INDUSTRIAL FIRE JOURNAL

FOR PROFESSIONALS PROTECTING LIVES, ASSETS AND INFRASTRUCTURE WORLDWIDE

Fourth quarter 2016 issue no.106

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Bring out the big guns

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Disaster averted

The water-mist system that saved the day (twice)

Dubai, UAE

intersec

January 22 – 24, 2017

Airport Fire Officers Association
Annual Conference
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*** US Naval Research Labratories (NRL) website – 90 years of Innovation**

"SEAC considers that fluorine-free foams can be taken into account on a long-term basis but cannot be relied on for the coming years for such a critical use."

Committee for Socio-economic Analysis (SEAC), Draft Opinion, on an Annex XV dossier proposing restriction on PFOA, its salts and PFOA-related substances, 10 September 2015, p14.

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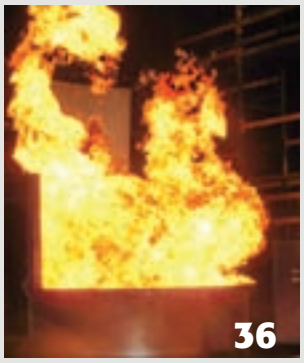
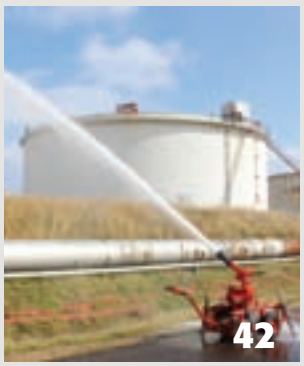
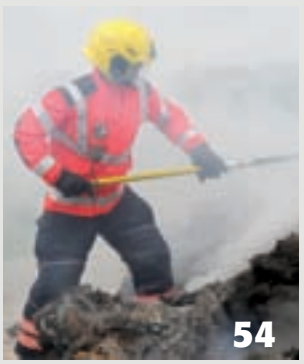






Front cover artwork: Darren Small.

Comment

Fire engineering and science come together beautifully in this issue, with multiple examples of research projects and technology innovation ranging from C6/ fluorine-free foam protocols and ethanol fire extinguishing to newly published water mist standards and the establishment of safe PFOS and PFOA levels in human blood. The willingness on the part of the majority of concerned parties to share their fire-related findings with colleagues around the world is a wonderful characteristic of an industry that shares a common goal – averting disaster.

But fire protection is not for the unwary. Regulatory and standards regimes designed to protect end users can also aid unscrupulous operators through their increasing complexity and specialism.

In this issue we hear of systems certified to marine standards for local applications being used on land-based installations. Are owners aware that in the marine sector these sorts of local solutions are backed up by total flooding systems? In this issue we also see how voice alarm systems, which one might presume are relatively straightforward, turn out to exist in a contradictory standards quagmire that could turn legally unpleasant in the event of a tragic incident.

On a more positive note, there has never been a better time for industrial responders to find suitable training and education to enhance their skills and knowledge, either via high-quality field courses or through the use of so-called blended learning that combines practice with e-learning. The expertise is all out there, it's just a question of finding it.

Jose Maria Sanchez de Muniain, Editor

NOISY EXTINGUISHING SYSTEM

A routine fire extinguishing test in ING Bank's main data centre in Bucharest, Romania in September took the centre offline for around 10 hours.

The noise emitted during the release of the fire extinguishing inert gas damaged a number of bank's hard drives, causing the financial transaction to be affected over the weekend and the bank's website to go offline.

The potential damage occurring to hard disk drives during discharges of automated dry extinguishing systems has been known to the fire industry since 2009, and consequently some 'silent' solutions do exist, such as Siemen's Sinorix silent nozzle and the Sinorix CDT regulated extinguishing system.

CLASS-ACTION LAWSUITS IN USA

Emergency response exercise Skyfall: the Peterson AFB Fire Department is the first responder for any aircraft crashes through a mutual aid agreement with the city of Colorado Springs. (©US Air Force, photo: Robb Lingley)

The first class-action lawsuits to name foam manufacturers as defendants in a case of contamination by PFCs through the use of aqueous film forming foams in training exercises have been filed in the US.

The lawsuits, which were filed separately in September by the Hannon Law firm in Denver and the McDivitt law firm in Colorado Springs, name six foam manufacturers in total: 3M, Ansul Foam of Wisconsin and National Foam of Pennsylvania are named in both, and Angus Fire, Buckeye Fire Protection Company, and Chemguard are also named in the McDivitt suit. Neither of the lawsuits name the Air Force as a defendant.

They relate to the contamination of groundwater in southern El Paso County, Colorado by Peterson Air Force Base, affecting residents in Security, Widefield, and Fountain. The base used AFFF foams containing PFCs for training exercises for two decades between 1970 and 1990, and the contamination was discovered following testing of the wells earlier this year, leaving local residents reliant on bottled water to avoid further contamination.

The foam manufacturers are blamed for knowingly manufacturing a toxic product and not warning customers, including the Air Force, about the dangers posed by the chemicals contained in the foam. PFCs have been linked to various forms of cancer and other illnesses as well as adverse impacts on reproductive health.

The Hannon lawsuit states: ''Upon information and belief, defendants had known of these health and environmental hazards for years. For example, by the mid-1980s, 3M began a major programme to review personnel handling of fluorochemicals and determined that fluorochemicals could bioaccumulate.''

The McDivitt lawsuit now has more than 1,500 signatures and lawyers believe up to 70,000 people could be affected by the contamination.

Prize announced for best PhD thesis

The International Water Mist Association has announced a competition for best PhD thesis related to water mist technology.

The winner will receive a prize of €1,000 (US$1,000) and one year's free membership of the association as well as the opportunity to present the thesis at the 17th International Water Mist Conference 2017 in Rome, 20-21 September. The deadline for the submission of abstracts is 30 April 2017. All entries will be assessed by the IWMA Scientific Council and the winner notified 30 June 2017.

In 2016 the Young Talent Award was presented to Daniel Martin for his master thesis: *The use of a water mist curtain as a radiation shield.*

For more information visit: www.iwma.net/publications/iwma-award/.

AUSTRALIA SEEKS CONSISTENCY

A special summit is to be held in Australia in 2017 to help develop 'nationally consistent standards for environmental contamination'.
The summit will discuss giving Australian states and territories greater powers to deal with contamination on land currently or previously owned by the Australian Government.
Queensland Environment Minister Dr Steven Miles, who has previously expressed concerns about the impacts from contamination on Commonwealth sites on communities and businesses in the state, has welcomed the news.
"The contamination of current or former Commonwealth-owned sites in Queensland is well documented, and Queensland's environment department faces significant challenges in managing environmental problems that occur on or around these Commonwealth-owned lands," Dr Miles said. "The Federal Government has ultimate responsibility for PFAS contamination at Defence sites and civilian airports, and also off-site where contamination is likely to have extended beyond site boundaries."
Dr Miles believes the Commonwealth should remove the legal barriers that currently make them out of bounds for state environment agencies. "There is an urgent need to resolve these challenges so that we can protect the community and the environment."
He added that a recent meeting of environment ministers in Sydney acknowledged the challenges of managing PFAS contamination and agreed to work more closely in the future, including around the timely communication of information to the public and ensuring that regulatory approaches are aligned and effective.
In July, the Queensland Government placed restrictions on the use of foams containing PFOS, requiring existing stocks at commercial and industrial premises to be withdrawn from service as soon as possible, and that foams containing related PFAS substances should be phased out and replaced with more sustainable alternatives as soon as possible.

PILOT MASTERCLASS SUCCESS

A pilot masterclass that aims to help site managers better manage their industrial firefighters has been successfully piloted in Rotterdam, the Netherlands.

The masterclass course on operational management for site managers (OMSM) centres on the challenges faced by those responsible for an industrial fire-fighting organisation, where good management skills are essential. It has been jointly devised by Falck Fire Academy and Business School Netherlands.

Uniquely, the curriculum of the OMSM masterclass does not cover the aspects traditionally associated with a fire-fighting organisation, namely saving lives, fighting fires and limiting the damage of incidents. Instead it focuses on financial aspects; organisational management, planning and control; and managing the interests of customers on a strategic level.

For five days in September the students – all active site managers from around the world – immersed themselves in the newly devised curriculum at Falck's international fire training centre in Maasvlakte Rotterdam.

At the end of the course the eight students received their certificates from Robbert van der Veen, general manager of Falck Fire Academy.

Antonio Carlos Martins, site manager of the Falck Fire Service stationed in Rio de Janeiro's two major airports, commented: ''I heard a lot of new things that I can apply in practice; issues that could conflict with operational readiness and quality, which you have to take into account in operational management. In my opinion the international exchange of experiences was very useful.''

The OMSM masterclass is now available worldwide for managers of fire service organisations.

VICTORIAN GOVERNMENT RESPONDS TO FISKVILLE FINAL REPORT

The Government response to the parliamentary committee report into the contamination of the CFA training college at Fiskville with PFCs was tabled in November in the Victorian Parliament, Australia.

The response covers each of the 31 recommendations made by the committee in its final report, published in May 2016. In each case, the Government has indicated its support for the recommendation, either in full, in principle, or in part. Where its support is in principle or in part, the Government notes that it agrees with the recommendation but believes ''further analysis is required or the intent of the recommendation can be achieved in a different way''.

Recommendation six calls on the Victorian Government to introduce potable water as standard for fire-fighting training at all facilities. In supporting the recommendation, the Government notes that it will also implement any necessary additional treatment processes to ensure water at training facilities is safe for use.

Other recommendations relate to health and safety at the CFA, including that the Emergency Management Victoria Inspectorate be given responsibility for overseeing health and safety compliance at CFA training facilities. In response, the Government has requested that that Inspector-General for Emergency Management develop an assurance framework that will allow for monitoring the safety of the operations at Victoria's emergency management training facilities, to be undertaken in consultation with Worksafe.

Similarly, relating to a recommendation concerning the EPA's powers to take pre-emptive action to prevent pollution, the Government notes that critical gaps have been identified in the EPA's regulatory toolkit. Its response to the separate EPA inquiry recommending a general preventative duty for the EPA is due later this year.

Critically, the Government supports in full the recommendation to investigate the development of a Maximum Residue Limit for PFOS and other PFCs. However, its response references the Australian interim national guidance on human health reference values for PFOS and PFOA published by EnHealth in June 2016, but this was criticised for setting tolerable daily intake values at more than 78 times higher than those set in May by the US EPA. The Australia New Zealand Food Standards Code is conducting further research and its final report is expected in 2017. Any new values published at this point will supersede those in the interim statement.

The Government supports in principle recommendations 21-27, which all relate to human health and include inviting the German Environment Agency to brief Victorian health and environment regulators about the latest evidence regarding PFCs and human health (see page 40), and that all Victorian firefighters should be monitored for PFC levels and provided with appropriate health advice. In its response to this point, the Government confirmed its commitment to developing a First Responder Health Programme designed to improve health outcomes for emergency responders.

Finally, the Government has said that it supports the intent of the recommendation to set up a dedicated redress scheme for those affected by the Fiskville contamination and will ''consider the many complex issues associated with a redress scheme, including funding arrangements''.

IMPACT ON PASSIVE PROTECTION

Double-digit growth over the last two years in the UK passive fire protection market is forecast to fall dramatically until 2020 as a result of Brexit.

According to a report by AMA Research, strong value growth of 23% was achieved 2013-2015 driven by higher levels in construction and activity in repair, maintenance and improvement. However, a much more subdued performance is forecast in the short term, with lower levels of construction activity anticipated following the decision to leave the EU.

Fire resistant doors, fittings and seals represent the largest sector of the market, accounting for 60% of total market value, according to *The Passive Fire Protection Market Report – UK 2016-2020 Analysis*. Keith Taylor, director of AMA said: "Underlying prospects for the fire protection market remain positive, though short-term growth is brought into question by the recent referendum and the likely resulting shock to the economy."

CSB CHANGES INVESTIGATORY APPROACH TO INCIDENTS

The US Chemical Safety Board has released its 2017–2021 strategic plan with an updated mission and vision statement.

The CSB, an independent federal agency, is charged with investigating serious chemical incidents.

According to chair Vanessa Southerland, in the future the agency will only investigate incidents "likely to yield products that inform many more stakeholders than just the companies and communities directly involved in the incidents."

Since the CSB began operations in 1998 it has deployed to 148 incidents and published 92 investigation reports. The new plan explains that the change in direction is caused by the large number of incidents that occur each year in the US, which is forcing the CSB to exercise discretion as to whether to initiate an investigation. Incidents that will have the greatest impact on workplaces, public health and safety, and the environment will be investigated, however.

The strategic plan is available at www.csb.gov.

The Queensland Government in Australia is organising the *Foam Environmental Management Policy Implementation Seminar* that will take place 21-23 February 2017 in Brisbane, Australia.
The seminar follows on from the release of the *Foam Environmental Management Policy* and is aimed at helping end-users address the risks and liabilities of foam use as well as legacy site contamination.
A call for expressions of interest from end users will be issued shortly. More details will be published in www.hemmingfire.com as they become available.

CLAMPING DOWN ON HAZMAT

A clamp that can be adjusted to suit different types of dome lids has been designed by DQE for hazmat responders.
The new tool is designed to prevent hazardous chemicals from leaking out of a tanker truck that has been involved in an incident such as a roll over.
Although traditional dome clamps are designed with central pressure plates that hold down the dome lid, many tanker trucks now carry seals that are not located in the middle of the dome.
The DQE Adjustable Dome Clamp features a unique offset pressure plate that creates an ideal relation to the exact location of the dome seal, effectively stopping any leaks.
The patented design is fully adjustable and quickly installed.

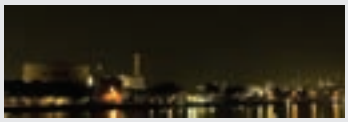
RED ONE TO DEBUT IN INTERSEC

Training company Red One will be exhibiting at Intersec 2017 in Dubai to mark its launch into the Middle East and Africa.
The company has completed a number of projects in the Middle East and Africa including assignments in Abu Dhabi and Mauritius.
Red One offers a wide range of FRS training courses as well as turnkey solutions for businesses seeking to outsource their industrial rescue and firefighting services.
Its client list includes organisations such as EDF Energy, London Fire Brigade, Serco, Babcock, and Centrica.

Fire association seeks experts on fire curtains to develop guidance

The UK's Association for Specialist Fire Protection (ASFP) is looking for assistance to develop guidance on the use and specification of active fire curtains.
Currently there is no independent guidance on the use and specification of active fire curtains, with available guidance limited to manufacturers' literature and short guides on particular end-use applications.
Assistance is sought from individuals, manufacturers or installers involved in the manufacture and installation of active fire barrier curtains.
The resulting guide will join the ASFP's range of so-called Colour Books, which contain detailed information on the use, specification, fire testing and certification of various passive fire protection products, together with information on legislation relevant to the product concerned, such as building regulations and risk assessment legislation.
Other documents in the range include the ASFP Yellow Book – *Fire protection for structural steel in buildings*; and the ASFP Red Book – *Fire-stopping: linear joint seals, penetration seals and small cavity barriers*. Interested organisations should contact Niall Rowan on niall.rowan@asfp.org.uk.

IN BRIEF



An independent investigation is underway regarding the cause of the fire and explosion that occurred on 17 October at BASF's plant in Ludwigshafen, Germany and which resulted in the death of four people.

The explosion followed a fire on a pipeline at the group's North Harbour facility; three firefighters who were tackling the initial blaze were killed in the subsequent explosion, along with a sailor who was working by the river. Some four hours after the incident small fires were still burning in the area.

Kurt Bock, CEO of German chemical giant BASF SE, said during a London press event in November that it appeared that contractors had been working on the wrong pipeline when the incident happened.

(PIC: CORIE DUNN)

A chemical release at a plant owned and operated by MGP Ingredients in Atchison, Kansas led to a shelter-in-place order for thousands of residents and at least 85 members of the public seeking medical attention.

The facility, which is around 60km north of the city of Kansas in the US, produces distilled spirits and specialty wheat proteins and starches. According to local reports, the leak on 21 October was the result of the inadvertent mixture of sodium hypocholorite and sulfuric acid, which caused a thick grey plume in downtown Atchison that led to the shelter-in-place order. The plume took around three hours to dissipate.

The US Chemical Safety Board has deployed a four-person investigative team.

A fire at the Exxon Mobil refinery in Baton Rouge, Louisiana on 22 November, left four people in critical condition in the regional burns unit of Baton Rouge General Hospital.

According to initial inquiries, flammable vapours were released during unplanned maintenance around a pump. Although there was no explosion, the release ignited and caused a large fire.

The refinery is the fourth largest in the US, with capacity to refine 502,500 bpd in crude oil. On site there is a 20-strong team of volunteer fire fighters that operate on a four-shift basis 24/7.

FIRES ON BUSES

A new regulation for fire suppression systems in bus and coach engine compartments has been issued by the United Nations Economic Commission for Europe.

The amendment of UNECE Regulation 107 includes a fire testing procedure for fire suppression systems for engine compartments of buses and coaches and includes four tests extracted from SP Method 4912. The requirements of fire suppression systems apply to single-deck, double-deck, rigid or articulated vehicles of category M2 or M3 and specifically vehicles having a capacity exceeding 22 passengers in addition to the driver.

It is now possible to start issuing vehicle and component type approval certificates, ie UNECE type-approval, with regard to fire suppression systems.

18-19 JANUARY, AIRPORT FIRE OFFICERS ASSOCIATION ANNUAL CONFERENCE, HILTON, GATWICK, LONDON, UK

Senior airport fire officers, local authority fire officers and anyone involved with air crash and aerodrome response are welcome to attend the AFOA annual conference.

Attendees can gain 11 hours of continuous professional development from the Institution of Fire Engineers while hearing real-life case studies involving major international incidents.

Ronald Dom, head of fire and emergency services at Brussels Airport, Belgium will discuss how the airport fire service responded to the terrible events of 22 March 2016 when three coordinated suicide bombings occurred in Belgium.

Another highlight of the conference programme is the opportunity to hear retired BA Captain Chris Henkey recount his experience of having to evacuate his aircraft when an engine fire broke out during the run out of Las Vegas McCarran Airport last year. Henkey made world news due to his admirable performance during his penultimate flight, just three weeks before his final retirement as airline captain.

AFOA chair Simon Petts commented: "Our hope is that the conference further supports the development of the rescue and fire-fighting arena. The UK regulating body, the Civil Aviation Authority, now has a regular slot on the programme, through which it gains an additional mechanism for engaging with the industry as a group. This year the CAP 699 workshop will be of prime interest to the delegates."

Sponsored by Rosenbauer UK, the conference also features an exhibition which will showcase a range of relevant products and services from key providers to the ARFF industry. Exhibitors already signed up to attend include Draeger, Angus, Simulation, IFTC, Geargrid, Newcastle International Airport Training Academy, Falck, Bristol Uniforms, Simply Training, Terberg, Respirex, ERDT, and Fireblast

There will also be plenty of opportunities for networking with peers, as there will be a gala dinner with entertainment on the evening of 18 January and a buffet dinner on the evening of 17 January.

For more information visit www.afoa.co.uk/2017conference.

22-24 JANUARY, INTERSEC, DUBAI INTERNATIONAL CONVENTION AND EXHIBITION CENTRE, UAE

Now in its 19th edition Intersec 2017 will feature more than 1,300 exhibitors from 54 countries spanning over 55,000m^2 of exhibition space.

One of the seven core sections of the show is Fire and Rescue, which has nearly doubled in size over the last four years and which last year attracted 350 exhibitors. This upwards trend is expected to continue in 2017, having attracted the likes of Apollo, BSI, Chemours, Fike, Hochiki, Grupo Komtes, LPCB, NAFFCO, Oshkosh, Rapidrop, Scott Safety, Securiton, SFFECO, Siemens, UL, and Velox.

