and the solutions. Yet cost-efficiency is always at the fore.

Another type of service is inspecting and auditing existing installations. Recently we performed an audit of the fire safety and extinguishing systems of an international customer. Our challenge was to reduce the various systems in multiple countries with different regulations to a common denominator and verify whether they met the company's general security standards – an extremely complex task. For the customer, the result was very valuable.

Another completely new service for building operators is our evacuation simulation. We analyse the possible escape routes in existing buildings or new construction. This analysis illustrates what would happen if a fire were to break out somewhere in the building. How can people exit the building quickly? Can the staircases accommodate enough people? Where are the bottlenecks that might be mitigated through construction measures? The simulation can also be used as a virtual training tool for first responders.

What fire safety innovations can we expect in the near future?

Alert handling will improve. Decades of experience are built into our current detectors, which make precise fire detection possible. Now we're exploring what to do with alarms. How can a building's existing sound and intercom systems be used to notify employees or visitors of an emergency? How can the systems involved be networked intelligently? For example, we employ mass notification to quickly notify large numbers of people in an emergency situation. In Europe this topic is still on the sidelines in stark contrast to the USA. There are very few requests for proposals that call for fire safety as a separate discipline.

Does that mean something needs to happen to raise awareness or are the laws inadequate?

Legislation is one thing. Then there's the individual responsibility of the CEO. He or she is obliged by the company owners and society to take all necessary measures to protect people and assets.

This awareness does exist. Our job is to demonstrate how to achieve the desired level of protection. You can assume, for instance, that most of the people will be in the buildings during the day, whether it's their place of work or a shopping centre. You can take advantage of that by linking the existing fire safety system to a voice alarm system and highlighting the escape routes as the situation demands, using the existing lighting. This helps people behave correctly in an emergency, even if they are not familiar with the escape routes in a public building.

We recently tested this type of model on behalf of the European Commission. A public police alarm was transmitted via smartphone to the people in a building as well as issued through Desigo CC.

We develop the software-based solutions for situational mass notification and emergency evacuation in house and then collaborate with partners for the peripheral components so we can offer a total, coordinated solution.

Overall, how eager is the security industry to innovate?

There is no dearth of ideas for innovation, but not every innovative idea is practical. You always have to ask yourself if an idea will truly benefit the customer, how it can be implemented technologically and whether it is cost efficient. Especially in security, new product development cycles often take years; this has to be brought in line with feasibility and implementability.

The fact that in most commercial buildings multiple parties are involved can also curb innovation. There is the investor on the one hand and the operator on the other. Which one is more likely to invest in innovative technologies? Investors are rarely prepared to do so because they usually don't profit from it. Yet operators will only invest if they can pass on the additional investment as an added value to the building occupants. This works only if the innovations benefit customers directly.

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Rising to the toxic challenge

Ian Buchanan, European manager, Spectrex, explains how open path systems work to detect toxic gases.

In February 2015 a Coca-Cola bottling plant in Speedway, Indianapolis saw emergency procedures being initiated after a strong ammonia smell was sensed by 25 workers. The plant was immediately evacuated and a significant emergency response was provided by local fire department and hazmat teams. The source of the leak was a 300,000-litre tank which was used in the refrigeration processes within the plant. Concentration readings fell from 700ppm to about 150ppm, which was significant, though the plant could not be operated until they were further reduced to below 25ppm. Throughout the incident, no threat was posed to anyone outside the plant, where readings were 2ppm.

Another example of an industrial ammonia leak occurred in a Chinese frozen storage and logistics business in Shanghai, in August, 2013, where the chemical was used in food refrigeration involved in the importing, exporting, storage and processing of seafood. A detached pipe cap caused a huge leak, as reported by Shanghai Municipality Information Office, and led to the deaths of 15 people and injuring a further 25.

In November 2014, a large amount of hydrogen sulphide (H2S) blanketed most parts of Moscow, causing emergency authorities to direct everyone to stay indoors. It was later discovered that the gas had originated in a Moscow oil refinery but no injuries were caused.

In May 2014, an oilfield worker in the municipality of Hazelwood, Canada was found unresponsive at one of the customer worksites. It appears that the worker died from exposure to high levels of H_2S.

While toxic gases may have many benefits and useful applications within a variety of industries, high concentrations can cause much damage to humans and can be life threatening. Two particular examples of toxic gases commonly present in industrial and agricultural environments are ammonia and hydrogen sulphide.

