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First quarter 2017 issue no.107

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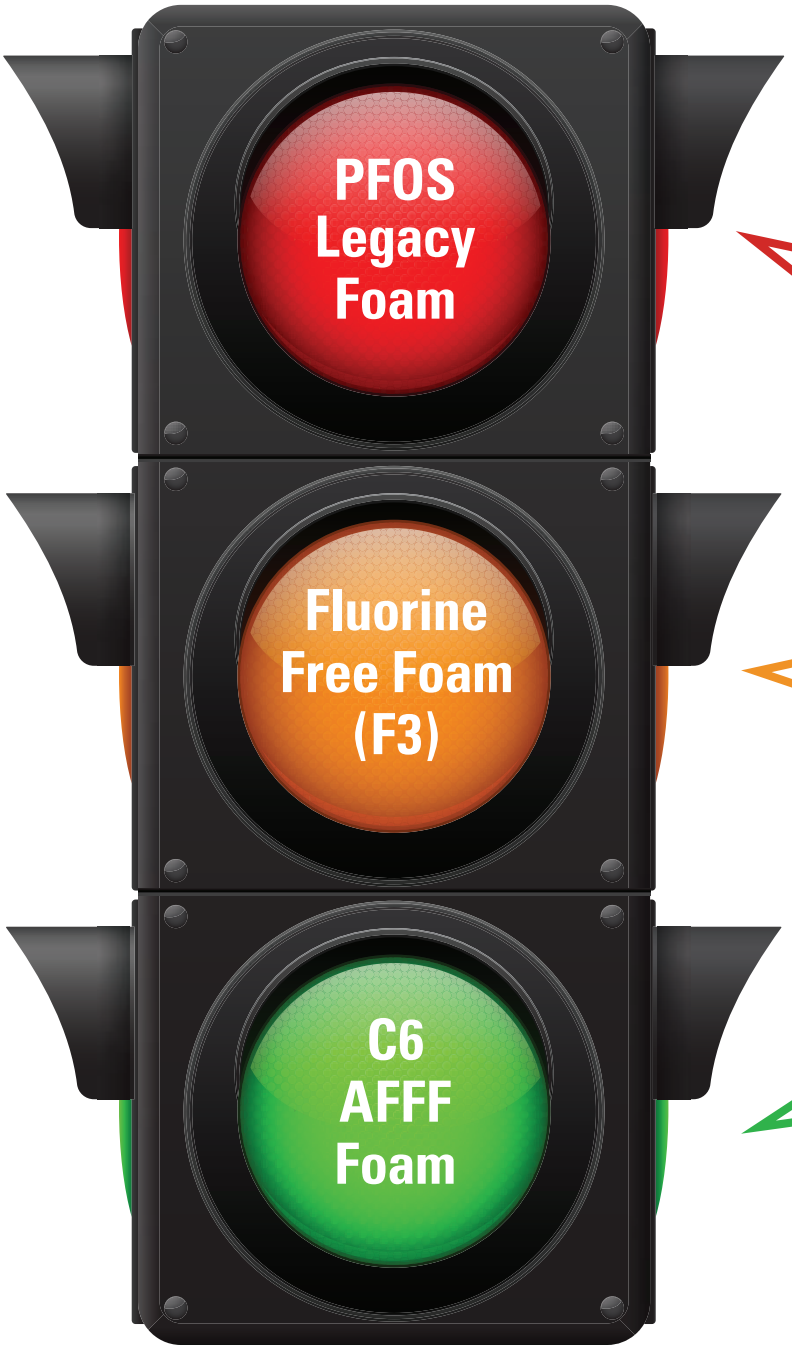

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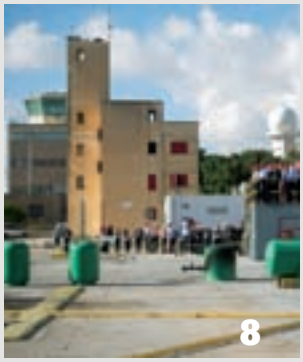

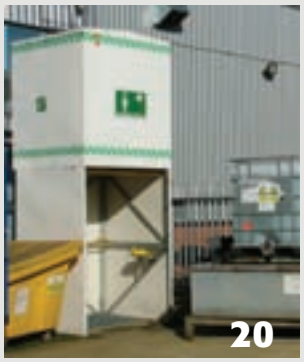

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Front cover artwork: Darren Small.