Ahmed Pauwels, CEO of Messe Frankfurt Middle East, the organiser of Intersec, commented: "Improvements in the enforcement of fire codes in the construction sector, and the constant need for fire protection and life safety means the GCC's fire safety market is estimated to grow annually by 14-16% to reach US$3.15 billion by 2020. This robust demand for the latest equipment, fire protection and firefighting systems is reflected in the strong growth in the Fire and Rescue section at Intersec."

Intersec's other core sections include commercial security, homeland security and policing, safety and health, information security, smart home and physical and perimeter security.

For more information visit: www.intersecexpo.com.

7-8 FEBRUARY, BERLIN, GERMANY, RESEARCH INTO FIRE TECHNOLOGIES SHAPING FUTURE STANDARDS

Euralarm and the European Society for Automatic Alarm Systems (EUSAS) are organising a European conference on research into fire technologies that will shape the future standards. The conference is aimed at representatives of the fire industry, test institutes, standard developers, practitioners and scientists, who are interested in fire protection engineering especially in private homes and/or in the EUSAS work in context of fire detection and system technologies.

The first conference session aims to introduce the problem of false fire alarm by fire detection systems and current approaches for enhanced testing to ensure an additional reliability against deceptive phenomena. The second session concentrates on performance and quality testing of fire detectors and fire detection and fire alarm systems. This includes addressing whether current environmental tests are suitable and provide a stable long-term behaviour of the equipment; as well as the exploring the suitability of today's fire testing regimen.

During the second conference day, in the third and fourth session the focus will change from fire detection to complete building solutions. These sessions will not only consider the integration of fire detection into a complex smart building environment, but also strive to answer current questions of technologies such as as visual alarming and evacuation; the interoperability of all these systems will be discussed in a final paper.

For more information visit: www.eusas.org/events.

23-24 MARCH, TUNNELS SAFETY & FIRE PROTECTION, NOVOTEL, SCHIPHOL AIRPORT, AMSTERDAM, THE NETHERLANDS

The second annual conference will feature speakers from 15 countries as well as over 20 keynote presentations from as far afield as China.

Speakers include Gunnar Gjaeringen of the Norwegian Tunnelling Society; Benjamin Truchot of INERIS; Gillaume Craveur of SNCF; Ulf Lundstrom of the Swedish Transport Administration; and Sigurd Heier of the Follow Line Project, the largest transport project in Norway. Delegates will be afforded two days of exclusive networking sessions, professional and interactive panel discussions as well as high-level case studies focussing on the challenges, successes as well as lessons learned from existing and newly developed tunnels.

To register contact bilina@enigma-cg.com.

17th International Water Mist Conference

20th & 21st September 2017

Rome, Italy

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Cultural challenges

The fabric and contents of heritage buildings present unique and complex challenges when it comes to active fire protection – Aston Bowles presents the primary considerations and latest technology.

Heritage buildings are often made of easily combustible materials; their layout and infrastructure can be confusing or difficult for users in evacuation; and the detection methods required to protect the sites can be demanding. Add to this the fact they often have many visitors or residents, and that installing protection systems can be difficult, and the industry faces a unique challenge.

Fortunately, some modern fire systems offer the flexibility and performance required to meet this challenge.

In the UK the Regulatory Reform (Fire Safety) Order 2005 stipulates that all reasonable steps must be taken to keep buildings safe and protect the people using them. An in-depth fire risk assessment needs to be carried out and, in the case of heritage buildings, normally needs to be supplemented with a more in-depth fire safety management plan. This should cover important factors such as active and passive protection measures, mitigation of identified risks, staff training and maintenance as well as review periods.

At the heart of the system will be a fire panel – single or multi-loop, standalone or networked – the choice available is wide but not simple. The installation costs are likely to dwarf equipment prices therefore finding a system that is easily installed, with flexible cabling and a range of communication options should be the priority.

The unique nature of heritage sites means they are likely to be connected to alarm receiving centres or to be located in remote locations with difficult access. If a low quality, unreliable or unsuitable system is installed, the downstream costs of fault-finding, repair and maintenance can be significant.

Another important consideration when choosing panels for heritage sites is the degree to which they allow you to subdivide and manage different building areas. The fire system should offer many easily programmable cause-and-effect options to accommodate the wide range of room sizes, layouts and uses frequently found in heritage buildings.

A common panel challenge is how to ensure that the system is as unobtrusive as possible without compromising its performance. By using repeater panels, the larger more obvious primary fire panel can be hidden from view in an office or service room. More aesthetically pleasing and easily disguised repeater panels are now available on which images and public information can be displayed when not in fire mode. An alternative approach is to create bespoke cabinets and housings for panels, which can be tailored to fit seamlessly into almost any decorative scheme or hard-to-access space.

Many factors can impact the performance of the fire system, and these are often exacerbated in heritage buildings. Unusual room geometry, large windows, archways, draughty fireplaces and high, irregular, suspended or decorative ceilings can create detection challenges.

Fire system performance can be influenced by many factors, including unusual room dimensions, out-sized apertures, arcades, draughty fireplaces and high, irregular, suspended or moulded ceilings. The primary consideration here is to make sure that smoke or relevant signals reach detectors. Given the unpredictable nature of fires and the different materials involved in heritage constructions, detector choice and system programming are critical.

Multiple detection methods can be specified and each country has its own guidance that should be used. The bible for detector placement in the UK is BS5839, which provides in-depth direction on the standards for varying types in unique spaces.

Optical smoke detectors remain the default choice, while heat detectors are commonly employed in utility spaces (eg kitchens) where cooking smoke and steam are likely sources of false alarms. Multisensor detectors bring together heat and smoke detection in one unit and have widespread uses, including (on some systems) helping ensure that a fire incident is valid by checking the smoke and heat signals independently. The sensing technology and processing power of point detectors increases every year, and the latest detectors offer real performance and sensitivity gains. All smoke detectors are not the same.

Because the floors and ceilings in heritage buildings are commonly made from wood or stone, fitting cable-based systems to permitted regulatory standards can be complex and expensive. Wireless detectors are simpler to fit and less obtrusive. They still require wireless receiver modules, which are wired into the panel loops, but the detectors themselves require

Aston Bowles is marketing manager for Avanced.

Modern analogue fire systems provide a wide range of functions such as verification times. Top: the Natural History Museum in London is protected by Mxpro panels.

no cabling and include many sensing and indication options. Some ranges also come in decorative finishes of wood or stone that allow them to blend in with the materials in a heritage site.

Aspirating detectors are an increasingly widespread method of fire detection. They work by continually sampling the air through a network of pipes that connect to a central, highly sensitive detector and, although the associated pipe-work can be bulky or unsightly, they are a viable option when installed in secondary spaces such as basements and lofts. They can even be run inside sealed display cabinets to protect high-value items.

Smoke dissipates differently in taller spaces, so point detectors (under BS5839) are inappropriate for rooms above 10.5 metres. Here, beam detectors are an invaluable tool. These are quick to install and very effective. The only downside is the need for a reflector on the other side of the room or space, so they are vulnerable to movements in older buildings, although some newer versions can self-align.

An additional technology consists of closed circuit video-driven flame detectors. While in most cases flames will be detected after smoke, these devices are useful where visible flame fires are more likely to occur, and some can also show live video of the space in question for confirmation

A final detector type is linear-heat cable. This can be run through any area to provide rapid warning of a fire. Tiny variations in temperature cause the current in the cables to short, notifying the fire panel of a fire. In some systems, this location can be precisely identified.

With the contents of heritage sites often more valuable than the structures themselves, best practice states that important areas should be afforded a higher level of detection; here, using single or multiple detector types means that incidents can be verified rapidly.

Rapid detection is the priority and extinguishing via sprinklers, water mist or, in high priority areas, suppressant gas or foam should be considered.

In the treasury at Lincoln Castle, home of a priceless copy of the Magna Carta, an Advanced Mxpro fire panel has been combined with an Exgo suppression control panel and fire suppression gas to protect the vault. A wireless reflective beam smoke detector from Hochiki has also been installed, with an automatic realignment feature. Automatic door controls isolate the space, preventing the fire from spreading and ensuring that the gas is concentrated correctly. In addition, to minimise the amount of cabling required and limit any disturbance with the fabric of the building, hybrid wireless fire detection products were installed. In the vault itself, all components were specified to blend into the decorative scheme.

Heritage properties have the additional challenge of longer, more complex escape routes, especially where they have been converted into hotels or apartments. Speed is of the essence in such sites and panels and networks should be chosen for this feature. Cause-and-effect programming can verify that the alert is genuine and then control the evacuation of the building. Automated paging systems can use vibrations to ensure sure that residents with hearing impairment are alerted; modern emergency lighting systems can also help safe evacuation.

Fire panels in heritage buildings are often linked to alarm-receiving centres, many of which now require human validation of a fire incident. Modern panels have a variety of ways of achieving this, providing verification times and investigation delays either automatically or with the help of responsible people or trained occupants.

Rather than use general or local alarms, radio-paging systems can alert staff as soon as the incident occurs – sometimes even before a detector reaches threshold. Using the nearest fire panel, trained personnel can then determine the location of the incident and validate it before overseeing an orderly evacuation or resetting the panel if no fire is present. Assisting evacuation and the fire fighting in complicated sites are a new generation of touch-screen graphical panels and repeaters that can display maps or plans of buildings with zone status.

Heritage buildings will always present extra challenges in terms of fire detection and alarm, but innovations in fire system technology have led to major developments that benefit occupants, owners and fire professionals. A well-thought-out system can protect any heritage site, as well as the people and artefacts it contains, enabling speedy evacuation and ensuring that fires are controlled and put out as rapidly as possible.

Mists of time

Heritage buildings require a challenging combination of effective fire protection performance and aesthetics – which is where high-pressure water mist comes in, writes Ruediger Kopp.

The fire protection challenge for heritage sites of unquantifiable societal value is to combine an effective system with an aesthetic appeal. Effectiveness here means reliable fire fighting coupled with an extinguishing agent that does not destroy the building's structure or the housed objects.

Damage from the use of too much water can in some circumstances be even more devastating than the fire itself, which is the disadvantage of a conventional sprinkler system. In addition, the space required by a sprinkler system is often just not available in existing heritage buildings.

While gas extinguishing systems are reliable in closed rooms and not that dangerous for the objects they are protecting, in many cases they are hazardous for human beings. They, therefore, cannot be used in public areas prior to their evacuation.

High-pressure water-mist systems are a staunch alternative and quite often they are the only solution for heritage buildings. Firstly, they use pure water so they are completely safe for people in enclosed areas. Secondly, as the high pressure of up to 140 bar and special nozzles produce a fine water mist, these systems can operate with only around 10% of the water amount of conventional sprinkler systems, considerably minimising any water damage.

In addition, immediately after system discharge, there is a strong cooling effect that protects people and property from the effects of radiated heat. The droplets' shielding effect reduces heat radiation and generates an effective water mist shield for any persons escaping from the fire and for rescue teams as well as for exposed building components, wall openings, facades etc.

Another significant factor is the oxygen displacement effect. The rapid vaporisation of water droplets withdraws energy from the fire. The water vapour, which has a volume 1,640 times greater than liquid water, displaces the oxygen directly at the fire source, thereby creating a suffocation effect similar to an extinguishing gas. Moreover, as this only occurs directly at the fire source there is no danger to people escaping from the fire.

Such a system was installed in Grafschafter Castle in the town of Moers, north of the city of Düsseldorf in Germany.

The castle, located in the middle of the town centre, is one of the oldest preserved late-Middle Age ring forts in the Rhineland and is an important tourist attraction with a museum that has been open to the public since 1901.

Due to substantial shortcomings in the castle's fire safety the city council to completely refurbish all the electrical installations and to integrate a fire detection and fire fighting system. Conventional sprinkler technology was ruled out because of the valuable exhibits, the wooden floors and other structures.

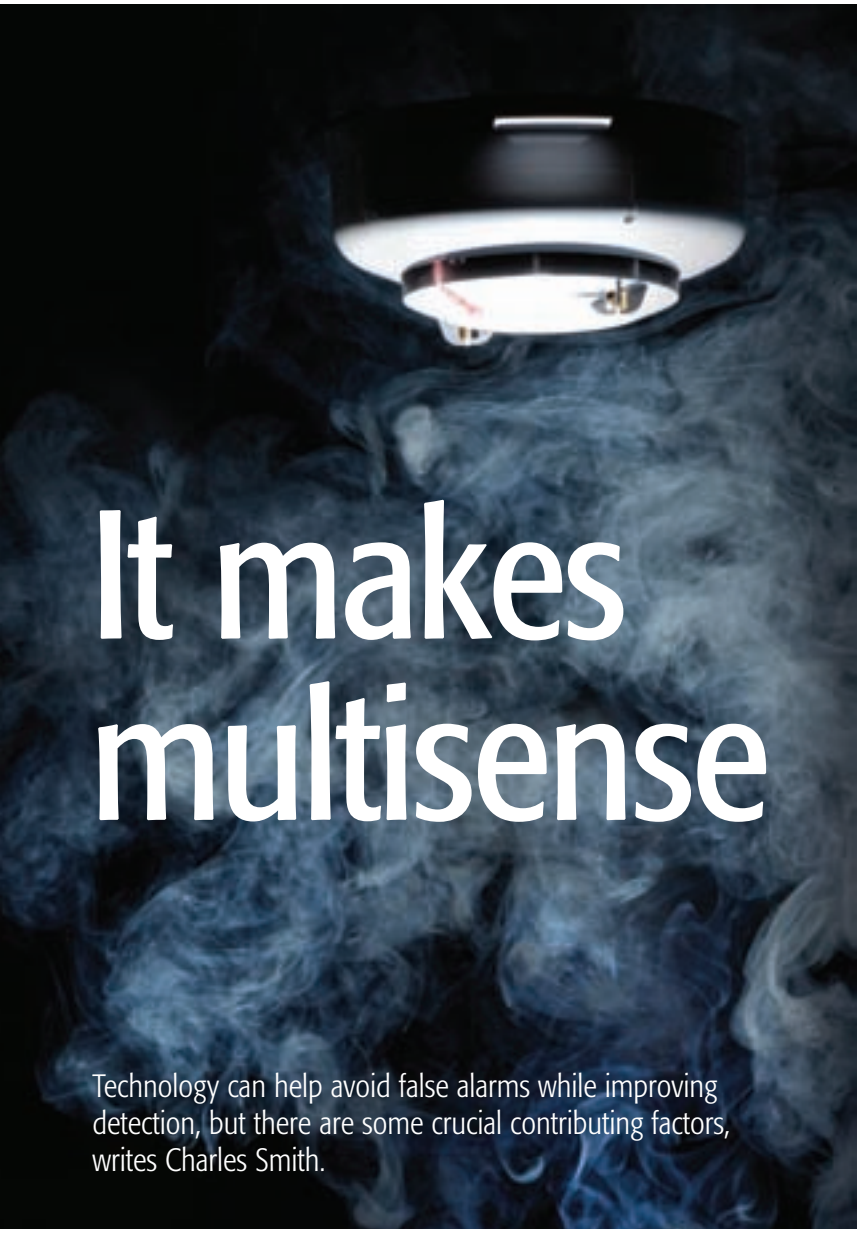
An automatic high-pressure water-mist system was identified as the most advantageous solution due both to the highly restricted space available for pipe-work, pump and water storage installation, and also to the limited water damage that would ensue in the case of system activation. The system design was based on full-scale fire test results which were independently evaluated by a fire consultant and approved by a certification body.

The entire pump unit including a water break tank was installed in a small room measuring only 10m^2 and, today glass bulb nozzles protect all six floors of the castle. Fitting the pipe-work in the building was a challenge with ceiling and wall structures hundreds of years old, greatly varying in their stability. The small-bore, lightweight pipes of the high-pressure water mist system worked well due to their slight load.

The city council of Moers appreciated the benefits of water-mist technology and have since approved the technology for other applications including a retirement home sited within a hospital.

Ruediger Kopp is general manager, fixed systems, at Fogtec Brandschutz.

Right and top: Grafschafter Castle in the town of Moers, Germany is now protected by a high-pressure water-mist system.



It makes multisense

Technology can help avoid false alarms while improving detection, but there are some crucial contributing factors, writes Charles Smith.

The fire protection industry has long been facing the challenge of improving the design of detectors so that they detect and alert to real fires whilst minimising the risk of false alarms. There were over 300,000 false alarms raised in the UK in 2014/15 and, although this number is slowly declining year on year and, they represent an estimated cost in excess of £1 billion (US$1.5 billion) a year.

Fire detection technology is no panacea and it is never going to prevent false alarms that are triggered with malicious intent. Neither will it prevent some of those occasions when alarms are triggered by accident, many of which could be avoided by system design, signage and education.

Training and product literature from the manufacturer is crucial.

Nevertheless, developments in fire detection technology are making a massive contribution to reducing the incidents of false alarms. Different types of fire detectors are suitable for a number of applications and each type forms part of the technology solution.

One such example is the multisensor detector, which by definition houses more than one sensor, for example, heat and optical sensors. These detectors have the ability to measure multiple fire phenomena and/or different aspects of the same fire phenomenon and, in combination, their readings can help to discriminate between a genuine fire and a nuisance signal and then make the appropriate failsafe decision.

Multisensor detectors are not to be confused with multi-criteria detectors. Where multisensors measure a number of fire phenomena, multi-criteria detectors measure different parameters of one fire phenomenon, for instance, the heat of a fire over a certain length of time. Single sensor and multisensor detectors will often include a multi-criteria, decision-making process as part of the algorithm to calculate the detector state.

Compared to a straightforward single-sensor detector, the decision about which multisensor detector to choose for an application is more complicated; and that is before all the different modes and settings available are taken into account.

When engineers set the modes correctly, multisensor detectors are extremely efficient in detecting real fires and ignoring false alarms. Reputable detector manufacturers work with system designers and installers to ensure they are aware of the settings and how to configure them correctly. The suitability of a detector can no longer be based on sensor technology alone.

The complexity is due to the fact that even in detectors with more than one sensor, the decision on when to go to an alarm is increasingly made not just by the hardware in the detector; specially developed algorithms and communication protocols interconnect detectors, allowing information to be exchanged and verification to be made.

Detector modes and algorithms have to be matched carefully with the potential fire risk when the system is being designed. Extreme care has to be taken not to be overly concerned with avoiding false alarms at the risk of missing a genuine alarm.

Well-designed multisensor detectors in carefully selected modes can detect more fires than many single-sensor detectors because algorithms increase the accuracy of the detector and help to filter out most false alarms if correctly applied. However, algorithms that are just designed to filter out false alarms can have dangerous consequences if they override the original sensor reading. This can be avoided by applying the 'and/or' logic in algorithms to allow the most likely fire phenomenon (most often smoke) to set off the alarm.

While the range of modes, settings and algorithms is developed and programmed by the detector manufacturer, it is the responsibility of the system designer and installer to apply the correct setting for the environment in which the detector is installed. This means they need to be aware of the different algorithm settings and modes, which is why manufacturers have a duty to make information about specific modes and settings available. Training and supporting literature is, therefore, crucial.

Even the most advanced technology will not make fire protection systems more safe and efficient if engineers and system designers are not given access to information and

training. We are already experiencing a massive skills shortage in the fire protection industry and the situation will only get worse as more and more experienced engineers retire and if we can't recruit and train new engineers in the near future.