Ammonia features in various industries in a wide range of processes, either as a raw product or as a by-product. These include carbon capture and storage in the oil and gas industry, fertiliser, nitric acid, explosive and plastic production and more ammonia, NH_3, in gaseous form is a colourless gas with a characteristic smell. However, the gas is toxic and even in liquid form when diluted, it is extremely corrosive. Ammonia is toxic and can cause lung damage and death (see Table 1).

It can also cause fires and subsequent explosions if concentration levels reach 150,000ppm (15% vol.). While it is essential to ensure that concentration levels do not become extreme enough to cause a fire, it is equally crucial to ensure that they do not reach life-threatening levels. Therefore, ammonia must be neutralised if high levels are detected.

Hydrogen Sulphide, H_2S, is also a toxic gas with a 'rotten egg' odour, is also colourless and is produced by the anaerobic breakdown of organic material. It is a by-product in many industries, including pulp and paper, produced by the breakdown of wood; construction where it can be released during excavation work; the petroleum industry where H_2S is removed from natural gas and oil, and more. It can be used as a precursor to metal sulphides and has a number of uses within analytical chemistry.

H_2S does not cause irritation at low concentrations but can be fatal at high concentrations, as shown in Table 2.

In addition to this, when burnt, H_2S releases sulphur dioxide which is a very dangerous, toxic and strong smelling gas which can cause irritation and death. At concentrations above

Table 1: effects of ammonia at increasing concentrations

25 ppm	TLV-TWA – Maximum exposure 8 hours
35 ppm	TLV-STEL – Maximum exposure 15 minutes
53 ppm	Detectable by humans
130 ppm	Irritates skin, eyes, nose and respiratory tract
2500 ppm	Life threatening

Table 2: effects of hydrogen sulphide at increasing concentrations

0.03 ppm	TLV-TWA – Max. exposure 8 hrs.
4 ppm	Eye irritation.
10 ppm	TLV-STEL – Max. exposure 15 mins.
20 ppm	Severe nerve injury.
30 ppm	Loss of smell, injury to blood brain barrier.
100 ppm	Unconscious after 15 mins. Respiratory paralysis in 30-45 mins.
200 ppm	Series eye injury and permanent damage to eye nerves.
300 ppm	Loss of reasoning and balance.
500 ppm	Unconscious in 3-5 minutes. Asphyxia.
700 ppm	Death - breathing will stop and death will result. Permanent brain damage if rescued.

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The Safeye 950/960 open-path gas detectors for ammonia and hydrogen sulphide.

40,000ppm (4%) it may cause a fire or an explosion.

Toxic gases has a broad range of uses, including agricultural fertilizer production, pure sulphur production, water purification, chemical reduction, oxidising, toothpaste production, water repellent production, concrete sealant etc. While the gases are widely used in all these applications and more, it is important that their concentrations don't reach dangerously high levels, risking those in surrounding areas.

It is difficult to determine when a toxic gas is reaching dangerously high concentrations. Even if it is possible to smell or use another sense to 'detect' a toxic gas, this is not reliable both because a lethal concentration may build up before anyone gets close to the leakage area, and because some toxic gases (eg H_2S) affect our sense of smell. It is therefore very important to be able to detect them using reliable, accurate apparatus. In order to control the potentially dangerous effects of these toxic gases, they must be detected at low concentrations

One method of detecting toxic gases is by 'point' type detectors. These are typically semiconductor or electrochemical based detectors, in which the monitored gas reacts with the sensor. A grid of 'point' detectors is required to monitor a large area, since the gas has to physically reach the sensor in order to be detected. Toxic 'point' gas detectors require periodic calibration and maintenance, which can be a considerable burden in large plants that may require hundreds of detectors. Since most detectors are installed in the highest risk areas, maintenance technicians are constantly exposed to high risks and are often required to wear oxygen masks.

In many applications, a considerable improvement over 'point' detectors is obtained using the method of open-path, line-of-sight gas detection. Open-path gas detection is based on a beam of light being absorbed by the detected gas between a transmitter (source of light) and a receiver over distances up to 80m. The chemical absorbs some of the beam's energy and the intensity of the beam is therefore reduced. The received beam signal is used to determine whether or not a gas is present. This method can monitor even traces of gases as they 'cross' the path between the transmitter and receiver units. As opposed to 'point' type detectors, the toxic gas does not have to reach the receiver (detector) unit in order to be detected. This reduces the number of detectors required for a given area.