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Comment

The news of the US President's budget proposal to eliminate the US Chemical Safety Board has been greeted with dismay and disbelief by the industrial safety, fire safety and labour sectors.

In typically understated manner the US CSB reacted by expressing its disappointment and reiterating its admirable raison d'être.

This is an agency that, uniquely, focuses on investigating chemical accidents and the failings of regulators. Without powers to impose fines or other punishments, it only seeks to find root causes that can be shared across industry: no punitive judgement, just the facts.

Puzzlingly, the US$1.15 trillion budget proposal titled 'America first: a budget blueprint to make America great again', has been introduced by the following: "A budget that puts America first must make the safety of our people its number one priority – because without safety, there can be no prosperity".

CSB president Vannessa Sutherland has pointed out that for over 20 years the CSB has made safety its number one priority, conducting hundreds of investigations of high consequence chemical incidents, such as the Deepwater Horizon and West Fertilizer disasters; its investigations have had an enormous effect on US public safety, "Our recommendations have resulted in banned natural gas blows in Connecticut, an improved fire code in New York City, and increased public safety at oil and gas sites across the State of Mississippi," she said.

The CSB's accomplishments have been made with a tiny annual budge of US$12 million. One wonders how many more lives could be saved if this budget was increased; and how many will be lost if or when it disappears. But we'll never know.

Jose Maria Sanchez de Muniain, Editor

EXPLOSION KILLS THREE AND INJURES SEVEN IN LOUISIANA

A three-person investigative team from the US Chemical Safety Board has been sent to the scene of an incident that occurred on 8 February at the PCA packaging plant in De Ridder, Louisiana.

The company manufactures heavy duty-corrugated containers and lightweight cardboard boxes.

According to initial reports, the explosion took place while contractors performed welding on a tank during a facility shut down. The explosion was powerful enough to cause the tank to fly and land in a different area of the plant.

"Our primary concern is for the safety and well-being of the people working on our site," the company's statement said. "The top priorities at this time are the notification of families of the deceased contractors and investigation of the incident with authorities."

The CSB stated that most hot work incidents result in the ignition of combustible materials or the ignition of structures or debris near the hot work.

"The CSB has investigated many hot work accidents across the country, including a 2008 explosion that killed three workers at a different PCA plant in Tomahawk, Wisconsin," said Chairperson Vanessa Sutherland. "Hot work incidents are one of the most common causes of worker deaths we see at the CSB, but also one of the most readily preventable."

CFB RM WINS BIG CONTRACTS

A specialist high-hazard protection and response company has announced multi-million dollar contracts with three of the world's largest chemical, plastics and bulk storage companies.

The contracts will see CFB Risk Management provide industrial fire and rescue safety services to Ineos Nitriles, Navigator Terminals and Huntsman Tioxide at their plant in Teeside, northeast England.

Under a shared service agreement, CFB Risk Management will provide the companies with asset protection 24/7.

Technical director at CFB RM Gary Cawley commented: ''We have just completed an initial three-year contract with Ineos Nitriles and are very pleased that it has been renewed with the addition of Navigator Terminals and Huntsman. It has taken more than 18 months of hard work and commitment to put this together and, by passing on savings to our customers, it is helping to support businesses and employment on Teesside as well as boosting our own workforce.''

The contract will safeguard 50 permanent jobs at CFB RM, create new posts and boost the company's apprenticeship scheme with more opportunities for the young unemployed on Teesside. It will also bring further investment in equipment and resources to enhance the asset protection services in the area.

Created in 2011 by UK fire authority Cleveland Fire Brigade, CFB Risk Management is the first organisation of its kind and it now has one of the largest workforces in the UK with the skills and competence to work in high-hazard conditions. It recently opened an office in Abu Dhabi.

The new contracts come on the back of recent growth for CFB RM, which provides a range of risk management services from risk assessment and auditing, emergency planning and fire engineering to emergency response and training and exercising.

Customers include blue-chip companies in high-hazard sectors such as oil and gas, power, petrochemical and nuclear that need to protect their people, plant, process and productivity.

FY2016 Impact Report published by CSB

A funding mechanism that provides firefighters with training on ammonium nitrate incidents is one of the CSB's achievements listed in its FY2016 Impact Report. In September last year FEMA awarded two grants of US$1 million each to the Georgia Tech Research Institute and the International Association of Fire Fighters to deliver hazmat training in accordance with CSB's recommendations following the West Fertilizer investigation.