Apart from designing and installing new systems, engineers and installers are dealing with an increasing number of maintenance issues with, or upgrades to, existing fire protection systems. Understanding the impact of maintenance on the performance of an existing system is vital before any changes or adjustments are made. Refurbishment and renovation of existing buildings may result in a complete change of use, eg from offices to flats, and warehouse to offices. Although the fire protection system may be deemed to be appropriate for the fabric of the building, the fire risks for the use will have to be reassessed and the fire protection system upgraded, even if the individual components are working fine.

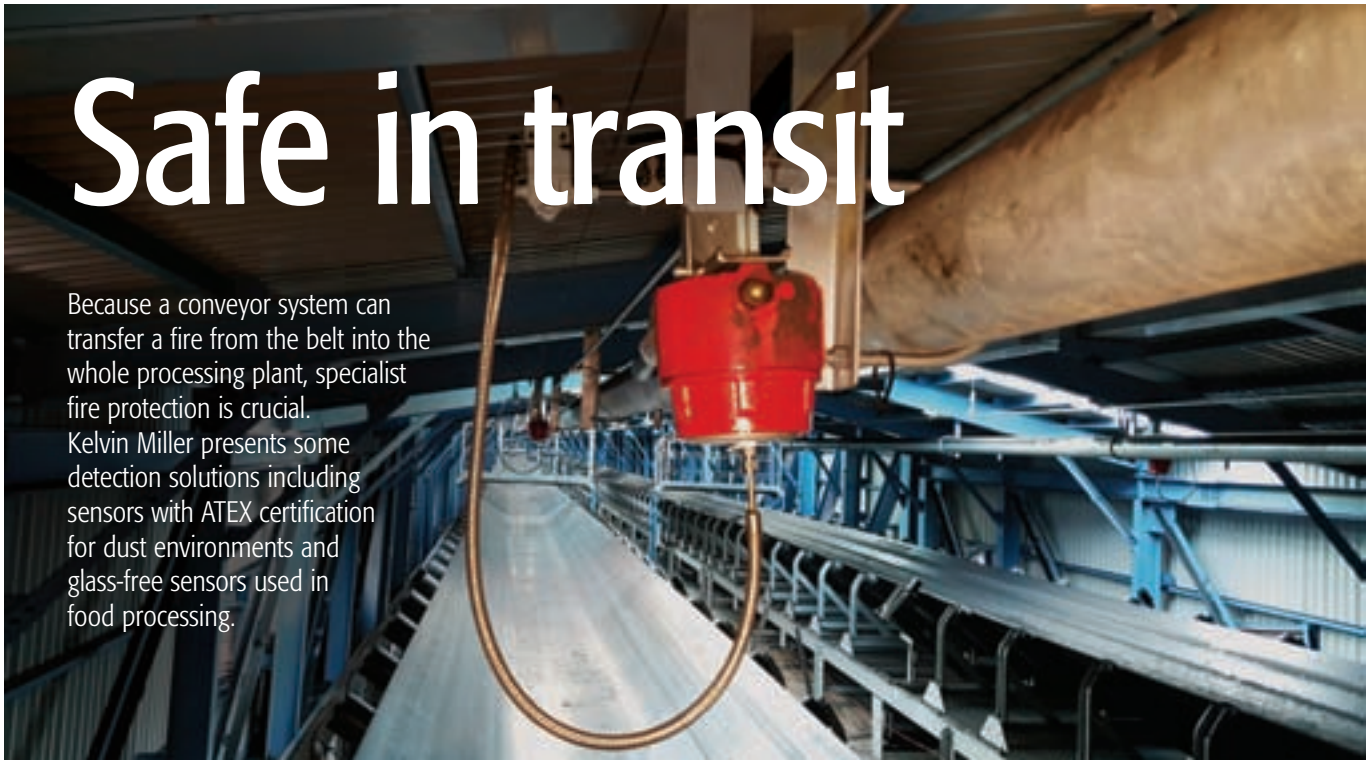
Fire protection system manufacturers have a role to play in offering training, genuine replacement parts and even maintenance programmes, like we have at Apollo, to refurbish and calibrate existing detectors.

At the same time as keeping up with the latest in fire protection technology and system design, engineers and installers need to be aware of the most common causes, and some of the rarer ones, of false alarms. This knowledge is the first step in minimising the impact of false alarms.

Multisensor detectors differ from multi-criteria detectors by measuring a number of fire phenomena.

Charles Smith is head of product management at Apollo Fire Detectors.

Safe in transit



Because a conveyor system can transfer a fire from the belt into the whole processing plant, specialist fire protection is crucial. Kelvin Miller presents some detection solutions including sensors with ATEX certification for dust environments and glass-free sensors used in food processing.

Mixed-fuel transit heat detector operating in a plant in Poland.

Many goods carried on conveyors such as biomass, coal, recycling products and sulphur are highly combustible and have the potential to self-ignite. If they should combust upon an unprotected belt the likelihood is that the system will enable the fire to spread into the holding hoppers, blending, crushing or other processing areas of the plant. As part of the operators' risk management policies, the installation of early warning protection along a conveyor susceptible to conditions of excessive heat can avoid catastrophic fire damage and substantial consequential losses.

Detectors available on the market include early-warning infrared transit heat sensors designed to monitor and detect, in ambient light, hot spots and embers from combustible materials being transported on conveyor systems.

The sensors in the Atex, IECEx-approved Patol 5000 Series, for example, feature a continuous air purging system that maintains an automatic cleaning system, preventing dust from settling on the lens of the sensor. Suited to hazardous and dusty environments, the sensors are typically mounted at 1 to 1.5m above the conveyors at an angle of approximately 30°. Initially sited 5m after the loading end of each conveyor system and thereafter roughly every 100m, sensors should also be located at transfer points and other inlets. The sensors are aligned such that the monitored potential hazard passes through their field of view. Relays can be connected to stop the conveyor in the event of a fire; with a fire-extinguishing panel operating a mist or sprinkler deluge system at the point of activation. The sensors also provide outputs for alarm/trip and fault monitoring.

Kelvin Miller is sales director at Patol.

Flame and heat transit sensor operating in the dusty environment of a biomass enclosed conveyor.

A fire that occurs alongside the conveyor system or upon a stationary belt is also a potential threat. When the conveyor has been stopped either deliberately or unintentionally by jammed rollers or bearing problems, any smouldering product could again cause significant damage. To provide protection against this possible problem, linear heat detection cable can be installed either side of the conveyor using knock-on clips at every 1m roller frame brace and/or above using a catenary wire.

Linear heat detection cable is available with resettable and non-resettable technologies. The resettable cable, described as 'analogue', is designed to provide early detection of fire and overheating in circumstances where other forms of detection are not viable either because of the environment or cost. Non-resettable or digital LHDC operates at fixed temperatures withing a range of alarm temperatures. The digital LHDC comprises a twisted pair, two-core cable. Each core is a tinned copper-coated spring steel conductor and has special heat reactive polymer insulation; it also has a protective chemical and UV resistant outer jacket or sheath. Optional monitoring can be installed; consideration should be given to additional mechanical protection for the cable with an optional stainless steel braided version. An LHDC system typically also includes an end-of-line termination box or an optional fire/fault test switch.

There may be thousands of roller conveyors in use in all kinds of industries around the world, but there are also solutions to ensure their safe operation, whatever the environment.

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Tried & tested

A factory that installed a low-pressure water-mist system in its warehouse two years ago has since successfully prevented disaster not once but twice, writes Andy Cooke.

Westland Horticulture was seeking to protect a building that stored a low value organic filler that was known to spontaneously combust or catch fire via external means such as vehicle exhausts, arson, component failure and augur bearings overheating.

The client was already aware of water mist technology, having installed in 2010 a high-pressure system in its main factory as an alternative to a sprinkler solution; another HPWM system was installed in the sorting bins area the following year. These solutions, approved by the insurer, had been selected because water mist uses smaller pipes and requires less stored water and building work.

The site for the latest system was a wood fibre processing and mixing plant with associated offices and outbuildings operating on a 24/7 basis. A fire had previously occurred in the area and, on that occasion, the engineering manager was fortunate to receive a call from a neighbour informing him that smoke was emanating from one of his buildings. On arrival at the site he used a fire hose reel to douse the fire until the fire service turned up and extinguished the fire, saving the building and machinery it contained.

The loss of the building and attached plant could have halted the £150-million (US$200 million) company, or at least enabled its competitors to gain higher market share.

The site presented a number of challenges. First was the size of the area to be protected, a building 12 metres wide, 60 metres long and 14 metres high. Second was the fact the site actually had very limited spare space and was 'land locked', so the solution had to have a very small footprint as regards the system pumpset and fire water tank storage.

Working closely with the water-mist system manufacturer VID Fire-Kill and its UK director Dean Reeve, Xcell Misting developed an automatic low-pressure water mist system for the protection of the entire storage area and manufacturing facility.

The solution came in the form of VID Fire-Kill's 2V modular deluge Fleet Suppression System, which has been specifically designed for the zoned protection of industrial conveyors. It has been successfully full-scale tested in accordance with several standards, and is approved for the protection of closed, semi-closed and open conveyors transporting clean wood residue, coal or wood pellets.

The site was divided into six zones with an assumption of three zones being able to operate simultaneously at 203 lpm per zone, and a minimum pressure of 4 bar at all nozzles.

Each zone has a feeder pipe that runs along the long side of the structure. At the location of the area to be protected, it turns 90° up to the central apex of the ceiling and then splits into two at 90° to feed two nozzle pipes on each side. The spacing between nozzles on the two parallel nozzle pipes is short, as each 6m length is fitted with 12 nozzles. The configuration results in a fine and even distribution of water mist but without an increase in the cost for fittings and works; it also uses large-diameter nozzle orifices to reduce the possibility of clogging.

As the design enables the simultaneous supply of water to any three zones of the six installed, it allows for smaller pumps; less volume of stored water (22,000 litres); and, in the event of fire, the whole zone can be operated along with the two neighbouring zones if the fire tries to spread. It also only needs two full-duty pumps, one pump for pressure maintenance, and six control valves. The system is actuated by a Kentec addressable panel that controls the IR3 flame detectors on a 24-volt monitored power supply. The detectors are carefully addressed so they monitor their zone only.

The system, which was commissioned after two full discharge tests, proceeded to successfully extinguish a fire not once but twice within a few months of its installation.

The first fire was caused by an overheated bearing igniting material on the auger, which then dropped onto a pile. On the second occasion, a vehicle exhaust system ignited material underneath it. In both instances the fires were detected and extinguished at an early stage, with no intervention required by the responding fire brigades.

Interestingly, both these fire scenarios had been discussed in early planning meetings by all parties, including the site operatives. Their input was key to the success of the implementation because they knew where the key fire issues were and how their business needed to integrate with the suppression system.

The finished design is now a standard set-up and we have just completed another installation for Westland Horticulture, this time in a 216m^3 area, with a one-shot full discharge in the event of fire. The company is now 100% a believer in water-mist technologies.

Andy Cooke is operations and technical director at Xcell Misting.

The system consists of six control valves and two full-duty pumps (plus one for pressure maintenance).

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Safe cruising

The engine rooms of 40 of Viking's river cruise ships are on course to be fitted with clean agent systems that can flood the entire engine room in 10 seconds and extinguish a fire in less than 40 seconds.

With each ship taking more than six months to build, two more ships are set for completion this year to achieve Viking's ambitious building programme, where fire safety has been a key consideration throughout.

American tourists in particular enjoy exploring the cultural treasures along the rivers Rhine, Danube and Main on Viking's ships. Unbeknown to the guests enjoying their colourful vacation is the complex technology operating round-the-clock below deck to ensure the safe operation of the ship.

Safety on board is critical and fire poses one of the greatest dangers on ships; which is why fast-growing Viking river cruise line has equipped 40 of its ships with the Minimax MX 1230 fire extinguishing system, which uses Novec 1230 fire protection fluid from 3M.

3M Novec 1230 fire protection fluid is designed to stop fires rapidly without causing damage to sensitive equipment or leaving any residue. With a high penetration capacity and a flooding time of around ten seconds, the agent takes less than 40 seconds to extinguish a fire after its detection.

As many as three engine rooms in each Viking river cruise liner are equipped with the MX 1230 fire extinguishing system.

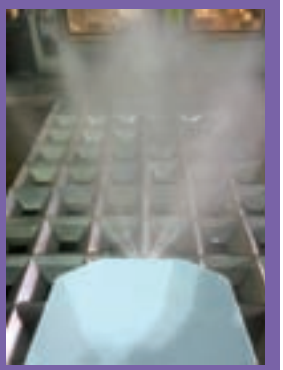
A significant advantage of the system is its small size, which is ideally suited for the restricted conditions of engine rooms. Novec 1230 is stored as a fluid and requires only a third of the space that a CO_2 system usually requires on ships. ''This is how we meet all requirements for reliable fire protection on board a river cruise liner, while taking up as little space and weight as possible,'' says marine engineer Olaf Roschinski of fire protection specialist Minimax.

The clean-agent system takes up about a third of the space of a traditional CO_2 system.

The fluid transitions from a liquid to a gaseous state only when discharged through a nozzle, thus ensuring rapid action with deep penetration. As well as leaving no residue, Novec 1230 is non-corrosive and non-conductive; it has negligible environmental impact due to its low Global Warming Potential of 1. Furthermore, unlike CO_2, the fluid is safe for occupied spaces and also provides the widest margin of safety relative to other clean agents such as hydrofluorocarbons and inert gas systems. This makes it suitable for boats and ships where exiting from a protected space may be challenging.

Today, Viking's river cruise liners include the MX 1230 fire extinguishing system as standard equipment in the engine rooms; in the near future so will the company's new vessels and communication/control centres currently being planned.

Water mist solution for the vulnerable



A portable water mist unit for domestic fire suppression has been certified to LPS 1655, BRE Global's fire performance standard for personal protection systems (PPS).

The certification was awarded to Surefire's Ultra Guard, which has become the first portable water mist unit to achieve third party certification to this standard.

A PPS is a domestic fire suppression system designed to protect a specific risk, typically vulnerable people who are at greater risk from a fire in the home.

In the absence of a dedicated BS or EN standard, LPS 1655 offers a robust, third-party approval standard to establish a credible performance level for PPS to engender specifier and user confidence.

The LPS 1655 standard incorporates system design requirements, including minimum levels of performance and functionality, system manual and installer requirements, fire test protocols, and maintenance arrangements. It also covers the examination and testing of components.

A PPS needs to detect and suppress a fire at a very early stage before significant heat and smoke has developed to cause serious injury. Notably, LPS 1655 requires system actuation by a fire detector (or detectors), as more traditional, thermally activated devices may be too slow, especially for smouldering fires in clothing or bedding.

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Best practice

The British Standards Institution has published two water-mist fire-fighting systems standards in response to widespread concerns amongst those involved in the specification, provision and insurance of fire safety in buildings, writes Bob Whiteley.

The lack of British or EN standards for water-mist fire protection was considered to be leading to instances of poor practice and fear of potential failure to protect life and property in the event of fire.

Consultations with interested parties concluded that EN water-mist standards were some years away and that, based upon the working drafts, could fail to address some of UK's concerns. The meetings of interested parties agreed to co-operate on the creation of two standards covering the two areas, where water-mist fire protection has application for land-based building fire protection and prepared justifications to British Standards for agreement to proceed.

The BS8489 series, published in May this year, is titled: *Fixed fire protection systems –industrial and commercial water mist systems*, where Part 1 covers the code of practice for design and installation; and subsequent parts provide fire test protocols for a selection of applications. This article will focus on BS8489.

BS8458, published last year, is titled: *Fixed fire protection systems – residential and domestic water mist systems, code of practice for design and installation*; which includes fire test protocols. It has been created to mirror BS9251 requirements for domestic and residential sprinkler systems to ensure consistency of approach.

Both standards set out requirements for components without setting down their type approval test requirements. They also provide the basis for assessment under third party installer audit schemes.

The standards advise – but cannot require – the desirability of third-party testing and certification of conformity with the British Standards.

As with other standards, the new water-mist standards have been created by industry experts on the basis that their execution would be entrusted to appropriately qualified and experienced people.

Local application

Local application water-mist fire extinguishing systems consist of a calculated supply of water arranged to discharge directly onto discrete and identified hazards. These systems enable protection to be provided for specific hazards within a larger, possibly unprotected, area. Typical risks include industrial oil cookers and diesel generators, for example.

Where a risk assessment shows that the spread of fire could involve two or more objects of local application, the water-mist system should be designed for the combined hazard.

System design parameters will need to be determined by representative and successful full-scale fire tests, which would be expected to have been verified by third parties, and with water supplies capable of discharge durations at least twice those required to achieve fire extinguishment and prevention of reignition; with a minimum discharge time of 10 minutes.

Volume protection

Volume protection water-mist fire systems, on the other hand, may be either open nozzle systems, where all nozzles discharge simultaneously throughout the entire enclosure, or automatic nozzles where only the nozzles in the immediate vicinity of the fire are expected to operate. Depending on the fire hazards and the fire test protocols used, the systems may be engineered to provide fire suppression – typically for Class A ordinary combustibles – or to provide fire extinguishment of flammable liquid hazards.

Volume protection systems should be designed and installed for the hazards to be protected within the volume, in accordance with the design parameters established through representative fire tests. For water-mist systems designed to extinguish fires the water supply duration would be as for local application systems; however, for fire suppression systems the standard requires discharge for the duration of 60 minutes at a minimum. Where the spread of fire is deemed likely to involve two or more enclosed volumetric spaces, this must be taken into account and the water-mist system should be designed for the combined hazard.

An annex to the standard sets out the provisions needed for 'enhanced availability', where a water-mist system is being provided for compliance with a regulatory requirement; or where water mist is proposed as an alternative means of compliance in respect of life-safety measures.

The installation of an automatic door closing mechanism is expected to improve the effectiveness of water-mist systems by ensuring that any doors to the volume being protected are kept shut to retain the mist and block strong air currents.

Fire testing

All water-mist system designs are required to be based upon successful fire testing of the supplier's system against fires that simulate those in the hazard to be protected. The testing determines the nozzle types, flow rates and operating pressures, maximum and minimum nozzle heights and spacing. As there are no 'standard' water-mist nozzles, each supplier will arrive at their own unique solution for any given hazard.

From the experience gained from testing and application of water mist over the past 20 years, a growing database of fire test protocols now exists for a wide variety of applications. Whilst BS8489 sets out a number of fire test protocols for hazards, such as industrial oil cookers, turbines, local application involving flammable liquids, and low hazard occupancies; the standard does not preclude the use of other fire test protocols.

One of the greatest challenges to the engineering of water-mist fire-fighting systems lies in determining whether the conditions of a particular test protocol are representative of the actual conditions in a given application based on an understanding of the dynamics of the interaction of water mist with fire. The following application parameters need to be determined as a minimum.

a) Is the fuel similar to the test protocol (liquid or solid fuel, flash point, combustibility, quantity, arrangement)?
b) Is the compartment volume equal to or less than the volume of the test room?
c) Is the compartment height equal to or less than the test protocol?
d) Is the compartment ventilation conditions similar (presence of fans, forced ventilation, etc, area of openings, position of openings)?
e) Are there more obstructions to the distribution of mist than the test protocol?
f) Is the duration of protection provided by the listed system appropriate for the actual level of protection needed?

Water mist is a specific application solution which needs to be proven for each individual application and/or occupancy and to have demonstrated performance against standardised fire tests and component tests, as indicated by a report issued by the fire test laboratory.

Users of the British Standard are advised to consider the desirability of using a test facility that operates a quality system and has water-mist testing in the scope of its accreditation. Of particular importance with respect to testing of water-mist fire-fighting systems are comprehensive understanding of water-mist technology; ability to properly condition and characterise the fuels; and use of appropriate instrumentation and methodology to verify the compliance or non-compliance with the pass/fail criteria, and repeatability.