Open-path gas detection (OPGD)

The theory of OPGD is based on the Beer-Lambert absorption equation, which is as follows:

$$I = I0 \cdot \exp(-E \cdot C \cdot L)$$

In this equation, I is the intensity of radiation after passing through a gas cloud and is recorded as the output beam. I0 is the intensity of radiation in a clean atmosphere, E is an absorption coefficient typical to the detected gas (dependent on the measured wavelength), C is the gas concentration in the measured cloud (in air) and L is the length of the beam's optical path through that cloud. The absorption coefficient E (as function of wavelength) is often called the chemical 'spectral fingerprint' and is unique for each chemical substance. Oil and gas products have unique 'spectral fingerprints' in the ultraviolet (UV) and infrared (IR) portions of the electromagnetic spectrum. An optical open path gas monitoring system analyses these spectral fingerprints in several spectral bands where the monitored gases have defined unique spectral absorption lines. Specific filters are designed for each spectral channel to identify the gases.

With reliability and safety being the most important issues when measuring and monitoring combustible or toxic gases, the following performance criteria must be addressed by the system:

- Reliable and fast detection – real time measurement and automatic self-testing.
- Withstand harsh and extreme environments – humidity, rain, fog, snow, industrial chemicals and background radiation (sun, lamps, heaters etc).
- Reliable false alarm free operation – immunity to any chemical reactions and to industrial and environmental radiation sources, which might cause false alarm or disable detection.
- Low maintenance requirements – continuous operation without requiring manual testing and part replacement.
- Easy alignment and commissioning – one-man setup.

Spectrex has developed a solution for the detection of toxic gases before their concentration rise to a dangerous level. The Safeye 950/960 open-path toxic gas detector detects the following gases:

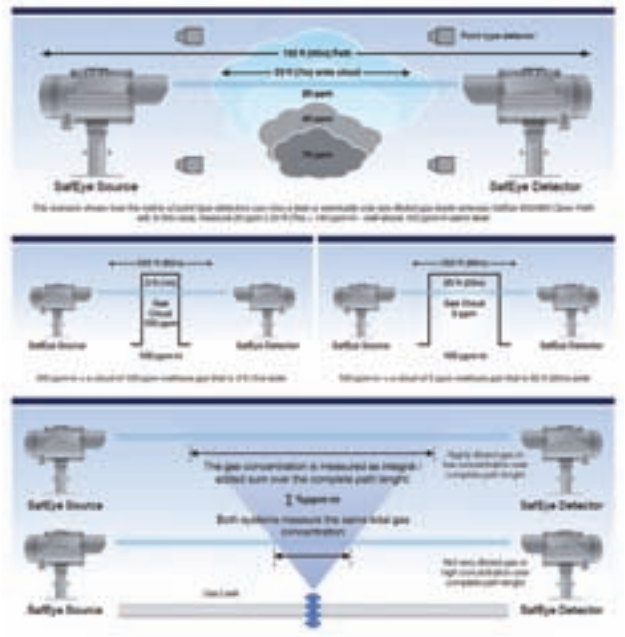
- Safeye 950 – ammonia (NH_3).
- Safeye 960 – hydrogen sulphide (H_2S).

The detector is able to detect ammonia/H_2S at distances of up to 80m using open path, line of sight technology. The system is fully operational and immune to false alarms caused by background radiation sources such as sunlight, filament

lamps, projectors, heat generators and other type of optical detectors. The detector provides a warning signal when no longer able to provide accurate detection (eg the path is blocked or obscured). However, they can function effectively even when 90% of the light is obscured by extreme environmental interference such as fog, rain or smog.

An open path system consists of two parts: a light source (transmitter) and a detector (receiver) located at a predetermined distance. The transmitter is a unique flash lamp source, which can be activated at various frequencies and which emits pulses of light with a wide spectral band (UV to IR), and the receiver is the sensing and analysing module of the system, which contains several sensors with unique filters.

The apparatus can detect different gases with respect to different band-pass filters. The location of the radiation source (transmitter) and the receiver (detector) define the optical path.



The light source and detector are mounted and aligned at a predetermined distance (fixed in a given installation). The optical path to be monitored is the direct line of sight between them. Since the distance between light source and detector is different from one installation to the next, the gas concentration is measured in ppm.m (parts per million multiplied by meters). To obtain the average gas concentration over the optical path, the ppm.m concentration is divided by the distance between light source and detector (in meters).