During 2016 the US Chemical Safety and Hazard Investigation Board completed seven major reports, including safety recommendations following the Macondo blowout and explosion; the Caribbean Petroleum refining tank explosion of 2009; the Tesoro Refinery incident of 2014, and the Freedom Industries chemical release of 2014.

In the past year the CSB added Preventive Maintenance and Emergency Planning & Response to its list of drivers of critical chemical safety change, which now numbers four with Combustible Dust and Modernisation of Process Safety Management. The safety organisation also published two freely available animated safety videos on its website in 2016. *Filling blind* covers the Caribbean Petroleum incident and *Dangerously close: explosion in West*, Texas depicts the 2013 explosion.

GUIDE FOR PASSIVE FIRE PROTECTION SYSTEMS

Spain's first guide for passive fire protection systems has been published. Titled *Passive fire protection systems in buildings, general classification and concepts*, the guide has been compiled by the passive protection committee of the Spanish Association of Fire Protection Societies (Tecnifuego-Aespi).
It has been compiled to provide a common point of reference for all the different organisations involved in passive protection systems.
Developed by architects, engineers, installers and suppliers, the guide provides a comprehensive and detailed analysis of the equipment and systems used in passive fire protection of buildings.
It is available free of charge at www.tecnifuego-aespi.org. fter registration.

TRAINING CENTRE TO OPEN 2018

International training provider Falck is to relocate to a new training and research centre in the Port of Rotterdam, the Netherlands.

The new centre in the Maasvlakte area will provide training services to municipal and industrial fire brigades as well as the offshore, maritime sector and wind industry.

Falck will leave its current site on the Beerweg when its lease with the Port of Rotterdam Authority ends in the spring of 2018.

The new centre, which will cover a hectare more ground than the current site, will be designed and built to the most modern standards in technology; environmental awareness; occupational hygiene and safety; and training, including virtual reality environments for incident control and crisis management.

The new site will also feature a field lab for research and practical experiments.

Joost Eenhuizen, business manager maritime industry and offshore at the Port of Rotterdam, commented: ''Falck contributes to safety in the port with its knowledge and expertise in this area. We wish to achieve a high safety standard as a port operator. We are delighted that Falck has been operating for so long in the Maasvlakte helping businesses in the port with its high-quality services to prepare as effectively as possible for incident management.''

The new training and research centre is planned to open in Spring 2018.

MISTY-EYED IN ROME

The most important water-mist event of the year will take place 25-26 October in Rome, Italy, organised by the International Water Mist Association.
The focus on day one of 17th International Water Mist Conference will be on applications; day two will be dedicated to research and testing.

The deadline for abstract submission is 15 May; the conference programme will be published 1 July 2017. For more information visit http://www.iwma.net.

MARITIME SAFETY AND SECURITY CENTRE INAUGURATED

Germany's new maritime safety and security centre has been officially opened. The €23.5-million (US$25-million) Maritime Safety and Security Centre Cuxhaven was officially inaugurated in February by the Minister of Federal Transport and Digital Infrastructure Alexander Dobrindt. The new centre is located on the premises of the Cuxhaven Waterways and Shipping Office; Cuxhaven is situated on the shore of the North Sea at the mouth of the Elbe River in Lower Saxony, around 80km north-west of Hamburg.
The new centre houses around 100 staff from the Federal Waterways and Shipping Administration; the Federal Police; the Federal Customs Administration; the Fishery Protection Agency; the Waterways Police of the five federal coastal states; the Central Command for Maritime Emergencies; and the German Navy.
The different specialist capabilities of each agency are pooled in the Joint Emergency Reporting and Assessment Centre, the operational core that is charged with the safety of the entire German coast and all water access routes.
The new centre includes a €5.5-million (US$6-million) IP-based communications solution that operates on commercial off-the-shelf hardware. The Asgard system, supplied by technical prime contractor Frequentis and verified by the Federal Office for Information Security, enables the secure exchange of information between maritime and public safety agencies.

IN MEMORIAM

Dr G Ramachandran, retired principal scientific officer at BRE Garston, UK and senior technical director at Aecom, St Albans passed away peacefully at the age of 87 on January 25, 2017 in Potters Bar, Hertfordshire. Dr Ramachandran dedicated his life to the study of fire statistics and insurance and is world renown for his pioneer work in probabilistic fire risk assessment since 1965.

His many publications include, *Quantitative risk assessment in fire safety* and *PD 7974 Part 7: Application of fire safety engineering principles to the design of buildings. Probabilistic risk assessment*, which he co-authored with David Charters.