Where a water-mist system application is not covered by a recognised fire test protocol, additional testing is likely to be required.

Water supply

One of the attractions of water mist is that, in general, it uses less water than other water-based fire suppression and extinguishing systems. However the supply must be just as reliable and readily available.

For smaller systems the supply may be provided by water stored in cylinders and purged by gas. This enables the supply to be 'stand alone' without the need for a permanent connection to a town's main supply. However, for most systems the supply is delivered by one or more automatically starting pump sets drawing from a storage tank in-filled from the towns' main.

BS8489 has gone into some detail on these provisions and the document sets out the determination of 'effective capacity' of storage tanks with and without vortex inhibitors, as well as the need for a flow-test facility to check the flow capacity of the town's main feed. This becomes necessary as the standard allows for reduced capacity tanks, holding not less than 30% of the total water required, where the town's main is sufficient to enable the system discharge duration to be met.

BS8489-1 also sets out the necessary electrical power supply provisions to ensure security of supply by requiring that the pump power connections are taken from the incoming supply side of the main switchboard.

Hydraulic design

All systems are to be fully hydraulically calculated. The standard calls for designs to determine the assumed maximum area of operation (AMAO) at both the hydraulically most remote area and the most favourable.

These two calculations are done to ensure that the water supply can deliver sufficient flow and pressure. In the case of the most remote AMAO, to ensure there is sufficient flow and pressure at the farthest part of the system after accounting for the pipe friction losses through the system. The calculation for the most favourable area is carried out to ensure that the water supply can still meet the increased flow to the areas close to the supply to where there are the minimum of pipe friction losses. The standard has a specific annex which explains how and where the AMAOs should be established.

Concluding, BS8458 and BS8489 replace the previously published DDs (Drafts for Development). They have been created through the collaborative efforts of industry experts to reflect experience gained over the past 20 years. They provide, for the first time in UK, standards to which specifiers can refer; engineers with knowledge and expertise in water-mist fire systems can provide consistent and uniform compliance; and auditors can review against. Their publication places in the public domain the current 'industry best practice' for the use of water mist when and where appropriate.

The design of all water-mist systems remains firmly based upon fire test verified solutions for each specific application supported by test reports made available to interested third parties so that it can be clearly understood exactly what has been tested and how.

Bob Whiteley is chair of the BS water mist committee and the joint FIA/ BAFSA water-mist working group.

One of the attractions of water mist is that in general it uses less water than other fire suppression and extinguishing systems.

Bright future

Not only is water-mist technology continuing to find new applications but work is about to begin on a new EN standard. Jose Sanchez de Muniain reports from the International Water Mist Conference in Vienna, Austria.

Work on an EN standard for water mist is beginning shortly as a result of industry realisation that the current Technical Standard causes confusion in a market where separate national standards exist in parallel.

Joachim Böke from Minimax provided an update on European standardisation work for water mist, explaining how the Technical Standard had been initially published eight years ago in order to introduce the concept of water mist into the market. Historically, a technical Specification (TS) document exists for standards that cannot yet obtain the required support as a full EN European standard, which has an obligation for implementation by EU member states.

The first water-mist task group was established in 1998 and it wasn't until 2008 that TS 14972 was published. The technical committee is now working towards converting the TS into an EN standard, and to this end, it has been re-designated as a working group as opposed to a task group, which according to Böke should speed up the process.

As part of the conversion process, the TS is being restructured and new test protocols added, many of which are identical to those published by FM and VDS.

A draft, expected next year, will then be reviewed by the national bodies.

Applications – automatic fire suppression system for modern architecture

Water mist as a fire safety solution that supports the modern architectural trend for wide open spaces in exposed glass and steel was highlighted by a project involving the construction of the new €196.4-million (US$200-million) Thermenregion Baden Hospital in Lower Austria.

Delegates heard how water-mist systems support architectural trends for wide open spaces and exposed steel and glass.

The 450-bed hospital, which is due for completion next year, consists of a high-ceilinged central hall that provides open access to three separate buildings, each three-floors high. The hall, which includes waiting/meeting areas and a café, connects with the three buildings via large glass facades with no fire partitions. The client was looking for an automatic fire-fighting system and, although this could have taken the form of a conventional sprinkler system, Rüdiger Kopp of Fogtec Fire Protection explained that water mist was favoured because of its high cooling ability. ''Fire resistant cladding could have been used but it would have increased cost.''

The resulting fire protection concept consists of a wet, high-pressure water mist system for the hall and all three buildings areas adjacent to the entrance hall, which include three floors of each neighbouring building. The system design is based on OH1 risk classification with 60 minutes of operation for a 72m^2 area. The main challenge for the project, however, was the 12m-high ceiling of the entrance hall, which led to a requirement for relevant fire tests.

As part of the system testing and acceptance process, a full-scale scenario was developed based on CEN TS 14972 and carried out at CNPP. Fire tests took place under a single nozzle and between four nozzles, all with glass bulb activation.

The fire load used was the same as per the IMO A800 fire test package, consisting of two sets of four sofas.

Evaluation criteria were; temperature reduction at the ceiling and vicinity of the fire (to ensure safe evacuation), reduction of heat radiation (to evaluate the effectiveness of water mist as a shield for exposed glass and steel); and fire control and suppression (to avoid fire propagation to the target sofa set).

All the relevant nozzles activated within 2 minutes and 50 seconds, with the discharge leading to rapid temperature and heat radiation reduction. The fire was controlled with no propagation to target sofas.

Based on the success of the fire test results a wet system for the 5m-high ceilings of all the rooms adjacent to the entrance hall has been developed. For the perimeter of the glass facades, the distance between nozzles has been reduced.

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Left to right: Dr Tim Nichols of Tyco Fire Protection Products and Joachim Böke of Minimax.

The water mist system is controlled by a central pump unit in the building basement, which contains five high-pressure pumps – including a redundant pump – with a capacity of 120 lpm at 120 bar; and two 2,000-litre break tanks with main water supply intake. The system has the capability to operate for 60 minutes feeding nozzles along 26m of the glass facades in the entrance hall, as well as nozzles in the neighbouring areas in the adjacent buildings. A central alarm valve and ten zone valves indicate where the system has been activated.

Summarising, Kopp emphasised how water mist's cooling properties are enabling architecturally pleasant solutions for open buildings, through compensating for missing fire separations.

Buyer beware

The incorrect implementation of marine-certified water mist systems in land-based local applications was the subject of a thought-provoking presentation by Dr Tim Nichols of Tyco Fire Protection Products.

A local application system is one where a fixed supply of extinguishing media is discharged into a defined area that either has no surrounding enclosure or is only partially enclosed.

Examples of local applications include Class B fuel risks such as transformers, generators and industrial machinery. These solutions are popular because in large spaces it makes no sense to fill an entire body with extinguishing media and a local application is, therefore, more economical whilst also reducing collateral damage.

Dr Nichols explained that he had come across a number of occasions where the IMO marine standard for local applications had been incorrectly used on land, even though the differences between the two regulatory environments are significant.

In ships, IMO 1387 is applied on the premise that a secondary, total flooding system is in place. This is because in a ship carrying multiple engines it would be undesirable to flood the entire volume to extinguish a small spray fire. "But if that local application doesn't work, at least you've got back-up."

Dr Nichols reported coming across land-based installations equipped with marine-based solutions where the secondary total flooding system had been 'forgotten'. Furthermore, he suspected that the fact that the marine test protocol IMO 1387 only covered spray fires was sometimes not fully understood by the owner. "A correct bid [for a tender] should say it does not cover pool fires or concealed fires."

Comprehensive protocols for land-based local applications do already exist, in the form of FM 5560 Appendix I – also the basis for a recently published British Standard – and the French standard CNPP TD2.

FM 5560 Appendix I comprises 23 test configurations, including square pool fires, channel pool fires, combined spray and pool fires, and obstructed pool fires. Mandatory interlocks are also required by the protocol for fuel, electrical and lubrication shutdown. "If you are involved in a land-based proposal [using IMO 1387], as long as that is documented, and the client is aware of the limitations, fine. But I am concerned we have marine-based designs going to land-based applications and the client thinks that it's going to put out all sorts of fires. And that is where you have to be very careful. Having been in five-plus witness cases, you do not want to be the other side of a lawyer when things go wrong."

To show the important differences between the marine and land-based protocols, Dr Nichols shared the results of testing Tyco had carried out according to the land-based standard CNPP TD2, but using marine IMO 1387-certified nozzles. Both low and high-pressure nozzles approved to IMO 1387 were tested, in addition to a new nozzle.

Significantly, both IMO nozzles failed the land-based test, and the new nozzle was successful only after the deflector design and K-factor had been changed – and even then only after the inclusion of foam additive.

The implication that there may be a number of land-based installations already carrying IMO-certified systems that would not perform as expected in a fire, concluded Dr Nichols, should be a concern for the entire water mist industry.

Aerosol turbines for mitigation of harmful emissions and firefighting

Francesco Fritz of Emi Controls took the audience through the testing programmes that culminated in the joint launch with vehicle manufacturer Magirus of a fire-fighting water-mist turbine called Aircore which can be either truck-mounted or used as a remote-controlled unmanned unit.

The gas-capturing capabilities of the turbine's water mist were first tested in open air and tunnel conditions at the Institut der Feuerwehr in the state of Sachsen-Anhalt, Germany, using trichlorosilane gas. The falling water mist was collected and the concentration of the gas absorbed in the water measured. Various settings were tested including turbine/water curtain techniques; droplet size; water rate; and air temperature.

Results showed how in the tunnel tests, the best gas mitigation rate of 75% was achieved using the turbine setting: "We also observed that smaller droplets improve the absorption efficiency since they create a bigger interface between the gas and the absorbing fluid."

Fire-fighting tests followed at the MOL refinery in Hungary using 160m² pool fires containing 2,400 litres of fuel, which resulted in heat release rates of up to 350MW. Again, tests were repeated using various application techniques; extinguishing fluids (water and 1% AFFF foam/only water); and rates of application: "We could knock down the flames to 5% of the initial heat release rate after 20 seconds compared to 65 seconds when using the traditional technique."

The turbine enables a gentle application of the water-foam mixture on the surface of the burning fluid; it was also found that the mixture surrounded small objects located in the stream and that use of the turbine reduced the use of water and foam.

"In all tests done, the aerosol turbine showed a higher efficiency both for gas absorption and for fire-fighting applications," concluded Fritz.

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Slightly alarming

Roland Hemming attempts to shed some light on the increasingly complex world of voice alarm systems.

Roland Hemming is an independent audio consultant. His book on voice alarm systems worldwide is available from rhconsulting.eu

Voice alarm systems have been part of my work for 18 years. I'm actually a professional audio engineer but progressively the disciplines have merged.

Put simply, a voice alarm system is a specialised audio system designed to assist in the safe evacuation of the public. In order to aid practitioners, there are a number of national, European or international standards to adhere to.

You would hope that the process is simple but we work in an industry full of confusion and contradiction and where the effectiveness and legality of many systems are seriously open to question. Before we get into that, let's look at the basics.

Any voice alarm system is based on four principles – it has to be intelligible and provide good audio coverage into each public space; it needs resilience so it will continue to work even with partial failure; it has to monitor faults so you know in advance if it will work at the crucial moment, and finally it has to be easy to use. The detail of this takes more than a magazine article to describe but let's look at a few items so you get more of an idea as to what is involved.

The resilience of a voice alarm system means that we need to use fire-rated loudspeaker cables, ceramic terminals and thermal fuses. This is to ensure the integrity of a circuit. If a loudspeaker burns out in a particular room it mustn't bring down the whole circuit, preventing others from hearing the emergency message from other loudspeakers on the same cable.

We can only protect the circuits because fundamentally a loudspeaker itself is still just a piece of paper that flaps.

One of 326 connection boxes for balcony loudspeakers at Twickenham Stadium, London. Top: loudspeaker clusters at Derby County Football Club. The PA and voice-alarm system there is considered amongst the best sounding in the UK.

All but the smallest voice alarm system will incorporate redundancy so there is no single point of failure – for example, the system might have a power amplifier that can cut in if another one fails. There are many similarities to fire alarm systems such as the requirement for backup power.

The standards set requirements for how loud each space needs to be, based on ambient noise and occupancy; and there are standards for measuring the intelligibility of a system to ensure people can hear what is being said.

Fire alarm people and voice alarm

An important point for the fire alarm practitioner to consider is that a voice alarm system is not a fire alarm system that uses loudspeakers instead of sounders and beacons.

Audio systems are a complex combination of solid engineering principles along with an understanding of acoustics and knowledge of what systems actually sound like under a variety of circumstances.

The reason why everyone loves sound engineers is because they understand technology but also have a sensitive side. Not many others understand the complexity of commissioning a sound system with the dozens of variables involved. How to change equalisation settings so it sounds right; how to deal with challenging acoustic environments; spaces with high ambient noise levels and much else besides. You can only learn all this from experience.

People often design voice alarm systems based solely on geometric loudspeaker layouts without really knowing if the system will provide adequate performance. More advanced projects will use computer-generated acoustic models to assist with loudspeaker placement. Models are often not taken as assistance but as absolute gospel, even though we know that the information given to create the model may be inadequate. Without human intervention and audio experience you may struggle to comply and you will probably spend more than you need to.

Blind adherence to standards

Speak with anyone associated with voice alarm and they will soon mention standards – specification documents are peppered with them. Having deeply dug into this it has become abundantly clear to me that a majority of voice alarm

practitioners do not understand the standards they are citing.

In general, there are two types of standard. A code of practice, which recommends how to design, install, maintain and operate a system. Secondly, standards that set out requirements for products used for voice alarm purposes.

A common approach is to mention as many standards as possible as if this gives some form of protection and assurance of quality. This is not the case and compliance with a standard doesn't make you immune from legal obligations.

The lack of understanding of voice alarm standards is astonishing. It takes a huge amount of work to properly understand what is really going on and the legal implications. Whilst some might argue that not everyone has the time or inclination to put work into this, let's not forget that these designers and installers are charging often very high daily rates specifically for that expert knowledge.

There is a big difference in fees for a normal sound engineer and a voice alarm expert, so unless they properly understand the legal element of what is being supplied, what superior knowledge are they being paid for, over and above a conventional public address system?

There are two main problems with people's use of voice alarm standards. The first is the usage of too many standards and the misunderstanding of their scope. Standards are often contradictory, so the more you use, the more contradiction and doubt. My book on voice alarm systems has tables citing what different standards say about the same issue. In many cases the advice is different, so take your pick.

The second and more important problem has come about with the introduction of EN 54. This is a set of European standards of which four parts relate to voice alarm.

Some people just ask for compliance with EN 54, as if it is one thing. If you see someone just writing EN 54 in a specification they definitely don't know what they are talking about. They need to specify the part numbers they are referring to.

EN 54 is complicated. It comprises different standards such as codes of practice and guidance on compatibility. The big fuss, however, is over its product approval standards. These are Harmonised European Standards (hENs) and they are the usual way to ensure that the products you are using comply with the European Construction Products Regulations (CPR). No standard is law but the CPR is, so you must comply with that.

Even if you have EN 54 test certificates, that in no way guarantees that your system is legal due to further rules as to how construction products must be supplied to the market. Our experience is that many systems are not compliant in this regard.

I still can't believe I'm saying this but I currently sit on three voice alarm standards committees. I am expert for audio alarms on the British committee for BS5839-8, which is the UK code of practice. I represent the UK as an individual specialist for the European voice alarm committee for the infamous set of EN 54 voice alarm standards. Finally, I chair another UK committee for sound systems at sports grounds, whose job is to make stadiums safer following disasters like Heysel and Hillsborough. This is not actually a fire standard, yet it helpfully refers to fire standards in every other sentence just to add to the confusion. I also speak on the subject at international conferences.

I reluctantly got involved because nobody could give me consistent answers to my concerns and the only way to improve the situation is from the inside. I'm still the only independent person on the voice alarm committees, everyone else works for an equipment manufacturer.

In the committee, I see my role as the person to ask stupid questions, but it is clear that many standards are badly written because my seemingly innocent questions often cannot be answered.

It has taken the EN 54 committee a great deal of work and legal advice to discover many flaws. Even now there is a special European task group looking at trying to solve fundamental problems with how product standards work under the CPR.

All of these imperfect systems, installed by people with inadequate audio skills citing incorrect standards, are all perfectly fine – until someone dies.

I don't wish to blame people for deliberately getting it wrong. So much has changed in the past few years that it's very difficult to keep up. Furthermore, it's become accepted industry wisdom that the whole subject of voice alarm is open to interpretation. Unfortunately, this has lead people to think they have carte blanche to interpret things the way they want.

The advent of EN 54 has put far too much emphasis on product testing against ensuring that the system actually provides a safe means of evacuation.

When I worked on the Olympic Games in London, one of my responsibilities was for accepting all life safety audio systems on behalf of the organising committee. I visited each local safety authority hosting a venue and explained our emergency audio strategy. With a couple of notable exceptions, none of them had any understanding of emergency audio systems, so they were unable to challenge or verify our plans. I might as well have been speaking in Martian.

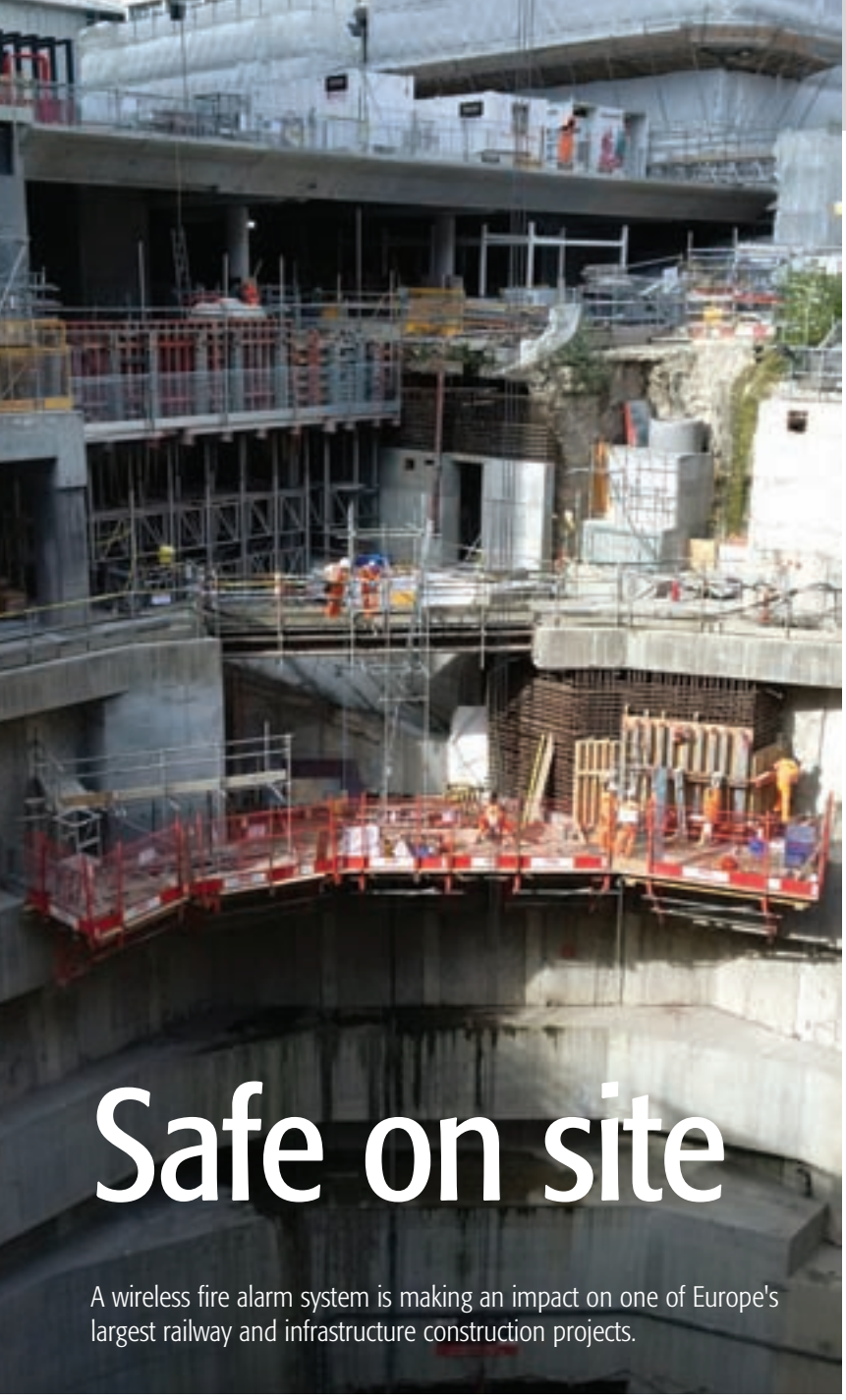
This puts a further onus on the people designing and installing these systems. I've certainly seen voice alarm people take advantage of the fact that there was no one else around to scrutinise their work.