The transmitter, which can be activated at various frequencies, emits very short (microseconds long) high intensity pulses of light enabling the recognition of its unique pattern by the receiver, which distinguishes it from background radiation sources such as sunlight, filament lamps, projectors, heat generators, etc. The receiver contains several sensors according to the specific gases (or chemical families) to be detected. In the toxic gas models, the signal and reference wavelength bands are in the 0.2-0.3 microns UV range.

ABOUT THE AUTHOR

Ian Buchanan is European Manager for Spectrex and is based in the UK. He has over 30 years experience in industrial fire and gas detection. Spectrex is a manufacturer of flame detectors and open path gas detectors for high-risk industrial applications.

Protecting Number 1

Providing fire detection systems for a landmark office building in the heart of London presented a number of challenges – not least of which was its location next to a five-star luxury hotel.

Knightsbridge is home to some of the most prestigious addresses in central London. It's a leafy district, with high-end retail stores and Hyde Park on its doorstep. Number 1 Knightsbridge, a landmark office building situated on the south side of Knightsbridge, is now being protected by the latest fire detection products from Apollo.

Tony Marsh, National Operations Manager at Integral Fire UK, explains more: ''We were brought in by the building services and environmental consultants for the site to help improve the fire detection systems within the refurbished building. False alarms were becoming a major problem with the legacy system in place. While this presented an obvious nuisance to any occupants of Number 1 Knightsbridge, it was also causing issues with its neighbours. The offices are situated next to a five-star luxury hotel and every time an alarm was activated the hotel was notified in order for it to take appropriate action in the event of a fire. Clearly with increasing false alarms occurring, this was an unsustainable situation.

''Overall, the team at Number 1 Knightsbridge were happy with the Ampac panels already on site, so in order to upgrade the system we needed to use open protocol detectors and call points. Apollo's XP95 range provided the solution. We increased the number of Ampac addressable panels – putting one on each floor and then installed more than 1,000 XP95 products including smoke detectors, manual call points, heat detectors and some visual alarm devices. In addition, we installed Apollo's intrinsically safe equipment in the basement, which was used for oil storage. With the risk of explosion this could present in the event of fire, we needed detection equipment that the occupants could rely on even in this harsh environment.''

Marsh continues: ''Working in the heart of London and next to a luxury hotel definitely placed some constraints on the installation. We could only work through the night and, with guests sleeping nearby, noise needed to be kept to a minimum. The familiarity the team had with Apollo equipment and the ease of installation made the night-time working a lot easier.''

Integral continued to install the fire detection system during the refurbishment of the whole building and found Apollo's ceiling tile mounting box particularly useful. Designed to make the installation of detectors and sounders quick and easy prior to the fitting of a false ceiling, the boxes enabled Integral to work around other contractors and complete the fit before completion of the refurbishment. The installation took the Integral team just under four months of night work to complete.

DETECTION NEWS

Italian company EDS has introduced two new explosion proof Ex-d Atex-certified detection products for use in environments classified as having a risk of explosion in zones 1-2-21-22.

The FL50 flame detector is particularly suitable for the protection of high-hazard environments because not only is it highly immune to false alarms but it also uses the highest level of sensitivity and minimum time delay. The principle of operation is based on the detection of infrared IR and ultraviolet UV radiation emitted by a flame. The detector can be equipped with a range of sensors: single IR (infrared); double IR (two sensors); triple IR (three sensors); single UV (ultraviolet); and combined IR and UV.

FL50 can detect a fire more than 50m away with viewing angle of 120°. It is equipped with a special internal circuit for automatic periodic testing or remote control manual testing. An optional automatic optical window heater allows the use of the detector even at very low temperatures. The housing of the device is made of aluminium alloy explosion-proof Ex-d Atex. Also new is the FL50 Tester, which has been designed for field-testing flame detectors in areas with the risk of explosion and where testing cannot be carried out with real flames.

It works by generating a wide band signal, from ultraviolet to infrared, similar to a real flame.

Tyco Fire Protection Products has undertaken a roadshow in Turkey to introduce the country to the Zettler range of fire detection technology.

Between 7-13 May the Zettler Truck visited Ankara and Istanbul to bring the latest innovations in fire detection directly to consultants and fire engineers, system integrators, installers, end users and fire brigades.