Douglas Woodward CBE died on 11 December 2016 following a period of ill health.
Woodward worked for the UK's Fire Protection Association 1964-1989 and was its director 1980-1989.

Douglas Woodward campaigned successfully for better fire safety measures throughout Europe following an initial career in journalism.

He remained with the FPA for 25 years retiring in 1989 when he was made OBE for services to fire safety. His many positions of responsibility included director general of the Arson Prevention Bureau; chair of the European Confederation of Fire Protection Association; and president of the European Arson Prevention Institute. In recognition of his work in Europe he received the Portuguese Order of Merit and the King of Sweden's Gold Medal.

As well as magazine articles he wrote a number of books including: *BSI – the story of standards* (1972), *Saving the city's heritage: a history of the city Heritage Society* 1973-2003 (2004). His last book, *A voyage round a Barbican garden* (2015), was largely autobiographical.

His wife of 58 years, Ann, whom he met in an air raid shelter where she was an Air Raid Precautions warden, predeceased him in 2008.

VISUALISING THE HAZARDS

A DVD presenting typical industrial hazards and benchmarks for loss prevention has been produced by the German Insurance Association (GDV) and fire protection institute VdS.

The four films in the DVD aim to provide fire protection advice to policyholders as well as fire-awareness training for staff. Typical fire hazards in industrial and business enterprises are highlighted and the technical circumstances that lead to them explained.

The themes covered are; storage of combustible materials close to buildings; fire loads in production and storage areas; machinery fire hazards; and electrical devices.

"Those films visualise the mostly complex issues of fire protection and make them lightly understandable, thus strongly easing optimal fire protection," said Alexander Küsel, head of loss prevention property insurance at the GDV, "They answer, among other things, typical questions usually arising at risk inspections of fire insurance providers and explain the impact of fire as well as appropriate steps for optimal loss prevention."

The 30-minute long DVD is available in German and English for €35.58 (US$38) at www.vds.de/3401en.

A CAMERA FOR EXPLOSIVE GASES

An optical gas imaging camera that shows the presence of hydrocarbon gases has been introduced for the oil and gas industry.

The GFX320 camera has been designed for use in potentially explosive atmospheres; it detects and visualises over 400 gas compounds such as methane, ethane, heptane, propane, benzene and other common volatile compounds found at oil and natural gas facilities.

Using the new equipment workers can assess potential risks from a safe distance and, if the area is deemed safe, can enter to continue scanning. According to manufacturer Flir Systems, the camera can scan large areas and check thousands of components over the course of one inspection; automatic GPS tagging helps meet reporting requirements without extra equipment.

A high sensitivity mode uses video processing techniques to accentuate plume movement for improved leak detectability.

In addition, it is capable of measuring temperatures up to 350°C with an accuracy of ±1°C.

Flir envisages that the new equipment will assist companies in complying with new rules from the US Environment Protection Agency regarding methane emissions.

Last year the EPA issued three new rules to kerb the emission of methane, VOCs and toxic air pollutants from the oil and gas industry. In particular, the EPA requires companies to reduce methane emissions from equipment leaks, pneumatic controllers and pumps.

The intrinsically safe camera is certified as explosion-protected by the International Electrotechnical Commission.

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Devastation revisited

Malta's Minister for Home Affairs and National Security Carmelo Abela welcomed more than 120 delegates to JOIFF's first International Fire & Explosion Hazard Management Conference, 3-4 November 2016.

Some of the world's most devastating industrial disasters of the last five years were reviewed in detail with a professional eye on prevention, protection and preparation. J Gordon Routley, division chief of Montreal Fire Department, Canada presented the sequence of events that led to the rail disaster of 6 July 2013 in the town of Lac Mégantic in the province of Quebec.

This incident involved an unattended 74-car freight train carrying 7.7 million litres of petroleum crude from North Dakota USA bound for Saint John, New Brunswick, Canada.

The train arrived in Nantes, Quebec, late on the night of 5 July 2013 and the locomotive engineer parked the train on a descending grade on the main track. He applied hand brakes on all five locomotives and two other cars, and shut down all but the lead locomotive. Railway rules require that hand brakes alone must be capable of holding a train and this must be verified by a test; that night, however, the locomotive air brakes were left on during the test, meaning that the train was being held by a combination of hand brakes and air brakes, giving the false impression that the hand brakes alone were holding the train.