There are many issues that I've not covered, such as the trend to merge entertainment audio with the emergency systems. Some say this must never be done, and yet we do it all the time in venues like stadiums.

Voice alarm are expensive systems that may be used in the most critical situations and the most important thing to consider is whether your system functions well. However, checking the documentation is also worthwhile. The methods of compliance need to be clearly stated and it needs to say more than just compliance with x and y standards. The variable nature of audio systems requires that the conditions and parameters under which you are working are clearly stated.

Voice alarm is a scary world to work in these days. Let us try and make it safer one system at a time.

Rigging public-address and voice-alarm loudspeaker clusters above Twickenham Stadium, London.



Safe on site

A wireless fire alarm system is making an impact on one of Europe's largest railway and infrastructure construction projects.

The Cygnus wireless fire alarm system from Bull Products has been specified and installed so far on seven Crossrail projects in London and surrounding areas.

Crossrail is an 118km-long railway line under development in London and the counties of Berkshire, Buckinghamshire and Essex. The new Elizabeth Line's main features are 21km of new twin tunnels, with the main tunnels running from Paddington to Stratford and Canary Wharf.

The Cygnus wireless alarm system is operating at stations, access shafts and ventilation shafts across many of the key stations on the line.

The wireless system is able to link 480 alarm devices in 15 zones, including fire alarms, smoke detectors, heat detectors, carbon monoxide detectors, first-aid call points and combined call-point and first-aid alerts.

At Paddington Station, which is experiencing the most substantial makeover since its completion in 1853, there are 10 Cygnus units incorporated along with the control panel. An interface unit also connects the Cygnus units to 19 radio-link heat detectors.

Construction work at Liverpool Street Station.

The Tottenham Court Road Station is also undergoing a significant renovation, with work underway for a new underground station and ticket hall at Dean Street, Soho and a second integrated ticket hall below St Giles Circus on Oxford Street. In this area, over 80 fire call point and first aid alarms have been installed that are linked to two main control panels. Four input/output units connect four bespoke safety signal lights with the alarm units. In the event of an evacuation, the light signal stays green to indicate the exit is safe to use, if not, it turns red. In addition, as mobile phones are not allowed on site, a paging system is also connected to the control panel. When an alert is raised the pager system panel sends a text message to a hand-held pager device that is worn by site managers or first aiders.

At Liverpool Street, a site surrounded by dense urban infrastructure, some 30 Cygnus units have been installed including a control panel and 29 fire call points and first aid alarms.

At Whitechapel Station, a new elevated station concourse and ticket hall is being built which will act as a bridge above existing lines acting as a bridge with the new line. Here, over 25 Cygnus fire alarm call point units are being installed linked to a control panel.

The Elizabeth Line will unlock its doors in central London in 2018, and from the end of 2019 will run from Heathrow through the new tunnels.

Voice alarm and evacuation systems manufacturer Baldwin Boxall is to launch a number of products at Integrated Systems Europe on 7-10 February 2017 in Amsterdam, the Netherlands.

The new products consist of a stand-alone voice alarm/ public address system, a transformerless amplifier and a touch screen microphone.

The new stand-alone voice alarm/ public address system Vigil Eclipse 4 has the ability to include up to four of the company's new Vigil 3 amplifier modules, totalling up to 2,400 Watts.

In addition, as with all the company's voice alarm systems, the new system connects with any leading fire panel via an internal fire alarm interface.

The new range of Vigil 3 voice alarm amplifiers consists of five modules with built-in power supply and floating transformerless output. The amplifiers are 66% lighter than their previous versions in Vigil 2 and include a 'sleep' facility that operates only when the system is on mains power and not batteries. Their smaller size means less rack space is needed and, for larger systems, fewer rack enclosures. The power supply for the new Vigil 3 amplifiers requires a charger module and the latest version is not only half the size of its predecessor but is also capable of monitoring and charging five Vigil 3 amplifiers at one time. Finally, also on show at Integrated System Europe will be a new touch-screen control microphone that serves as a multi-function user interface for Vigil voice alarm systems. Features include near-field-communication smart card or pin code access and the ability to connect a third-party music audio feed for broadcast to user-selected areas. Other user features aimed at safety officers and facility managers comprise zonal volume adjustment for non-critical broadcasts, ability to record, store and play back messages.

Trial by fire

Four commercially available intumescent paint systems used for steel constructions were studied and tested by SP Fire Research – and two did not perform, write Robert Jansson McNamee, Karolina Storesund and Reidar Stølen.

The behaviour and performance of four intumescent systems available on the Nordic market for steel constructions were investigated using different, frequently occurring fire scenarios that included standardised tests.

The test typically used for this type of protection system is EN 13381-8, a standard that forms the basis for the design tables used for selecting a proper system thickness. While according to this methodology test specimens are exposed to a standard time/temperature fire curve in a furnace, SP Fire Research went one step further and added some additional tests. This is because the previous experience of fire testing intumescent systems had shown that heat exposure and the flows around the expanded product could influence performance. Therefore ceiling jets and fire plumes were included in the experimental study to make the tests better reflect real-life scenarios of cross-sections in open-plan houses. Cone calorimeter tests and standardised furnace tests were also carried out.

The four different intumescent paint systems used in the experimental study, A-D, were applied to hollow, square cross-sections of steel beams in accordance with the instructions from the respective suppliers.

The thickness of the intumescent paint was chosen from the suppliers' respective design tables so as to enable fire resistance for 60 minutes at a design temperature of 550°C.

According to the suppliers, all systems had been tested in accordance with the current European standard for intumescent paint. Despite this, one paint – System A – included a non-certified primer that had been delivered by the supplier even though it had not been used for the standardised testing that the certification was based on. The supplier nevertheless maintained that this primer was equivalent.

The results of the testing in the fire resistance furnace showed that Systems A and B did not function as designed, as they failed to limit the rise in temperature for 60 minutes, despite the fact that these two systems were the ones that expanded the most during the 50 kW/m^2 exposure in the cone calorimeter.

During the ceiling jet and fire plume scenarios, System A lost its adhesion to the steel surface, leading to a rapid rise in the temperature of the steel. It has not been possible to determine whether this was a result of the use of a non-certified primer or the very high expansion that was measured for System A during the cone calorimeter tests (or a combination of the two).

In summary, while two of the four tested systems performed very poorly, the experiments only tested a single cross section carrying fire resistance protection designed for one hour. The study, therefore, does not claim to provide a comprehensive picture of the behaviour of intumescent paints.

However, the thickness of intumescent paint used was not the highest allowable by the design tables, which meant that it was less likely to result in adhesion problems. The fact that adhesion problems did occur shows that the adhesion of intumescent paint systems deserves further attention.

The study did not clearly demonstrate whether the additional ad-hoc scenarios of ceiling jets or fire plumes were more decisive than the standard furnace exposure test. These tests did, however, enable the regulation of the flow around the test specimens, something that is near-impossible with standardised furnace tests. This feature potentially makes these types of tests better for evaluating the adhesive capacity of intumescent paints at elevated temperatures, as this is often what governs the efficiency of these systems.

A summary of the paper 'The function of intumescent paint for steel during different fire exposures' (SP Report 2016:43) was first published in Brandposten magazine, issue number 54.

Dr Robert Jansson McNamee, Karolina Storesund and Reidar Stølen work at SP Fire Research, Sweden.

Top: testing of intumescent paints in a fire plume scenario. Parts of the protection on the specimen on the right fell off during the test.

Active in passive

The Hydrocarbon Passive Fire Protection Network was launched in September during a one-day technical meeting at Manchester Metropolitan University.

The raison d'etre for the Hydrocarbon Passive Fire Protection Network is to raise standards in an industry that, by its very nature, is highly dispersed throughout the globe and where standards are often little understood and inconsistently applied, even though they apply to a life-critical component. Simon Thurlbeck, a founder member of PFP Net and a consultant specialising in major hazards risk management, explains the problem. ''It's quite normal to have a US-based company having a facility designed in Dubai, manufactured in Singapore and installed in offshore Australia. Our company has had a lot of exposure to fire protection and we've seen a lot of the problems at first hand, as we are involved in specifying and inspecting them. We find that hydrocarbon passive fire protection is less well understood than other systems that are well regulated and have good oversight.''

The potential benefits of improving this area of fire protection are huge, says Thurlbeck, because operators that specify incorrect systems or that maintain systems incorrectly can end up with high maintenance bills when problems are finally identified. ''Fire protection is a safety critical item so operators are duty-bound to make sure these things are fit for purpose. But quite often when they look at the systems they don't know if what they are looking is damaged or not.''

PFP Net's launch meeting was specifically structured to reflect the PFP supply chain, with four streams running in parallel; design and specification; material testing and certification; application and installation; and inspection, maintenance and repair.

Delegates were randomly split into the four groups and then rotated between them, so that by the end of the day each had attended all four work streams.

The next phase will see a proposed works scope and membership structure voted on by an independent steering committee. The latter has governance over the group and consists of six representatives, each from a different section of the supply chain.

Thurlbeck expects the final shape of PFP Net to be revealed in early 2017, with the development of membership structures, competency registers, training courses and accreditation for PFP application and inspection.

The EMEA region will be the first to benefit from the network, followed by the Americas and Asia-Pacific. It is hoped that the premise of saving costs whilst driving standards in safety and loss prevention will prove highly appealing to the operators

To find out more about PFP Net visit www.pfpnet.com.

Over the next few years PFP Net aims to become an international centre of excellence offering training courses and advice on passive fire protection in the hydrocarbon industry.

Problem magnified

The devastating fire that destroyed one the most important production plants in southern Spain is thought to have been caused by the relatively rare magnifying glass effect, reports George Potter.

According to initial investigations of the fire of 16 July at the Ybarra production plant in the town of Dos Hermanas, 15km south of Seville, the fire began in an exterior area where wooden pallets, cardboard boxes, plastic bottles, weeds and other abandoned combustible materials had accumulated without control.

Spain's extreme temperature in mid July had contributed to the dry state of the wooden pallets that served as fuel for the fire and to its rapid propagation. It is thought that the sun's rays, concentrated on the debris by empty plastic bottles, resulted in the intense fire that destroyed four large olive oil storage tanks as well as several production installations and storage areas for mayonnaise and other foodstuffs derived from vegetable oils.

The magnifying glass effect is not an uncommon cause of fires, and during the five-year period of 2010-2015 the London Fire Brigade documented some 125 fires caused by this phenomenon.

The dense black smoke generated by the burning olive oil prevented firefighters from entering the buildings. (Images: @Rafaruiz76)

Soon after the fire had taken hold, the regional emergency communications centre received around 40 simultaneous telephone calls from around the plant reporting heavy smoke coming from inside the premises.

The first responders from the Dos Hermanas fire station, comprising one pump and a crew of four, immediately requested additional support and another pump and crew were despatched from Dos Hermanas, as well pumps, crews and a hydraulic platform from the surrounding towns of Alcalá de Guadaíra and Utrera as well as Seville city. Within a few hours the intensity of the smoke generated by the burning olive oil had led to the evacuation of two nearby residential communities.

At the height of the incident there were ten vehicles and over 30 firefighters on the scene under the operational command of Andalucía's regional emergency management. By the following day the fire was under control, even if numerous small, isolated fires were still burning. Several pumps and firefighters remained on scene for the following two days to ensure the total extinguishment of the fires, while residents of the evacuated communities returned to their homes.

Four large oil storage tanks as well as processing and storage buildings were destroyed, while the main offices and laboratories were spared.

One of the reasons for the devastating impact of the fire lies in the chemical properties of olive oil, which has a flash point around 220°C and which when heated may generate smoke at a temperature of around 160°C. Olive oils burn at very high temperatures making the control and extinguishment of these fires very difficult. Also, as with most other burning vegetable oils, they generate extremely dense, nearly black smoke, which can impede access to the interior of involved buildings while provoking serious health problems. In Ybarra's case, several buildings involved in this fire were lost because firefighters simply could not enter due to the extreme heat and dense smoke generated.

While all vegetable oils including olive oil can be considered as combustible liquids, they are in reality Class F fuels. This classification is normally applied to the cooking oils and greases found in kitchens in relatively small amounts. In this fire there were several hundred thousands litres of burning oil, a situation more akin to a petroleum storage facility.

The most common extinguishing agents used for Class F fires are water mist, wet agents and dry powders. These are fine against a couple of dozen litres of kitchen oils but in Ybarra's case these extinguishing agents would not have been practical.

In this particular incident the wetting/foam agent Bio For N was used at a 1% application rate, and this did work.

There were no serious injuries or fatalities, although several employees and neighbours suffered from the effects of the dense smoke.

Fortunately for the company and its employees the disaster was not as devastating as it could have been. In October Ybarra announced yearly revenues of 200 million euros (US$200 million), only 14 million down from 2015. This was in large part achieved through a series of agreements with local firms that agreed to temporarily produce products on the company's behalf.

A modern 30 million-euro (US$30 million), 30,000m^2 factory is planned for completion in December 2017 to re-employ the 175 people that worked in the old plant.

INDUSTRY VULNERABILITIES

While the ratio of one firefighter per 1,000 population is generally considered to be the 'ideal', the average ratio in Spain is one for every 2,300 inhabitants.

In this specific region the Seville municipal fire brigade's approximately 400 officers and firefighters protect a population of more than 696,700, while often responding outside the city's limits, as in the Ybarra fire.

The municipality of Dos Hermanas, with a population of more than 130,000 people and a multitude of industrial hazards, has a brigade of 70 officers and firefighters.

The two responding brigades from Alcalá de Guadaíra and Utrera, also equally below ideal staffing, were only able to respond with one vehicle and crew each. While doing so they left their respective stations completely unmanned.

Although the nearby Seville international airport and the joint Spanish and USAF airbase at Morón de la Frontera are both equipped with aviation crash tenders with foam application capabilities, neither were summoned to the Ybarra incident.

The incident has highlighted the vulnerability of Spanish industry to fire, given the sparse resources allocated to municipal emergency response and the lack of co-operation between private and municipal brigades.

Etankfire update

The latest research into large-scale fires involving ethanol suggests that common test standards for foam do not reflect tank fire situations. Report by Henry Persson and Magnus Bobert, SP Sweden.

Although conducted in 2015 the results of the reduced scale fire tests, which simulate tank firefighting with ethanol, have up to now only been available to the Etankfire consortium of companies that are financially backing the research project.

The goal of this part of the Etankfire project was to evaluate the potential of traditional and unconventional extinguishing media and application techniques for ethanol tank fires.

Two series of fire extinguishing tests in reduced scale were conducted with large amounts of fuel and long preburn times.

Foam application techniques, foam properties and application rates were investigated both with AFFF-AR 3x3 foam and one 3F-AR 3x3 (fluorine-free foam). Some tests included alternative extinguishing media such as cellular glass, liquid nitrogen and aqueous vermiculite dispersion.

Free-burning fire prior to the addition of a layer of cellular glass and foam. (Photo: Magnus Bobert)

In total 29 extinguishing tests were carried out in the first test series using a 0.41m^2 fire tray. Fourteen tests took place in the second test series using a 3.14m^2 fire tray.

The first tests were used to better understand the various parameters that might influence the extinguishing process. The second tests focused on verifying the extinguishing performance of the most promising tests in the first set, but in a larger scale. The results from both test series showed that a tank fire situation with an increased depth of fuel, a prolonged preburn time and a slightly higher impact position of the foam on the tank wall might have a severe influence on the foam extinguishing performance.

In several tests the fire could not be controlled at all or it could not be controlled until the fuel was significantly diluted by the foam solution. This was also the case when using a fixed foam pourer on top of the tank; the hot tank wall prevented the foam from sliding gently down to the fuel, resulting in forceful application. The results indicated that the conditions used in the most common test standards for foam, such as EN1568 and UL 162, do not really reflect tank fire situations.

However, the results also showed that fire performance can be improved significantly by adjusting the finished foam properties, for example via higher expansion and/or longer drainage. In these tests, improvement was obtained by increasing the foam concentration compared to the nominal concentration value, which provides more stability and better survival of the foam when landing on the fuel.

Another method to improve the finished foam quality was to use CAF instead of aspirated low-expansion foam. A combination of higher foam concentration and CAF provided the best results. These changes even made it possible to significantly reduce the application rate and still achieve improved performance.

The importance of gentle application is well known when extinguishing water-miscible fuels but these tests also showed that an improved quality of the finished foam can compensate for a more forceful application, and is far more important than the application rate.

In addition, the tests that combined cellular glass with foam resulted in very good extinguishing performance, because the cellular glass layer reduced foam breakdown in the severe direct application (Type III) conditions. Even a moderate layer of cellular glass was found to reduce the burning rate and thereby the heat radiation significantly before the foam application starts.

The full results will be announced at a meeting in Stockholm, Sweden, 26 April 2017. Further information will be published on the Etankfire website, www.sp.se/en/index/research/Etankfire/Sidor/default.aspx

TRIAL BY FIRE

The first phase of practical research on the application of fluorine-free and C6 hydrocarbon chain fluorosurfactant foams on dike/bund fires has been completed by LASTFIRE, the international consortium of tank operators and associates.

Different foams with different application techniques were tested in order to further develop a protocol for the assessment of their performance. The research also aims to produce optimised and accepted strategies for extinguishing large bund fires section by section.

The work was carried out 17-21 October 2016 at the Százhalombatta Refinery, Hungary under the direction of LASTFIRE coordinator Dr Neill Ramsden with the head of the FER industrial fire brigade Dr Laszlo Pimper.

During the tests conventional application techniques using aspirated and non-aspirated monitors and foam pourer system nozzles were evaluated against CAF application using both foam types. Ramsden commented: "The work clearly showed the need to rethink foam application standards and there is now a perfect opportunity to do this with the current emphasis on using foams with lower environmental consequences.