The truck's first stop was the Sodex exhibition in Ankara where it held live demos to demonstrate the system's functionality and effectiveness in the event of a fire.

Following Ankara, the roadshow travelled to Istanbul for an exclusive customer event at the Çırağan Palace Kempinski hotel.

The Zettler Profile Series is based on Tyco's proven MZX Technology to offer high resilience and reduce the risk of false alarms. An enhanced installation, configuration and service set-up saves valuable time and cost, and features new innovations such as login via an RFID tag, which replaces conventional key switches. This allows unique identification of users and complete traceability of all actions performed on the fire panel, particularly suited to high-risk environments where critical function changes need to be tracked.

Drax Technology has launched a cloud and subscription-based system that enables users to access fire alarm management remotely on any device.

Sold through an annual renewable licence, Smart Web can be used by service and maintenance organisations, facilities and estates managers and end-user organisations to prove which devices have been checked during weekly testing and quarterly maintenance visits.

Keith Minster, product manager, commented: ''Service and maintenance companies use different methods to produce evidence of what has been tested – engineer's hand-written service sheets, print-outs from control panels, marked-up drawings and coloured or bar-code stickers affixed to each device for example. None of these methods are fool proof. Smart Web records exactly when a device has been tested, detailing the time, date and location. This level of detailed consistency means that Smart Web becomes a powerful compliance tool for both service and maintenance companies as well as end users.''

Smart Web uses plug and play hardware. Users simply connect it to the fire alarm control panel to be monitored, enabling the interface to communicate via GPRS with the server and they can then monitor every sensing device connected to the panel 24x7.

Flexible approach

Adapting firefighter PPE to meet different industrial environments and performance standards has led Bristol Uniforms to design a layered solution, writes Philip Tasker, UK sales director.

Right: simply put on an extra top coat to increase the protection of the Layerflex structural fire fighting kit from Level 1 (pictured) to Level 2. Below: Bristol's Xflex Hainsworth Atlas Paris (navy).

Whilst the nature of many industrial fires across the world may be broadly similar, the climatic and local infrastructure environments vary widely across continents and countries. This is reflected in the different standards required and by the way protective garments are designed and made. It has long been recognised that global challenges need global solutions.

Industrial fires, broadly categorised as non-structural fires, encompass a wide spectrum of incidents ranging from underground explosions and fires in mines, through hot fires involving oil and gas both on land and at sea at petrochemical installations and on offshore oil rigs and exploration platforms to transport fires involving aircraft, rail and road transport accidents. Marine fire fighting, as well as covering offshore industrial activity also encompasses fighting onboard vessel fires at sea.

This wide range of environments, as well as the nature of different types of industrial fire, creates a need for firefighter equipment and personal protection based very much around risk assessments of individual locations. Clearly two principal subdivisions of industrial fires relate to the environment as the challenges facing responders is very different on land and at sea. Access to fire fighting equipment and prevailing weather conditions have a fundamental impact on the capability of emergency responders to deal with fires and execute rescue missions effectively. On land, resources can be more readily brought to the scene and evacuation of people and access to medical attention is often less challenging than at sea with more facilities available and more readily accessible. On the other hand, the nature of fires can have similarities such that hot fires involving oil, gases and petrochemicals on land and at sea present similar fire fighting challenges. Fires underground, which are often accompanied by, if not the result of, gas explosions deep underground present particular challenges where saving lives of trapped workers must be the first priority as oxygen can rapidly run out and extinguishing fires underground can take a long time during which further explosions can occur or new fires break out.

For firefighters, the challenge is to source protective clothing that satisfies three principal criteria.

Firstly, it must be fully effective at protecting the wearer from injury arising from the hazards presented by the type of fire involved as well as shield them from any immediate health risks associated with the nature of the fire.

Secondly, protective garments need to address the effects of the environment in which fire fighting and rescue operations take place.

Thirdly, as industrial fire fighting frequently involves being at the scene of the fire for long periods – many fires can take days, or even weeks, to fully extinguish – long and arduous shifts require firefighters to be clothed in kit which helps to minimise the physiological impact of extended periods of strenuous activity on the front line.

To meet these often-conflicting challenges has been the focus of the technical and product development teams of leading firefighter PPE manufactures for many years. Much research has been undertaken by PPE designers and manufacturers – such as Bristol – in collaboration with providers of materials to create composite constructions that can satisfy these complex needs.