The lead locomotive had experienced mechanical difficulties throughout the trip from North Dakota and, while being parked, excessive black and white smoke was emitted from its smoke stack; it had been agreed that the matter was to be dealt with in the morning.

Shortly after the engineer had left for the night, the local fire department responded to an emergency call reporting a fire on the train. After shutting off the locomotive's fuel supply, the firefighters moved the electrical breakers inside the cab to the off position, in keeping with railway instructions. At that point, with all the locomotives shut down, the air compressor no longer supplied air to the air brake system.

As air leaked from the brake system, the main air reservoirs slowly depleted, gradually reducing the effectiveness of the locomotive air brakes. Just before 1am, the air pressure had dropped to the point where the combination of locomotive air brakes and hand brakes could no longer hold the train; it began to roll downhill toward Lac Mégantic, a small town around 11km away. As it moved down the grade, the train picked up speed reaching a top speed of 104kph. The rail line in Lac Mégantic is on a curve with a speed limit for trains of 16kph and, as the train reached the curve in the centre of the town, it derailed.

Almost all of the 63 derailed tank cars were damaged, and around six million litres of petroleum crude oil were released. The fire began almost immediately and the ensuing blaze and explosions left 47 people dead. Another 2,000 people were forced from their homes and much of the downtown area was destroyed. The pileup of tank cars, combined with the large volume of burning petroleum crude oil, made the firefighters' job extremely difficult.

Fire crews responded from Canada and the US and, even after 20 hours, the centre of the fire was still inaccessible to firefighters. Local firefighters who initially responded had no easy access to their fire station, which was surrounded by burning fuel. When they eventually did reach the station, they had to break in to get access to the pumps and other equipment. Despite all the challenges, the response provided was well coordinated and the fire departments protected the site effectively.

Vanessa Allen Sutherland, chair of the US Chemical Safety Board, discussed the tragic incident of 17 April 2013 in the West Fertilizer Company's plant in the city of West, Texas. A fire involved the seed and fertilizer building that contained pallets of bags of seed and fertiliser bulk materials including a large amount of ammonium nitrate.

As the building became more involved in the fire, the roof collapsed and a huge explosion took place that registered 2.1 on the Richter scale. The blast killed 10 firefighters, two civilians who had responded to the incident to assist, and three civilians in the nearby residential area. Several responding firefighters suffered debilitating or near-fatal injuries; civilian injuries totalled more than 200. The blast created a 27m-wide, 3m-deep crater and damaged or destroyed 500 structures in a 37-block area, including three schools and a nursing home.

David Price, UK president and principal engineer at Gexcon, focussed on the incident that took place 12 August 2015 when a series of explosions killed more than 170 people and injured hundreds of others at a container storage station at the Port of Tianjin, China.

The incident was initiated by two explosions that occurred within 30 seconds of each other; the second explosion was far larger than the first, involving the detonation of about 800 tonnes of ammonium nitrate. Fires caused by the initial explosions continued to burn uncontrolled throughout the weekend, repeatedly causing secondary explosions, eight of which occurred on 15 August. David Price highlighted the impact of other serious incidents where explosions had taken place and which, whilst serious and causing major damage, injuries and deaths, were small in comparison

Other papers presented during the conference included discussion on various aspects of fire and explosion management planning, consequence modelling, ETANKFIRE (ethanol tank fire) project update, insurance, passive protection, ageing installations, foam, operational readiness and mutual aid.

JOIFF is planning an FEHM Regional Summit in Africa 2017 as well as a second Fire and Explosion Hazard Management Planning Conference in 2018. For more information visit http://joiff.com/

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During the conference delegates visited the training grounds of the International Safety Training College. Here they watched demonstrations of aviation and industrial fires carried out by the trainers of ISTC working with fire crews from Malta's municipal brigade and Malta Airport's aviation responders.

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The faces of fire training

Industrial Fire Journal profiles five top instructors from different training facilities around the world.

ORGANISATION: INTERNATIONAL FIRE TRAINING CENTRE, NORTH EAST ENGLAND
NAME: ANDY BENNETT
AGE: 49
JOB DESCRIPTION: AVIATION FIRE-FIGHTING TUTOR

How would you describe a typical course day at the academy?

My first task of the day is to make a coffee. Then I check my emails and my allocated course for the day, week, or longer, and pick up the course paperwork. If it is a new course, I carry out a welcome and introduction and enrol the delegates.

Most courses are a mix of practical and theoretical learning. If we are spending the day on the practical fireground, we arrive there at approximately 09.00 and leave around 16.00. If the course is on an exercise phase, we aim to fit in at least four exercises, complete with debriefs and feedback.