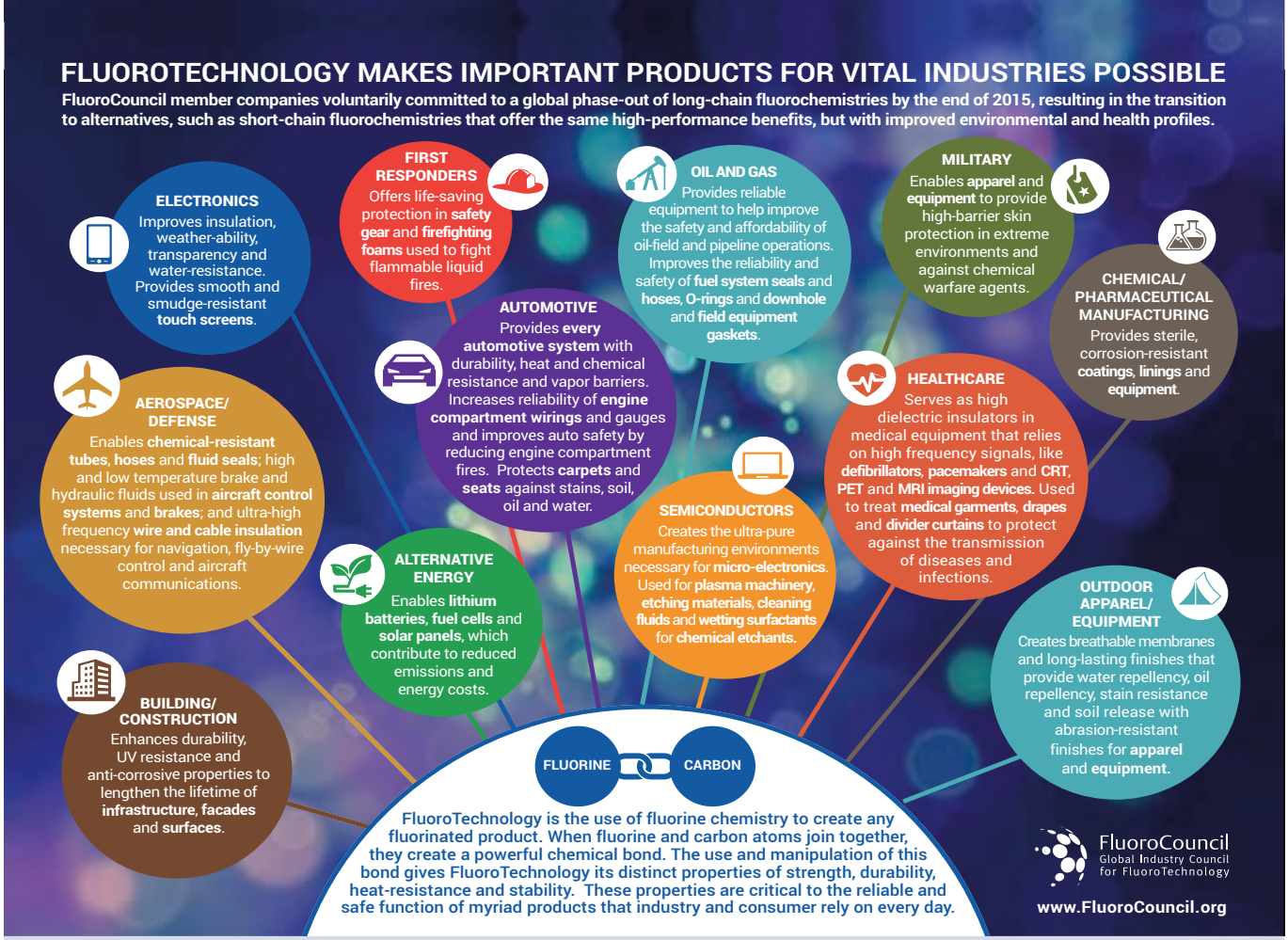
"Having established a critical performance-based test protocol in line with the principles of the International Association of Oil and Gas Producers' guidance on fire systems integrity assurance, the intention is to use this in a more comprehensive programme in early 2017, when several different foams will be tested in realistic scenarios of tank and bund related incidents."

"The work carried out in Hungary was very much preliminary work to ensure LASTFIRE can focus on the critical issues in the next phase," added Ramsden.

The next phase of testing is planned for March 2017 in Hungary and/or Spain using an 11m-diameter tank and at least one 4x4m bund.

The research, whose results will initially only be available to LASTFIRE members, is expected to relieve the pressure on foam users to develop more efficient application techniques for new foams.

Any company interested in becoming involved with this programme should contact Niall Ramsden via: niall.ramsden@lastfire.org.



Altered reality?

Dr Stephen Korzeniowski of Beach Edge Consulting writes a response to Dr Roger Klein's article *Fluorochemicals: What is all the fuss about?* which appeared in *IFJ* Q3 2016.

Much has been written about fluorinated chemicals since the announced exit from the PFOS and PFOA businesses by 3M in May 2000. For the past few years many have chosen to reside in an altered reality whereby the focus is all about the negative, with no consideration for the essential value fluorochemistry delivers.

The focus has been on their ubiquity in the environment; the presence in humans and various biota; their potential PBT properties; their environmental fate and effects (EF&E) consequences; drinking water advisories at the part-per-trillion levels; and application of the Precautionary Principle to the exclusion of risk-based approaches. And we are all aware of the various pronouncements such as the Helsingør and Madrid statements that manufacturers should exit this chemistry completely. The latest article by Dr Klein is of the same variety.

While all chemistry bears scrutiny to ensure its safety, this particular article discounts and avoids the significant benefits fluorochemistry still provides to various end users.

This lack of balance and value-in-use recognition (AFFF saves lives – performance does matter) as well as the numerous cavalier misstatements is the focus of this editorial response.

Eight companies joined with the US EPA in the 2006 Voluntary Stewardship Program[1] to exit from long-chain chemistry (ie PFOS and PFOA) and transition to short-chain alternatives with fluorinated chain lengths of < 6 carbons. This transition was a voluntary agreement with the EPA – not a legal proceeding. Industry developed this agreement with the recognition that it needed to move away from the long-chain chemistry to a more sustainable short-chain offering. Given that many of fluorochemistry's uses were and are still essential, the VSP signatories agreed to a two-tiered phase-out with the first milestone in 2010 and 'virtual elimination' at year-end 2015.

This 10-year period gave time to suppliers to redo their complete product lines and re-engineer plants; and customers to re-qualify this chemistry in critical and exacting applications. And what many conveniently forget is that development and innovation of short-chain chemistry provided a clear avenue and incentive to exit long-chain product manufacture and use.

This author takes issue with the numerous misstatements by Dr Klein – opportune statements not grounded in truth or facts. While most of the industry did exit PFOS manufacture in the early 2000s, it was for its overall PBT properties – not simply 'environmental grounds'. It is quite true that fluorotelomer-based polymeric products are used to treat textile fabrics. However it is a completely false statement to maintain that perfluorocarboxylic acids (eg PFOA, PFHxA) are extensively used in textile treatments. They are not used and have never been used in DWR treatments. Similarly, it is also completely false to insinuate, especially without first-hand knowledge and research data, that short chain chemistry requires more fluorochemical and/or does not perform as well in end-use applications such as textiles, FFFP and AFFF. Moreover, a typical 3% AFFF foam concentrate contains about 0.5% fluorine, not 1% as noted.

Current generation short chains are qualified in the toughest fire test standard (Mil-F-24385) and they are used in high-performance DWR textiles and military/law enforcement/ protective gear applications. They also meet the toughest standards for oil and chemical repellency.

By repeatedly invoking the Precautionary Principle without consideration of alternatives, over a more classic risk-based analysis, this article infers that all PFAS's (perfluor-oalkyl substances) are the same and that the short-chains are likely regrettable substitutes. Numerous global regulators have been approving this chemistry for the past 30 years and a significant

The author Dr Stephen Korzeniowski left DuPont/Chemours in July 2015 after 37 years and has been involved in fluoro-telomer-type surfactants and repellent coating chemistry for nearly 25 years. He has served as member and chair for the Telomer Research Program (2000-2011); member of the Fluoro Council (2011-2016); and founding board member and chair of the Fire Fighting Foam Coalition (2011-2015). He is current chair of the Fluoro Council Science Work Group (2016-2017) and is the principal of Beach Edge Consulting, with clients in the fluoro-technology and other industries.

amount of data is available in the public and peer-reviewed literature to support the short-chain products[2]; to imply otherwise is disingenuous. The broad-brush approach that insinuates that this whole class of compounds be treated the same is both a groundless premise and misleads *IFJ* readers.

Under all circumstances, end users should follow appropriate safe handling guides developed by suppliers and/or industry associations and others. Both the textile[3] and AFFF[4] industries have such guides available.

Underlying the arguments made in this article by Dr Klein is that not only are all PFASs unacceptable chemistry but that sufficient alternatives exist to fulfill the market's performance needs – especially with fluorine-free products in the fire-fighting industry. While fluorine-free foam products do hold various certifications, the real reality today is that nothing can put out a Class B fire like short-chain AFFF – seconds count. AFFF provides significant advantages in fuel repellency, film formation, foam spreading on fuel, extinguishment time, burn-back resistance and reduced noxious firewater runoff.

In the end, when performance counts and life safety is critical, it doesn't matter what altered reality you reside in, only that fluorochemistry gives you the results you need to provide true duty of care.

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STRANGE PARTICULATES APPEAR IN AFFF TANKS

The US Federal Aviation Administration has issued a Certalert for airport operators and ARFF departments after particulates have been found in some AFFF tanks on ARFF vehicles.

The FAA is asking airports to check their vehicles, foam trailers, and bulk storage tanks to help determine whether this is a widespread issue. The Certalert has been issued after some ARFF departments reported finding crystalised particulates in the AFFF tank on their ARFF vehicles.

The issue had previously been encountered only once, several years ago, in the reserve AFFF storage tank of Oklahoma City Airport. According to the FAA, the issue has resurfaced again and has been found in at least four different ARFF stations around the US.

Although to date these crystals have not been found to affect the fire-fighting capabilities of AFFF, the FAA is concerned is that the crystallisation might possibly restrict the AFFF proportioning system and alter the AFFF production or nozzle discharge.

The FAA is asking Certificated Part 139 airports to proactively inspect the AFFF tanks on all ARFF vehicles, foam trailers, and bulk AFFF storage tanks as soon as possible.

The potential particles are grey/white in colour and are hard to the touch, with a crystallisation structure. A high concentration of particulates will be settled in the bottom of the tank, visible with a strong flashlight.

The FAA is advising affected organisations to contact the AFFF manufacturer for guidance; complete a survey; and send a sample to the FAA.

When are PFOS and PFOA safe?

The German Federal Environment Agency (UBA) publishes official safe levels of PFOA and PFOS in human blood.

Safety thresholds for PFOA and PFOS in blood plasma have been set at two nanograms per millilitre and five nanograms per millilitre respectively by the German Human Biomonitoring (HBM) Commission.

These levels, so-called HBM I values, represent the concentration of a substance below which, according to the HBM's latest assessment, adverse health effects are not expected, and no exposure reduction measures are necessary. The values have been published in Germany's Federal Health Gazette, Bundesgesundheitsblatt, which is the equivalent of the US Federal Register.

Evaluation of human epidemiological studies led the HBM Commission to conclude in July this year that exposure to PFOA and PFOS was adversely associated with fertility and pregnancy; weight of newborns at birth; lipid metabolism; immunity after vaccination; hormonal development; thyroid metabolism; and onset of menopause. It described these associated effects as 'well proven' and 'relevant'.

The UBA recently demonstrated that it was prepared to argue the validity of these conclusions even if it meant contradicting its own Government. In September it publicly corrected the Minister of Agriculture and Consumer Protection Peter Hauk after he had said in a television interview that no scientific studies were yet available that proved perfluorinated compounds (PFCs) were harmful.

Martin Ittershagen, head of public relations for the Federal Environment Agency, said: "The comments made in the interview with regards to the health effects of PCFs are wrong. There are numerous scientific findings from epidemiological studies through to experiments on animals." He later added: "When exceeding the HBM-I value, health effects cannot be excluded with sufficient certainty based on the current knowledge we have."

PFOA and PFOS are fluorinated organic chemicals that are part of a larger group of chemicals referred to as perfluoroalkyl substances. PFOA and PFOS, the most extensively produced and studied of these chemicals, have been used to make carpets, weatherproof clothing, fabrics for furniture, paper packaging, and cookware. They have also been used for making AFFF fire-fighting foam.

All human populations around the world carry varying levels of PFOA and PFOS in their blood. In a 2012 scientific study of blood serum concentrations of perfluorinated compounds in men from Greenlandic Inuit and European populations it was found that in Greenland the average level of PFOS in blood was 52 nanograms per millilitre, ten times higher than the safe level published in Germany. In Poland, it was four times the limit and nearly twice the limit in Ukraine.

Nevertheless, these levels have been in decline since 3M began to phase out PFOS production in 2000, and since the US Environmental Protection Agency introduced the PFOA Stewardship Programme that aims to eliminate PFOA production by 2015.

Given that PFOA and PFOS have been key ingredients in fire-fighting foam for years, the latest findings from the HBM Commission could raise concerns from members of the fire-fighting community that have used AFFFs containing PFOS or PFOA before their replacement with short-chain (C6) fluorotelomer surfactants.

NEW FOAM LAUNCHED IN ASIA

During Tank Storage Asia in Singapore, in September, Bioex introduced its new fluorine-free foam to the Asian market.

According to the fluorine-free foam manufacturer, Ecopol F3 HC has an exceptionally fast extinguishing action on hydrocarbon fires and 'performs better than the best AFFFs.'

Ecopol F3 HC can be used at 3% in direct application on hydrocarbon fires and has been certified by an independent laboratory, obtaining the top 1A performance classification under EN 1568-3 standard (certified 1A/fresh water – 1A/sea water). It has also received the highest performance classification under LASTFIRE (Good-Good-Good).

As a totally fluorine-free foam concentrate, Ecopol F3 HC is not subject to current or forthcoming regulatory controls on products containing fluorine derivatives.

It is free of fluorine derivatives such as perfluorinated compounds, which have been widely recognised as being persistent in the environment, bio-accumulative and toxic to living organisms.

According to a Bioex spokesperson, in addition to its extinguishing action on hydrocarbon fires and a long burn back time equal to the best protein foams, Ecopol F3 HC offers durable adherence on vertical surfaces and can be used as a protective fire barrier for long-lasting cooling of storage containers or hydrocarbon tanks.

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Play time

A crude oil storage tank overfills and its contents ignite in the bund leading to a multi-tank fire – this nightmare scenario formed the basis for a multi-agency training exercise that took place in September at the Esso Refinery at Fawley, Southampton, UK.

When the alarm was raised firefighting personnel and high-volume pumps from four neighbouring counties responded to the multi-tank fire, liaising with the refinery's Fire and Response Group and laying out the equipment necessary to feed the Williams Six-Gun monitor.

The exercise was a crucial element for maintaining the highest level of safety possible at the Exxon Mobil-owned Esso Refinery at Fawley, near Southampton. This, the largest in the UK and one of the most complex in Europe, is classified as a top tier site under the Control of Major Accident Regulations – the national implementation of the European Union's SEVESO II Directive. The refinery's mile-long marine terminal handles around 2,000 ship movements and 22 million tonnes of crude oil and other products every year. As well as processing around 270,000 barrels of crude oil a day, it also produces 750,000 tonnes of chemicals every year.

The multi-tank aspect of the exercise was particularly appropriate for a site that not only contains numerous large-diameter tanks but also lies directly adjacent to another top tier COMAH site, in addition to a number of other COMAH plants in the area. Schools, nurseries and residential housing developments also surround this industrial complex.

The joint action by Hampshire Fire & Rescue, Hampshire Constabulary and Exxon Mobil began at 0900 and ended at 1300 with a hot debrief and lunch. The sequence of events ran as follows: the refinery's Fire and Response Group (FRG) responding to a bund fire in Tank 312 assess the scene and request assistance from HFRS by dialling the emergency number (prefixed with 'for exercise purposes'). Fire control mobilise appliances at their home stations, manned by firefighters aware that they are taking part in an exercise, but without knowing the details. The first attending crews liaise with the refinery's FRG and the remaining resources move to the so-called Process Forward Control point, a safe position close to the incident that is determined by the shift site manager, readily identifiable by a fluorescent orange high-vis jacket emblazoned with 'emergency manager' across the back.

Monitors were used to cool down the adjacent tanks. Water was drawn from three holding tanks at a relatively low 4-bar pressure.

Unsurprising for a complex exercise involving two public agencies and one sizeable private organisation, there were a number of objectives to tick off. These included the test of key actions detailed in the pre-operational plan and operational support plans of HFRS and Exxon Mobil; liaison between the municipal and the refinery's FRG; the effectiveness of the refinery's management coordination centre; the response of the high volume pumps to the site and their ability to supply the requisite amount water to the fire ground; and the role of the Airwave Tactical Advisor and the use of the Airwave network. The latter is a national private network for mission critical comms that uses TETRA technology to enable emergency services to talk with each other via shared talk groups. In contrast with the police, who regularly use the technology, it is widely recognised that talk groups are rarely used by the fire services except at a basic level and, consequently, few firefighters know how to use them in scenarios requiring interagency cooperation.

The exercise also presented HFRS with a valuable opportunity to use the METHANE model, which has been designed to help agencies gather initial information about a major incident in a consistent manner. The acronym stands for: Major incident declared: Exact location: Type of incident: Hazards present or suspected: Access: Number, type, severity of casualties: Emergency present and those required.

Four high volume pumps were deployed from East Sussex, West Sussex, Dorset and Kent. As with all exercises, some allowances were made for logistical reasons and Kent FRS's high-volume pump, usually sited some 140km away, had therefore been allowed to arrive the previous night at the main holding area in Eastleigh Fire Station.

Although foam was not used, foam concentrate stocks and foam proportioning equipment were deployed.

As would have been the case in a real scenario using out-of-county FRS resources, all appliances were guided down to the site by Hampshire Constabulary in a convoy procedure.

In a twist from the previous exercise that had taken place here in May 2012, the HVPs did not tap into the virtually unlimited water supply available from a small lake 3km away, as this would have inevitably prolonged the exercise as well as caused greater disruption for the operator.

Instead, the water came from three holding tanks that draw salt water from the marine terminal for process cooling as well as for feeding the emergency fire main. Should the pumps supplying these holding tanks have failed, there would still have been sufficient water in the tanks to supply a fire requiring 27,240 lpm for six hours.

For the purposes of the exercise, however, so as not to interrupt the process cooling operations the water was drawn at a relatively low 4-bar pressure from the holding tanks. The lower flow nevertheless did manage to satisfy the discharge rates of the Williams Six-Gun monitor (7,571-22,700 lpm) covering the involved tank – if only just.

The training exercise enabled Exxon Mobil to test its firefighting equipment, including its Williams Six-Gun monitor.

For the fire and rescue services one of the positive outcomes was the quick access facilitated by the main gate guards to the industrial compound, and subsequent navigation to the incident area and Process Forward Control point – no easy task when involving fire personnel responding from neighbouring counties with no prior knowledge of the area.

Other positive outcomes were the successful set up of HFRS's Silver Command in the refinery's management coordination centre and the use of Airwave radio talk groups between the various emergency response agencies.

One such talk group had to be set between the fire ground and the command and control centre, as the distances involved were too great for the VHF/UHF radios. Visiting fire brigades were provided with TETRA radios and successfully taught (or 'upskilled') by the Airwave Tactical Adviser to change channels to the appropriate talk groups. A key learning point here was the ongoing requirement for dedicated radio experts on site to facilitate the communications between the different agencies involved.

PC Mike Batten, who attended the incident as the Hants Constabulary Hazmat Advisor, linked up with the FRS Hazmat Advisor at both Bronze Command and then – in a departure from previous exercises – he also sat in Silver Command as the exercise developed. ''I was happy with the multi-agency liaison at Bronze and with my on-scene working relationship with the HFRS Hazmat Advisor, which was one of the best I have experienced,'' he remarked, adding that he had used his body-worn video to record the exercise for debrief purposes.

One key learning point related to training management. The arrival of increasingly senior FRS personnel to the Process Forward Control point inevitably resulted in the passing over of responsibility for incident command, which obliged the refinery's emergency manager to explain the incident's sequence of events on a number of occasions – sometimes with only minutes in between. Although this could be regarded as a useful way of testing a greater number of fire fighting personnel, it did result in delays for the progress of the scenario.