In recent years, the combined resources of PPE suppliers with fibre and fabric producers such as DuPont, PBI Performance Products, AW Hainsworth and WL Gore have harnessed the properties of new and improved materials to develop significant improvements in high-performance protective garments. These newer garments have been exhaustively tested in test laboratories, fire test manikins and in the field to produce some of the most advanced PPE ever made available to fire and rescue services in the industrial arena.

Multinational operators in key industrial fire risk sectors such as shipping, oil and gas exploration and production, mining and all forms of transport adopt internationally-developed and recognised standards of performance when specifying the levels of protection required for their firefighters. Most advanced countries use either EN or NFPA standards which not only apply throughout Europe and North America but are widely adopted, sometimes with minor local variations, in South America, the Middle East, Australia and New Zealand. The PPE specifications are

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FIRE MAX 3 NOW EVEN TOUGHER

The Rosenbauer Fire Max 3 protective suit is now available with a PBI Neo outer fabric.
According to Rosenbuaer the Neo fabric has the same high levels of heat protection and flame resistance characteristics as the previously-used fabric PBI Matrix but with a better mechanical performance characteristic.
The Fire Max 3's outer fabric now has eight times the strength stipulated by European fire fighting clothing standard EN 469. It also represents a 150% improvement on the previous Fire Max version.
Resistance to tearing is another performance characteristic that has seen a massive improvement, with the Neo being 24 times more resilient than the standard as well as four times higher than that of the suit with PBI Matrix.
Rosenbauer's Fire Max 3 is made of three layers which as well as the PBI Neo include a PTFE moisture barrier and a safety thermal lining.
PBI (polybenzimidazole) fibres neither burn nor melt and even after intensive flaming remain largely functional. The fabric hardly shrinks or becomes brittle and does not break open. In addition, the high-tech fibers offer first-class resistance to acids, lyes, solvents and other chemicals.
As well as PBI Neo, the Fire Max 3 is available in Nomex Tough and PBI Matrix. The latest offering will be available in gold and brown.

predominantly the same as those used for structural fire fighting – with the exception of fire fighting at sea where marine specifications often apply.

For non-marine fire fighting the standards are EN469:2005 (soon to be superseded by EN469:2014) and NFPA1971:2013. For marine fire fighting in European jurisdictions, the European Marine Directive 96/98/EC (MarED) also applies. Enhanced accreditation for leading companies is provided through the Wheelmark Certification.

Ergonomic design, coupled with garment flexibility, are keys to achieving the best all-round solutions in balancing the protective, health and comfort elements of industrial fire fighting PPE. Protection against the principal hazards of radiant heat, flame lick, water penetration and resistance to chemical and hydrocarbon ingress remain the focus of design and largely determine the composition of firefighter clothing and the materials used for the outer layer.

The health and wellbeing aspects of wearer protection focus on the moisture barrier and thermal layers and their ability to minimise heat transfer through the garments from the outside. This includes how the layers accommodate the outward transfer of body heat and moisture vapour in the form of sweat.

The design that brings together two or three layers into a composition with optimum wearer comfort underpins manufacturers' efforts to provide garments that can be used with confidence.

Bristol has been designing firefighter PPE for industrial markets for many years and is a major supplier of fire kit for airports, oil and gas exploration and production, both on land and offshore, shipping companies and mining undertakings in regions including Europe, the Middle East, South America, Asia and Australasia.

For offshore and marine fire fighting Bristol offers two options. Its Fleet Suit, recently fully upgraded with the introduction of a new

head-to-toe ensemble, has been in use fighting shipping fires for over 50 years. It is fully proved to EN, Mared and Wheelmark standards and it is available in Level 1 and Level 2 combinations. For close-proximity oil and gas fires an aluminised one- or two-piece protective garment is also available where protection from intense heat and severe flame lick is essential.

For onshore fire fighting, flexibility is a key factor. In some instances the hazardous conditions can be assessed in advance whilst, in others, unknown factors coupled with unpredictability, render it virtually impossible to select the right kit for the situation on the ground. To meet these needs a different approach can be required which allows wearer protection to be assessed, and reassessed, on arrival and during the mission. In addition to the deployment of lighter weight constructions such as the Ergotech and Ergotech Action styles, Bristol has more recently introduced its Xflex design. This offers even greater manoeuvrability and forms the basis of the latest solution, Layerflex, which uses a layered approach to allow a number of different needs to be met in a set of only three garments. Where fire fighting conditions change, either from those anticipated at initial deployment or during an operation, the three garments can be used in different combinations. This can be a cost-effective means of equipping firefighters as all regular protection scenarios can be met by using just one trouser and two coats – a Level 1 coat which, when used with a topcoat, provides Level 2 protection.

Continued investment in research and development of fibres and fabrics by leading manufacturers working in collaboration with internationally active garment manufacturers, whose close contact with their users is a vital component of a successful partnership, is set to ensure that product evolution continues to reflect the changing needs of firefighters.

PRESENTING 'PROJECT B'

Kermel has launched a fabric that doesn't break open when exposed to fire called Kermel Project B.

The French fabric and fibre manufacturer said that Kermel Project B has been designed to lower the cost of ownership of fire fighting clothing whilst maximising wearer comfort.

The fabric continues to offer the highest level of personal protection whilst looking professional and showing little to no shrinkage after 30 industrial wash/dry cycles, said the company. This wash performance means that the lifetime of the garment is extended and its costs reduced. "We have also introduced a sustainable development programme whereby old garments no longer in service can be collected and recycled for use in other areas where heat and flame are a risk," said Kermel spokesperson Véronique Quartier.

Kermel will be exhibiting at Interschutz, hall 12, stand B47.

Kermel Project B suit prior to manikin testing in an independent laboratory.

The suit shows no signs of shrinking or breaking up after the maninkin test.

VISIONS THROUGH THE HALO

As news breaks of the launch of a new helmet-mounted TIC Ann-Marie Knegt speaks to Halo Thermal Imaging's James Brooks about how the tool will enhance fire operations.

Firefighting operations are about to change. The developers at Halo Thermal Imaging at Durham Tees Valley Airport in the north of the UK have come up with a product that is set to greatly improve operations.

Head of Innovation at Halo Thermal Imaging (formerly K2) James Brooks lives and breathes thermal imaging cameras. His passion for developing the latest TIC is obvious in how he talks and visualises his new product, the Halo; the worlds smallest, most lightweight thermal imaging camera. It is so light in fact that it attaches on a firefighting helmet with a torch clip, providing the user with hands-free operation and constant vision.

James firmly believes that this new product will be a game changer for the fire industry.

"Every piece of technology in this camera is patented. This will be the future of firefighting," he comments.

In the past, Halo has produced thermal imaging cameras for the White House, NASA, and Ferrari Formula 1 as well as being an established supplier of thermal imaging cameras for firefighting and search and rescue operations. Halo is one of the few thermal imaging camera manufacturers that builds its own internal engine.

It was at the Airport Fire Officers Conference held in Dublin in January 2015 that a thermal imaging manufacturer predicted that interest would soon return towards helmet-mounted thermal imaging camera technology. It turns out that this manufacturer was right. However, the Halo is more than just 'interest', says James, "Halo is a viable product that has been received to wide acclaim by the firefighters all over the world who have tested it – with the two most prolific brigades being Northern Ireland FRS and Rome FRS in Italy.

The 390g Halo is in the process of attaining NFPA 1801 certification.

Historically, helmet-mounted and helmet-integrated thermal imaging cameras have been regarded as less user-friendly than hand-held or hands-free cameras, but this perception is set to change – there is nothing like the Halo," says James. And there is no doubt about it, this TIC is small. It only measures 60x70x125mm and weighs 390 grammes. "These are the type of dimensions and weight that


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Halo features a 6.35 cm high-definition display with snapshot function that enables image freezing for situational assessment.

really provide the wearer flexibility and comfort without compromising operational performance. Most hand-held TICS on the market weigh 1-1.5kg."

Simplicity is key

James explains that simplicity is one of the key elements of the design of the Halo. "The equipment becomes part of what they are doing, and it should be unobtrusive, because the firefighter's job is to get a casualty out. With hand-held cameras, the brain is having to tell the arm to hold the TIC up, and then it is having to tell the hand where it is moving. This means that one part of the brain is already occupied."

Central to the design process was also ensuring that the IP67-certified TIC would be easy to pass around between team members. Consequently it has been configured to be attached to all types of firefighting helmets with a simple torch-mount adaptor. It can also be attached to a tunic and operated with a lanyard.