Like any exercise of its type there were some minor niggles. Some players felt the application of foam would have enhanced the exercise, although the refinery did mobilise its foam concentrate stocks to the foam proportioner at the incident area.

The Process Forward Control point, marked by the emergency manager's car, was sited in the middle of the site's perimeter road. Some felt the unused contractor premises that lay alongside could have been put to better use, but as it turned out the weather was on the players' side.

Although the formal debrief had yet to take place by the time of going to press, by all accounts the aims and objectives of the one-day exercise were judged to have been met.

Hardley Station watch commander Chas McGill, who had helped plan the day over the past nine months, told *IFJ* that he hoped the success of the day would lead to further exercises in the refinery. He said there had been a four-year gap between this and its predecessor, Exercise Shannon. ''I think we can improve on this, especially considering that so much has changed in that time – people have changed, the plant has changed and our procedures have changed. Ideally we would carry out an exercise on a petrochemical plant like this, built in the 1950s, on an annual basis, with a programme covering scenarios other than tank fires. But of course getting people to buy into taking part in an exercise on a weekend is difficult, which is why such long lead times are essential.''

Why the FEHM approach works

A strategy that is consistent with both legislation and business risk reduction is possible, writes Chris George

Fire protection practices in high-risk industries used to be highly prescriptive and with no basis on the real needs of a particular facility. However, due to major incident experience, internationally recognised authorities such as NFPA (USA) and HSE (UK) have set a requirement for goal-setting, performance-based standards within a so-called safety case.

The risk-based approach puts the onus on operators to demonstrate to the regulatory authority that they are taking all necessary measures to reduce risk to life safety and the environment to acceptable levels. This may be achieved by a number of options including both prevention and mitigation measures

Such legislation demands the development and presentation of a safety case detailing all the measures taken at a facility to reduce risks, including risks from fires. A business unit may, of course, decide to provide additional levels of fire-risk reduction to reduce business and reputation losses. For example, a minor fire incident in a critical part of a facility may have minimal life safety or environmental effects but could cause considerable down time; and so an operator may include additional fire detection or extinguishing systems, not as a matter of safety, but as a measure to reduce incident consequences to business. Thus, there is no conflict between the approach required by legislators to demonstrate the reduction of risk to acceptable levels and that of operators to reduce business risk.

However, it is important to recognise that the types of risk that are important to legislators may not be the only ones important to operators.

By demonstrating the link between potential scenarios and the risk-reduction measures implemented, the fire and explosion hazard management (FEHM) approach, if carried out properly by experienced personnel, will result in a strategy that is consistent with both legislation and business risk reduction requirements.

The FEHM approach is a technique that enables facilities to properly assess their fire and emergency incident risks and provide an integrated, pragmatic, site-specific and cost effective strategy that will not only meet legislation but recognise and respond to the business risks involved in fire and emergency incidents.

This approach is actually in line with the latest non-prescriptive, risk-based, safety-case legislation that is being adopted by an increasing number of countries and, in particular, the European Union. With this legislation the onus is on the facility to analyse the hazards and risks associated with their operations and develop, implement and demonstrate policies that reduce risk to acceptable levels. The regulatory bodies then review the policies and decide whether or not they are acceptable.

Many facility operators, including major international companies have recognised the benefits of the approach and have consequently adopted it for all their facilities, even where it is not demanded by legislation.

Chris George is managing director of Falck Fire Consulting.

Extreme training goes global

Historically there have been few opportunities for hands-on industrial training for firefighters wishing to challenge and enhance their skills – until now.

Williams Fire & Hazard Control is extending the industry-recognised training that first originated in Port Arthur, Texas in 1993 with three industrial fire and hazard training events for 2017 in the EMEA and APAC regions.

For more than 30 years Williams Fire & Hazard Control has been facing some of the world's most challenging fires; the front line experience gained in over 200 major incidents has given its response team a distinct understanding of flammable liquid fires and the tools it takes to fight them.

Williams is the only global company that responds to emergencies with its own hardware and specially formulated foam concentrate engineered with the firefighter in mind. This field-tested knowledge and expertise has now been translated into a training course for the benefit of industrial firefighters everywhere.

The Xtreme Industrial Fire & Hazard Training curriculum has been designed to provide a comprehensive, hands-on learning experience for emergency response specialists and HSE managers involved in operational industrial fire response at on-shore petroleum, oil and gas facilities.

Working directly with members of the Williams response team, attendees benefit from their long history of successful extinguishment of land and marine-borne fires; the training is also an opportunity for participants to discuss best practice with their peers from across the industry.

The training is split between classroom study and practical field training exercises covering various incident profiles and fire dynamics; foam and dry chemical application; response logistics and field operations; and large-volume equipment applications. Instructors cover the latest methodologies and fire behavior using real-life case studies and insights into typical industrial operating profiles and their inherent exposures. This focus on 'lessons learned' relative to operating conditions, incident characteristics and successful response measures, strengthens the group and the industry as a whole.

By drawing on recent response activities by the Williams Response Team and its work with fire professionals throughout the industry, attendees can closely examine the response to events around the world that have shaped their profession — assessing incident characteristics, response methodology and impact. Considering that the emergency response team attends new and unique incidents each year it is not surprising that this portion of the training is in a state of constant evolution.

All phases of fire suppression are covered in order to ensure that participants understand the different types of response and equipment options available, even if these are often driven by the incident. Proper foam application and understanding of the unique dynamics of fires involving hydrocarbon and alcohol-based fuels is covered in the classroom and during laboratory presentations that introduce participants to the fundamentals of AR-AFFF foam.

During the course classroom study is adapted to the training field and then tested. Live fire exercises involve pressure-fed fires, pooling fires, running fuel fires and fuels-in-depth to exercise the group's use of coordinated foam application, dry-chemical usage, hand-line attacks, ground-monitor deployment, quick-attack monitor operations and large-volume equipment logistics. The simulations replicate process unit fires, pressurised pump alley fires and storage tank fires amongst others. Moreover, hands-on experience with the latest product innovations from Williams such as the Dependapower hydraulic submersible pump and the Thunderstorm 1% x 3% AR-AFFF C6 foam concentrate, is also included in the course.

The field training is suited to those directly involved in operational roles, such as fire officers and municipal fire departments; while the classroom courses are ideal for specifying engineers, safety consultants, corporate safety specialists and chief fire officers.

"When faced with fires at petroleum, oil or gas facilities, it is the experience that makes the difference and this course is the perfect opportunity to gain that experience in a safe environment," said Chauncey Naylor, director for training and emergency response operations at Williams Fire & Hazard Control. "Everything we do is governed by in-depth knowledge, whether it be designing new products, writing methodology or formulating new foam, and we want to impart this knowledge on to as many people in the industry as possible."

The Xtreme Industrial Fire and Hazard Response Workshop takes place in Thailand on 16-19 January and in France in Autumn 2017 (location and date tbc).

Classroom study is followed by field training in a wide variety of scenarios such as process unit and pressurised pump fires.

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Flip, blend and learn

E-learning is the future for fire, rescue and safety training, writes Chris Thain of Red One.

On-demand learning with 24/7 access to lessons, information and even wearable holographic computing could soon be enabling firefighter students to learn at their own pace and even in their own virtual world.

This is known as 'flipping' the classroom – or moving the learning into a new space where each individual student can learn in their own style and at a time and location that best suits them. This is particularly relevant for emergency responders, who can undertake interactive training while being operationally available.

Content rich active e-learning, accessed through web-based media players, enables students to experience real-life and interactive CGI examples of incidents and scenarios that previously would have been unavailable to them. A library of best practice videos can demonstrate phenomena, situations and techniques that then provide greater clarity for future performance assessment and task-led skills. A selection of 'how to' videos can also show how different equipment is operated or tasks/skills undertaken, for example operating a CAFS pump or stabilising vehicles. Students can access videos, e-lessons and recorded webinars to further enhance their learning.

E-learning solutions can be used for assessment and evaluation of progress; students attending practical courses prepare by first undertaking an e-learning module, at the end of which there is a straightforward quiz style assessment. Such tests – automatically marked – can be retaken until a thorough understanding is achieved.

This type of learning is now a reality. Red One in close partnership with parent organisation Devon and Somerset Fire and Rescue in the UK has combined the latest e-learning methodologies and applications with the more traditional 'hands-on' experiential training approach of live fire training that has been operated by fire brigades for decades.

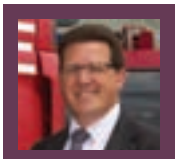
While this 'blended learning' approach is not widely available in the market, Red One has been constantly developing and refining the concept and starting to introduce it to clients and fire departments around the world. DSFRS has been using this system to train its own staff and to test the concept, via an internet-based portal with training content in a variety of different media including interactive video, questionnaires, multiple choice papers, click-and-proceed slides, animations and real-time action sequences.

E-learning systems are currently being developed around dedicated packages for each key area of the responder's skill set, providing standardised content that can be aligned with national or regional guidance; service policy; and learning outcomes defined by a training department.

All this is being done whilst accepting that the purpose of e-learning is to complement the task and skills-based practical training that every emergency responder must regularly undertake, not to replace it. In fact, Red One is supporting both forms of training within a blended learning program, where 'pre e-learning' by each individual student is then blended with safe, practical experiential training, in real fire and rescue environments and situations. This type of learning, in the form of computer simulation, is already being used extensively by UK FRSs in incident command training, where fire officers can regularly practice the command and control skills required to successfully manage and resolve a wide variety of incident types that would be cost-prohibitive to set up in large scale training exercises.

With an eye to the future Red One is considering how 360° stills and video cameras can be harnessed operationally; and how footage can be further integrated into training programmes. It is also investigating the possibilities offered by emerging wearable holographic computer technology, which could enable students to interact with high-definition holograms within their own 'world'.

These new ideas and concepts are influencing Red One's training offer. The company is collaborating with other fire brigades and emergency service providers to share experiences and further develop blended learning.



Chris Thain is director of business development and marketing at Red One.

Students can undertake an e-learning module prior to taking part in practical exercises.

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Practical fire engineering

The multi-million pound Engineering Innovation Centre is one of the more eye-catching projects underway at the University of Central Lancashire. Jose Sanchez finds out what else is new at an education centre where practical fire engineering has always been a main focus.

A £30-million (US$50 million) investment by the University of Central Lancashire is expected to ensure that the next generation of fire engineers and fire-fighting leaders continue to receive a blend of theory and practice in fire engineering.

The University of Central Lancashire in the city of Preston, northwest England, has its roots in the teaching and research of practical fire engineering. The BSc (Hons) Fire and Leadership Studies course, for example, was created in partnership with the UK Fire Service to create a 'graduate entry scheme' for firefighters and as a means of developing serving officers. A number of universities had been approached but none wanted to invest in designing a new course, rather preferring to try and adapt existing programmes. In the end, UCLAN worked with fire service and professional bodies to devise a bespoke course that continues to be supported by the service.

Its influence grew stronger through the 90s when UCLAN put in place reciprocal arrangements with the Fire Service College in Moreton on Marsh as well as the Fire Safety Engineering College in Oman, and set up a franchise undergraduate and postgraduate courses in fire safety engineering with the City University of Hong Kong.

UCLAN's Engineering Innovation Centre will be completed in 2018.

This partnership approach has laid the foundations for the wide range of courses on offer, which include MScs in fire safety engineering; fire scene investigation; fire and rescue service management; oil and gas engineering as well as MEng/BEngs in fire engineering; and oil and gas safety engineering.

One of the main advantages for UCLAN's fire engineering students is that they are able to draw from multi-disciplinary expertise, as the University also delivers mechanical, civil, energy and oil/gas safety engineering.

Today the School of Engineering's particular blend of academia and industry regularly draws support from companies wishing to develop their own fire safety officers, from sectors as wide ranging as transport, retail, and petrochemical sectors throughout the world. What's more, its industry links mean that students have the option for industrial work placements where they can develop the practical engineering skills needed by employers.

One recent success story is Eugenio Garcia-Diaz, who graduated in 2015 with an MSc in Fire Safety Engineering. He won the Chartered Institution of Building Services Engineers 2015 Award for his MSc dissertation, *Advanced computational simulation of fire performance and external spread on multi-storey facades*. "It's a huge accolade, and it's great to put the University and its engineering department on the map for the quality and high standard of work produced by our students," commented Dr Tony Graham, senior lecturer in fire engineering at UCLAN. Garcia-Diaz has since then secured his dream job, having been hired by Aecom, a company specialising in building engineering and architecture design.

Looking ahead, this year construction finally started on UCLAN's Engineering Innovation Centre which, when it opens its doors in 2018, will serve as an integrated hub for teaching, research and knowledge exchange, bringing together academia and industry.

HAZARD MANAGEMENT WORKSHOPS TAKE TO THE ROAD IN UK AND IRELAND

CFB Risk Management is taking a free Fire and Explosion Hazard Management Workshop on the road in the UK and Republic of Ireland in 2017. The half-day event is aimed at those responsible for protecting businesses against the hazard of fire, explosion and release of toxic materials.

The workshop, which has been jointly organised with Angus Fire and Iamtech, is designed to help delegates ensure their workforce, site, assets, equipment and reputation are protected; as well as reduce the risk of costly disruption.

Amongst the objectives of the workshop is also the clarification of legal requirements as well as the identification of hazardous risks.

It will take place in the following towns: Swansea, 24 January; Ellesmere Port, 7 February; Cork, Republic of Ireland, 21 February; Teeside, 19 April; Grimsby, 8 May.

For more information, visit www.cfbrisk management.com/fehm-self-assessment/

AVIATION WORKING GROUP FORMED BY AFOA AND IFE

The inaugural joint meeting of the Airport Fire Officers Association (AFOA) and the Institution of Fire Engineers (IFE) that took place at Gatwick Airport Fire Station in October 2016 has resulted in the first Special Interest Group for Aviation in the UK.

The group will share information and work together on future educational programmes for fire-fighting professionals with an interest in aircraft and aerodrome response.

The concept for the group was initially discussed by Graeme Day of Heathrow Airport Fire Service, AFOA chair Simon Petts of Gatwick Airport Fire Service and Andy James of the IFE, with the idea of joining up the expertise of the AFOA committee and its membership with that of the Institution of Fire Engineers.

Graeme Day chaired the initial meeting, leading the first discussions around the groups' remit.

The Special Interest Group for Aviation will next meet during the AFOA conference on 18-19 January 2017.

A Z6 ARFF vehicle has been delivered to Xinzheng International Airport in Zhengzhou, Henan province, China by Albert Ziegler. Built on the Thomas chassis, the all-wheel drive, 1+3 persons ARFF vehicle has a working range of up to 400km and can reach 80kmh in 31 seconds.

The diesel engine has a power output 515kW and a maximum road speed of 120kmh. The extinguishing equipment includes the FPN 10-8000-1ML Ziegler fire-fighting pump with a flow rate 8,000 litres per minute. The vehicle carries the 17m-long Z-Attack extendable turret, with a flow rate 6,000 lpm and a front-turret Ziegler Viper. An 11,000-litre water tank and 1,400-litre tank of foam concentrate are also included.

The Z6 has joined the more compact Z4 ARFF vehicle that was purchased from Ziegler by Xinzheng International Airport in 2015. The two-axle Z4 is built on a special chassis with all-wheel drive and fully automatic titanium transmission with engines meeting exhaust gas norms Euro III, V or VI. This smaller fire truck can nevertheless carry up to 7,000 litres of water and foam as well as 250kg of extinguishing powder.

Xinzheng International Airport is one of the eight largest airport hubs in China with a throughput of around 17 million passengers per year and a cargo throughput of around 400,000 tonnes, which makes it the fourth largest freight airport in the country.

This Rosenbauer Panther was introduced to the US market at the annual conference of the ARFF Working Group, Frisco, Texas in September.

The Panther is Rosenbauer's flagship ARFF vehicle and is one of the world's most popular airport fire trucks. They are manufactured at facilities located in Wyoming, Minnesota and Leonding in Austria.

The USA-manufactured Panther is scheduled for roll-out in 2017.

ARFF WITH AN EVEN LONGER REACH

A new Oshkosh 6x6 Striker with a 20m high-reach extendable turret was unveiled at the 2016 ARFF Working Group annual conference, Frisco, Texas in September.

The Snozzle HRET features a high-flow nozzle; a piercing and perforated carbide steel tip; and an optional infrared camera. The device enables firefighters to discharge from 1.8m below grade to elevations of up to 19.8m.

Engineered in two lengths, the 15m HRET is available on 4x4, 6x6 and 8x8 Striker vehicles and the 20m HRET on 6x6 and 8x8 vehicles. Both lengths are able to pierce the upper deck of new large aircraft and recent advancements in the Snozzle technology include a new control system for easier diagnostics, faster servicing and simplified control.

The piercing steel tip now features an updated hydraulic rotary actuator that delivers an increased range of motion of 280° as well as greater skin penetration strength. The piercing tip can penetrate up to 1.2m to provide access deep into cargo areas for effective application of extinguishing agent.

Around 100 Snozzle aerial devices have been sold by Oshkosh and the latest version is the longest one produced by the manufacturer.

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FERRARA

Maintain your standards high

What are the different standards for firefighters' PPE and why are there so many different standards bodies? Ivan Rich explains the PPE landscape and explores the latest developments, including the effect of Brexit and the role of the British Standards Institution in Europe.

Fire and emergency services across the globe need to know that they can fully rely on the safety and quality of their personal protective equipment, whether this is purchased at home or abroad. To ensure the best level of protection, most countries demand conformity with both national and international performance standards for PPE. By insisting that any equipment purchased meets appropriate global standards, they can be assured that, at the very least, the minimum safety requirements will be met and the quality of the products will be satisfactory. This helps to break down technical and language barriers between countries and makes it much more straightforward for manufacturers to trade goods and services.

There are currently three major standard-setting bodies on the world stage: European Committee for Standardisation (CEN) which covers Europe; the National Fire Protection Association (NFPA) which covers the USA, Latin America and the Asia/Pacific region; and the International Standards Organisation (ISO) which sets standards worldwide.

In Europe, the first standard for firefighters' PPE was introduced in 1995. Entitled EN 469, it became the first PPE standard to cover all countries in the European Union, serving to strengthen overall product safety and quality, and to encourage the sharing and adoption of good practices.

The current version of EN 469 is EN 469:2005. This is a harmonised standard, which means that rather than being simply voluntary, it supports essential requirements of the new EU PPE Regulation (EU 2016/425) to which all European PPE must comply by 2018.

EN 469:2005 was reviewed and updated in 2014. However, it was subsequently withdrawn from the Official Journal of the European Union due to errors. The standard is now being reviewed and rewritten in discussion with CEN consultants, who are employed by the EU Commission to monitor and advise on standards development. I sit on a panel group formed by British Standards Institute and we recently met for the second time to discuss the revision of the standard and the list of requirements that the UK would like to see included.

The NFPA Standard for PPE has been adopted in the USA and across the world including Asia, the Middle East, and Latin America. NFPA 1971 was first published in 1975 and has undergone numerous revisions since, most recently in 2013. NFPA 1971:2013 protects firefighting personnel by establishing minimum levels of protection from thermal, physical, environmental, and blood-borne hazards encountered during structural and proximity firefighting operations. Its requirements apply to the design, performance, testing, and certification for structural firefighting. The revision process has commenced and the next edition will be published in 2018.

The original ISO standard for *Protective clothing for firefighters*, ISO 11613, was introduced in 1999. It is currently under revision and is being prepared for a Draft International Standard ballot. This revised standard will be titled *Protective clothing for firefighters who are engaged in support activities associated with structural firefighting – Laboratory test methods and performance*.