Halo Thermal Imaging has built and designed the Halo's engine with a lens especially designed for close-range work required in firefighting. A 6.3cm high-definition display with snapshot function enables image freezing for situational assessment. The camera features spot temperature measurement with four colour maps with single button configuration.

"At the minute we do not run a 384x288 sensor, but instead use a 160x120 core which is upscaled to be equivalent to 320x240. Obviously the more pixels you can cram into a screen the clearer the image, but the real question is, how many pixels do you really need?

"We decided not to implement a higher number of pixels in the image because this would mean having to increase the size of the TIC. Our research revealed that if you marry up a good 160x120 sensor with the right lens and software you get a superbly performing camera at the smallest size," says James. He adds that due to the superior dynamic range the Halo can clearly detect casualties against a fire as well as in 'colder' scenarios such as search and rescue. "Every firefighter that has trialled the Halo says the vision is just perfect, even for people who require glasses. The TIC is exactly at the right height, and users can move the display up and down according to their requirements."

Another clever feature is its shutter-scanning awareness, which means that the TIC avoids missing information when the detector is callibrating itself or switching between different operating modes.

The Halo has a ten-hour battery life and a continous operating range of -20°C to 85°C, operating for 15 minutes within the range of 150°C. For temperatures above 260°C it can operate for 7 minutes.

"Right from the start we have always wanted to design and build the most innovative fire safety products. With the Halo thermal imaging camera, I know we have achieved this. To provide a firefighter with the best tools when they are working in such a difficult and life threatening environment, gives myself and our team immense pride," concludes James.

AUSTRALIAN FIREFIGHTERS WARNED OF CANCER-CAUSING CHEMICAL IN PROTECTIVE CLOTHING

Australian firefighters have been advised to take precautions handling their uniforms after they were found to contain formaldehyde, a chemical linked to lymphatic cancer and brain tumours.

The Safety Alert by the Australasian Fire and Emergency Services Authorities Council (AFAC) follows the publication of a study by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) which found 'unexpected levels' of the chemical in protective clothing.

AFAC commissioned CSIRO to conduct research to assess contaminants in the Proban-treated cotton PPC.

This research identified a potential concern of formaldehyde levels in some test results of Proban-treated product.

The research was conducted in a laboratory environment and the results indicated that further testing is required. Further testing will ensure the results take into account the operational environment and establish any potential exposure for firefighters.

Proban is a chemical additive and process that is applied to fabrics (such as cotton) to provide flame retardant capability. It is currently found in:

- CFA – technical rescue overalls and wildfire jackets/pants and overalls.
- MFB – wildfire jackets and trousers.
- DELWP – wildfire jackets and pants.
- VICSES orange coveralls and two piece.

Formaldehyde is naturally present in air, food and water, and a wide range of human domestic and industrial activities are responsible for both direct and indirect release of formaldehyde into the atmosphere. It dissipates quickly when left in a well-ventilated environment.

Safe Work Australia considers formaldehyde to be a probable human carcinogen when exposure is above the current occupational exposure standards. Further research is required to extrapolate these findings to an operational environment.

Until further investigations are completed AFAC recommends the following guidance be followed:

1. Agencies to advise members of the dangers of breathing in fumes that are emitted from Proban-treated PPC that has been stored in a confined space, eg a kit bag. Wherever possible, Proban-treated PPC should be stored in a well-ventilated environment but if this is not possible precautions should be taken to avoid breathing in the fumes (gases) emitted when opening the confined space.
2. Wherever Proban-treated PPC is stored in a sealed or confined space, ensure that it is opened in a well-ventilated area and allow a short time to pass before removing.
3. Agencies instruct personnel to wash separately Proban-treated cotton garments before they are worn for the first time and after each use.
4. Agencies advise members that direct skin contact with Proban-treated PPC may cause skin irritation. The known incidence of skin irritation time (over 30 years) that Proban-treated cotton has been used in Australia is minimal. Where there is evidence that skin irritation is occurring when a Proban-treated over-garment is being worn, individuals should wear long sleeve shirts and long pants underneath these garments.
5. Agencies instruct personnel not to shake Proban-treated garments as a means of removing dust and particulates before washing.
6. Agencies instruct personnel to wash separately Proban-treated cotton garments after each use so as to minimise the amount of dust and particulate matter trapped in uniforms.

AFAC says that further research and investigation on the impact of this safety advice issue will be undertaken by the agencies, and further information will be provided as soon as it becomes available through either AFAC or CSIRO.

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