ISO has also recently published a new ensemble standard for PPE used by firefighters, ISO 11999. This is entitled *PPE for firefighters – Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures*. There will be ten parts to the standard in total – eight have been published already – with part three covering the requirements for clothing.

It makes sense for national, European and international standards to be drafted and developed in line with each other. So wherever possible, CEN, NFPA, ISO and many national standards bodies work closely together to replicate requirements. This makes adhering to standards much easier, and helps to promote global best practice by drawing on international expertise.

Former firefighter and PPE expert Dave Matthews, who leads on a number of BSI, CEN, and ISO committees, believes it is vital for both manufacturers and end users to have a level playing field to protect against unscrupulous PPE suppliers.

Under the Vienna Agreement, for example, CEN has agreed to collaborate with ISO to develop a common European and international standard. More than 30% of the European standards adopted by CEN are identical to international standards. These EN/ISO standards have the dual benefits of automatic and identical implementation across Europe and globally. Some examples include EN ISO 11612:2015, which specifies minimum performance requirements for clothing to protect against heat and flame, and EN ISO 14116:2015, which details performance requirements for the limited flame spread properties of materials and protective clothing.

National standards bodies (NSBs) such as the BSI have to adopt CEN and ISO standards so that by adhering to one standard, manufacturers can easily adhere to them all. NSBs outside Europe, such as Standards Australia, often choose to adhere to ISO standards or have their own standards.

Ultimately, it is up to the customer to decide which standards they would like their PPE to follow, although clearly those in the EU would be advised to follow EN 469 as it a harmonised standard and complies with EU regulations.

There are some who believe this three-tiered approach of

Ivan Rich, technical manager at Bristol Uniforms, is closely involved in developing and reviewing standards for firefighter PPE. He is the secretary for two European committees, which include standardisation for heat and flame PPE and firefighters' PPE.

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Bristol Uniforms' fire kit, as worn by Cambridgeshire FRS, complies with EN, NFPA and ISO standards.

developing national, European and international standards is unnecessary and inefficient. In today's global business world, why not do away with national standards and simply follow international guidelines? However, national standards are an essential fallback in countless situations, most crucially when a nation is faced with a specific scenario, or where there is strong national demand that may not be reflected internationally.

If a standard does not exist internationally, NSBs are able to create their own. For example, despite European guidance on how frequently PPE should be cleaned, Europe still rejects calls for a standard that sets criteria for the cleaning, maintenance, and repair of firefighters' PPE.

This is an issue that many countries are taking seriously, since regular cleaning can guard against the dangerous infiltration of carcinogens, which have been linked to higher incidences of cancer among firefighters on the front line. Currently, the only standard in the world setting such criteria is NFPA 1851: 2014. The UK industry in particular is keen to create a standard to help protect against these health concerns, so the BSI is working to develop a national standard to meet this demand.

Finally, many countries in or trading with Europe are keen for an update on the consequences of the UK voting to leave the European Union, the impact this will have on the UK's membership of CEN, and its future adherence to EN standards. There has been speculation that Brexit may trigger a demotion of the UK to Affiliate Member status, currently held by 19 NSBs from EU neighbouring countries.

In response, the British Standards Institute has confirmed that it is 'business as usual'. For the foreseeable future, it sees no change in its status and obligations as a full member of CEN, or in its membership of ISO. The BSI director of standards, Dr Scott Steedman, who also holds the position of vice president of policy at CEN, made this position clear in a recent webinar, *EU referendum – the UK's future role in developing European standards.*

"Our position is that it is absolutely business as usual for BSI. Our commitment to the European system is undiminished and our work internationally will not be distracted… We see considerable benefits in retaining the single standard model in the UK. It provides access to the largest integrated tariff-free market in the world." It is possible that the UK could retain full membership despite not being part of the EU, like other CEN members such as Switzerland, Norway, Macedonia and Turkey, although it is unclear at this stage whether the UK would need to rejoin EFTA to retain its status.

Bristol Uniforms, for its part, continues to provide PPE to firefighters in over 110 countries, offering garments to meet not just EN, but NFPA and ISO standards as well. We will continue to play an active part in the development of these performance standards covering structural, wildland and technical rescue PPE.

Time to wear IT

Will wearable technology save lives? Rebecca Woodhead discusses the trend for wearable technology and the latest innovation from the Scott Safety Firefighter of the Future Team.

In computer science wearable technology is also known as ubiquitous computing, meaning computing carried out using any device, location or format. What does this mean for the fire-fighting industry? Well, ultimately, the aim is for this technology to prevent injuries and save lives; recent operational statistics in England state that firefighters sustained approximately 2,600 injuries during 2015/16, with approximately 1,050 sustained in operational incidents, and 49 classed as major injuries.

Of course, the fire-fighting industry has already adopted advanced technologies and equipment such as location devices, thermal imaging cameras, real-time monitoring of teams and even drones. However, there is always more to be done, which is why Scott Safety created a specialist Firefighter of the Future Team that is solely focused on harnessing the latest technology to benefit firefighters. The latest innovations include wearable technology such as this UK fire fighting industry first – Scott Sight.

Scott Sight is a hands-free thermal in-mask system that provides firefighters with a clear, unobstructed view of their surroundings by keeping a thermal image in view at all times. The hands-free innovation integrates a lightweight thermal-imaging camera within the firefighter's in-mask display, which enhances situational intelligence. Using the system there is no need to stop searching or put the hose down in order to deploy a hand-held camera. This sophisticated thermal imaging tool supplements existing hand-held technology by offering the wearer hands-free visibility in inhospitable situations. The wearer can stay focused on the fire, hazards and casualties while also staying identifying a secondary egress in the event of a sudden change of circumstances.

The technology produces a clear picture without eyestrain with its 160 x 120-pixel resolution; weighing just 240 grammes it is also lightweight for wearer comfort. It also has an auto-dimming feature to protect against changing light conditions and is configurable to the user's needs with adjustable view, user interface options, and temperature settings.

Furthermore, Scott Sight is compatible with the AV 3000HT face piece; a high performance positive pressure face piece manufactured using innovative materials that have been engineered to provide enhanced thermal durability.

It's innovations like these that will continue to shape the fire industry towards a safer future.

Distress signal units for the fire ground

Unlike most personal alert safety systems, the new NFPA-compliant PASS from Grace Industries does not require an SCBA for its operation – the device can simply be transferred from one piece of protective clothing to another.

This means that the Superpass 5, Superpass 5X and Tpass 5 ensure firefighters can comply with NFPA 1500, the standard that defines how the technology should be used operationally.

The new technology complies with the latest PASS device standard NFPA1982-2013 Edition, and Grace Industries claims it is the only manufacturer to meet it.

The new technology aims to solve the common situation where firefighters remove their SCBA and then continue to work on the fire ground. As most PASS and RF PASS systems are integrated into the SCBA, once the SCBA is removed firefighters are potentially in danger and do not comply with NFPA standards.

Grace's new RF PASS and Incommand accountability systems also aim to reduce congestion of radio voice channels on the fire ground, which can cause confusion and put firefighters at risk when critical messages are not heard.

The wireless personnel accountability report (PAR) check is a function of the accountability system that significantly reduces radio voice traffic on the fire ground while keeping the incident commander informed of acknowledgements from the crew.

Grace Industries' president Bob Campman explained: "Radio voice PAR check traffic creates congestion that competes with fire ground voice radio traffic. Our proprietary and patented Automated PAR check replaces the traditional manual PAR check performed on the radio voice channel. The Automated PAR check is now part of our affordable, Automated RF PASS Accountability System, designed to fit the operational needs of both large and small fire departments.

Secondly, a standalone PASS or RF PASS solves the problem of limited protection given to only those fire fighters inside the hot zone with SCBA integrated PASS. As required by NFPA1500, now all fire personnel, both inside and outside the hot zone are protected by wearing a standalone Superpass 5, Superpass 5X, or Tpass 5 that does not require the use of SCBA."

Personal radiation monitor with Bluetooth

The belt-worn Identifinder R100 integrates networking capabilities to safeguard firefighters and other responders by delivering immediate radiation threat alarms. It also provides automatically-generated radiation dose rate reports to offer increased situational awareness to central command personnel.

The Identifinder R100 is an IP67-certified and American National Standards Institute drop test-compliant personal radiation detector. The device meets the 1.5m drop criteria required by ANSI N42.32, a key performance standard for alarming PRDs in Homeland Security.

As well as offering protection against dust and immersion in up to one metre of water, the unit features integrated Bluetooth smart wireless technology, which facilitates recording and sending real-time dose rates and geotag information via a companion mobile app.

All Identifinder models, including the Identifinder R100, share the same user interface, which enables coordinated emergency response between law enforcement, firefighters, and hazmat teams using any unit from the same family of products.

The Identifinder will be available globally in January 2017.

FLASHOVER IMMINENT!

A flashover protection alarm unit called First has been launched by Intellimon, a UK startup company.

First uses artificial intelligence to detect and predict the changes in temperature associated with a flashover, and creates an audible and visual alarm that warns both the individual firefighter and nearby comrades.

The visual warning changes from green to amber as the threat is detected and goes to red when it is imminent. The audible warning is in excess of 90dB and is distinctly different to the accepted 'man down' alarm in established distress signal units. The warning can provide up to 30 seconds advance warning to evacuate the location or to take mitigating action.

The system is designed to integrate with a wide range of breathing apparatus and is powered by the BA's battery set. If the facility is available, the warning can be displayed on the face mask with its simple traffic light display.

First can also aid rapid intervention rescue teams searching for fallen firefighters. An RFID chip is activated when the unit is powered up. Using a hand-held RFID scanner, rescue crews are able to locate a man down much quicker, especially in areas of low visibility.

The intelligent monitoring systems built into the lightweight yet rugged unit continually processes and update temperature data, notifying the operator of critical changes through both the visual and audible warnings. This data can also be fed to a computer through established radio telemetry for command and control, and post-incident analysis.

ROYAL NAVY ROLLS OUT ANTI-SNAG DEVICE FOR BREATHING APPARATUS

A pioneering invention of a Hampshire firefighter will soon be helping to save lives on the high seas.

The ground-breaking anti-tangle strap was designed to protect fire crews from getting caught in falling cables and trapped while tackling a blaze.

This device, which bridges the space between the back of the pack and the cylinder on breathing apparatus, is to be rolled out to hundreds of Royal Navy vessels during the next two years. Defence contractor, BAE, who make warships for the Royal Navy and work closely with the fire service, already use the strap on all their breathing apparatus.

Colonel Mike Tanner, Captain of Portsmouth Naval Base said: ''The anti-snag extended duration breathing apparatus devices appear to offer a common-sense way to better protect our people when fighting a fire inside ships and we're excited about this opportunity. We've already trialled the equipment with RN fire experts in our Phoenix Fire Fighting facility with very positive results.

''This demonstrates just one of the many ways in which we closely work with Hampshire Fire & Rescue, as well as the many joint training exercise held on ships and within the base and, of course, preparations ahead of the arrival of the Queen Elizabeth-class carriers''.

The piece of kit was created by Fareham acting crew manager Pete Broomfield, who was involved in tackling the 2010 fatal fire in Shirley Towers, Southampton, in which two firefighters died. An investigation identified falling cables as a factor in the tragedy.

The anti-snag device, which Broomfield designed based on his wife's hair clip, has received interest from fire crews in Canada and the US. Broomfield hopes that in the future the device will be fitted on all sets of BA equipment before they leave the factory.

Pillars of fire

Speaking at the Fire Protection Association's Fire Sector Summit in October in London, Minister of State for Policing and the Fire Services Brandon Lewis outlined his vision for the UK Fire Service. Jose Sanchez de Muniain reports.

The prospect of privatisation in the fire service was ruled out at the beginning of Minister Lewis' speech, which then mainly focussed on the fundamental fire reform that he said was necessary to make the service the best it can be.

His role, he explained, was to deliver the radical and ambitious package of reforms Prime Minister Theresa May had announced earlier this year when she was Home Secretary.

The final agenda has been refined into three distinct pillars comprising efficiency and collaboration; accountability and transparency; and workforce reform.

Examples of collaboration include shared estates and support functions between FRS and Ambulance Service, and a statutory duty to do so is being included in the Policing and Crime Bill currently being heard at the House of Lords. ''It is intentionally set at a high level and it is non-prescriptive, because we want to ensure local leaders can determine the sort and style of collaboration that is in the best interest of their local communities.''

Combined procurement has been classed as another form of collaboration, and one that is not just about reducing costs, said Lewis, but also about purchasing more smartly and more effectively. ''I appreciate that every single fire service in this country can justify why their fire engine needs just a little bit different colour paint than the next one, but we have got to do better.''

A recent exercise that saw the publication of prices paid by different fire services for commonly-procured goods (see page 36 *IFJ* Q3 2016) would be repeated, said Minister Lewis, adding that it may even be expanded. ''The differences in price paid across fire and rescue authorities for the same item is remarkable. Over 28,000 pounds of variance in price in staff vehicles, let alone the differences in price for laptops and helmets.''

He emphasised that he wanted fire and rescue authorities to collaboratively buy goods and services and engage with the industry 'as one voice' via a more standardised, joint way.

This approach could also be extended to product evaluation and he said that CFOA, the Fire Service College and the Fire Industry Association were collaborating to run a research and development function that would evaluate equipment once, rather than repeatedly by each local service. ''I've heard stories of individual pieces of kit being individually tested by 20 services at any one time. That kind of duplication is wasteful, and our expectation is that the services will engage in this function going forward.''

A coherent and comprehensive set of professional standards were also in development and the establishment of a standards body was being explored to drive sector improvements: ''I see the possibility of a standards body as a powerful lever in securing professional ownership and driving up performance in key areas of fire reform.'' These standards would include professionalisation, ethics, technology, and the workforce.

In addition to the new standards body, there were also plans for the introduction of an independent inspection regime for fire, a revised peer challenge process to support sector improvement, and the new National Fire Chiefs' Council that would replace the Chief Fire Officers Association. Further details of this reform pillar will be announced before the end of this year.

Turning to the second pillar, accountability and transparency, Minister Lewis explained that the Policing and Crime Bill contained provisions enabling police and crime commissioners to take on the functions of fire and rescue authorities where a strong local case was made. ''I'm aware of a number of police and crime commissioners who are already doing the work on their business cases,'' said the Minister, who explained that the move would facilitate collaboration while providing greater accountability. He highlighted that such a move was not a 'police takeover' and that the distinct identities of both organisations would be retained. Royal Assent was expected for the Bill around the end of the year.

The Policing and Crime Bill also contains a provision to create an inspection framework for fire, which the Minister said would be both independent and rigorous. It will strengthen the inspection powers in the Fire and Rescue Services Act 2004 to enable fire inspectors to enter premises and access information. The new regime is expected to be fully operational in April 2018, with the preceding period being used to plan, pilot, and develop standards of performance and future performance.

Regarding pillar three – the workforce – the Minister noted that a third of the employees in the fire and rescue services would be retiring in the next five years, affording the fire and rescue authorities with the opportunity to reshape their thinking and workforce. ''There is clearly much rebuilding to be done about culture and trust within the service.''

He continued by informing delegates that the Adrian Thomas Review would shortly be published. This review was commissioned in August 2014 to consider whether current terms and conditions were conducive to building the fire and rescue service of the future. These included management practices and crewing arrangements; collaboration and integration with other emergency services; the use of on-call firefighters; the process of fair recruitment and remuneration of chief fire officers and fire officers. ''The majority of the review's recommendations are for the service to deliver. I know that many services and the sector more generally, challenged and supported by government, have not waited for publication and are already taking some steps towards reform. For example, the recent decision by CFOA to become the National Fire Chiefs' Council and the positive engagement between the sector and government on the development of professional standards and a fire inspectorate are clear examples of this.''

Following the detailed description of the ambitious journey planned for the UK Fire Service, Minister Lewis did not remain to answer questions from the fire sector, to the great disappointment of his audience.

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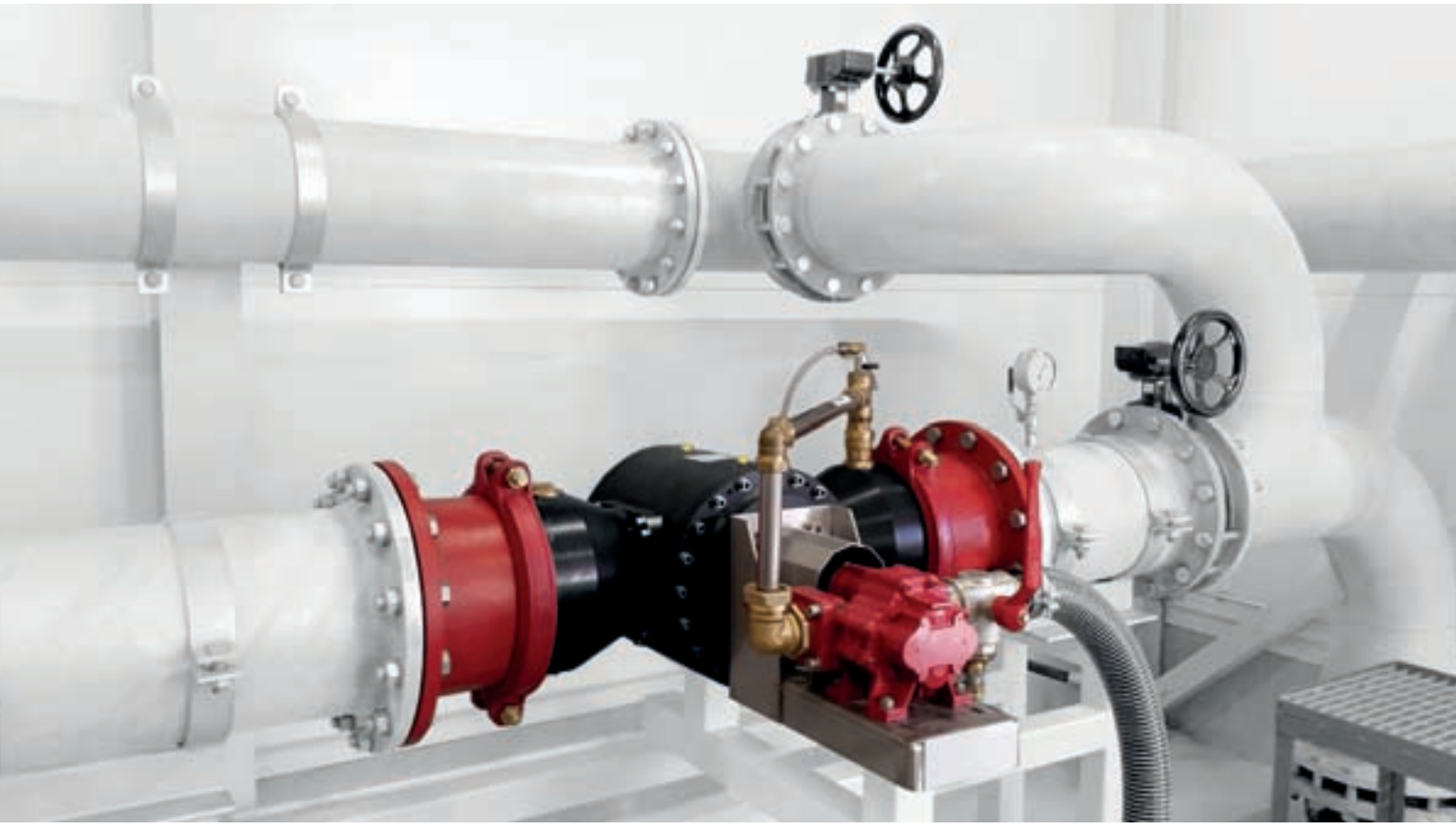

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