Once back in the office, I check my emails again, bring the paperwork up to date, and ensure that any incidents that need to be reported are passed on to my curriculum manager.

What is the best thing about being a fire instructor?

The diversity of the courses we deliver. From one week to the next, I might teach a course of men and women completely new to the profession, with the responsibility of using my experience and knowledge to mould them into professional firefighters. Then I might teach a revalidation course, which may include fire service professionals of an equal or more experienced standing. And, although I am an aviation fire and rescue tutor, I have experience in many other firefighting related fields, so I might also be called on to teach an offshore or industrial course, which present different ways of applying fire-fighting principles.

IFTC's Andy Bennett would like to see more emphasis on incident command and compartment fire-behaviour training.

What is the main mistake you see students make?

New firefighters have to make a huge adjustment when they start training. They have to adjust their mindset from just looking after themselves to forming part of an effective team and focusing not only on the task in front of them, but on the people to either side of them. The main mistakes I see are made during this transitional process.

What should they be taught instead?

Firefighter training at the moment reflects the needs of the industry. A lot of liaison is carried out with airports and fire authorities to ensure that what is being taught is relevant to the working environment.

I would like to see more emphasis placed on two key areas: incident command and compartment fire behavioural training.

These two subjects are predominantly course-specific, however, with absorption of breathing apparatus control procedures into the incident command system, and the continued need for fire behavioural awareness, I believe associated training should be delivered more regularly across the experience range.

What do you see as the main strategic development in training?

There are a lot of strategic developments in training at the moment, and one of the main ones centres around breathing apparatus. UK BA guidance is changing, which is having an impact on procedures. As a training provider to the aviation rescue and fire-fighting services, IFTC has to be at the forefront of these changes and adopt the new procedures and equipment, such as telemetry.

Airfield fire appliances are also getting more and more advanced. High-reach extendable turret vehicles are being used in greater numbers worldwide. IFTC has been proactive in developing a training course that aims to improve skills and awareness when using this type of technology.

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What is your favourite piece of equipment and why?

My favourite piece of equipment has to be breathing apparatus because of its importance in fire service operations, and the pleasure I derive from teaching BA procedures to delegates, especially new recruits.

I am the centre lead for compartment fire behavioural training, and the breathing apparatus set plays an important part in the sessions. It is amazing to see the confidence of my students grow in this environment thanks to this piece of equipment.

What sets your training academy apart from others?

We are in the fortunate position that we can burn hydrocarbon fuels such as aviation turbine fuel. A lot of training providers are only able to offer gaseous burns using LPGs. Although the gas burns do the job of simulating fire, they are more controlled and don't offer the same challenges or the realism of burning fuel.

We also offer a vast array of aviation, offshore and industrial simulators whereas other schools may only have one per sector.

What is your favourite quote when it comes to fire fighting?

It's not so much a quote as the opening statement from a set of principles associated with training people to do a very dangerous job. People join the fire service with different attitudes and expectations, and it takes a particular mindset to want to do this job. Operations today are built upon dynamic risk assessment, so I always try to instil the first statement of those safety principles in my trainees: 'Firefighters will take some risk to save saveable lives'. And there's the quote I use in regards to risk management: 'you own the risks'.

ORGANISATION: ROYAL NETHERLANDS AIR FORCE FIREFIGHTING TRAINING ACADEMY, WOENSDRECHT AIR FORCE BASE, SOUTH WEST NETHERLANDS
NAME: DENNIS VAN'T ENDE
AGE: 36
JOB DESCRIPTION: FIRE INSTRUCTOR

How would you describe a typical course day at the academy?

There isn't really such a thing as a typical day at our fire and rescue training centre because we run such a wide array of courses.

The Woensdrecht Air Force base is where we train all our new recruits, as well as our commanders (lieutenants and captains) and our on-scene commanders. We specialise in aircraft firefighting and we have an aircraft fire trainer, fuel spills, an F16, and a helicopter to train on.

There are eight instructors on the base and we teach a lot of different classes. For example, we offer six-month training courses for firefighters covering EMS, fire, extraction, hazmat, pumping, and aircraft firefighting, and one-year courses for crew commanders. We also train on-scene commanders in four-week courses using our virtual reality system ADMS.

In addition, the airfield crews keep up to date by training here for one day, twice a year, and the army and navy use the facilities for various training programmes – including helicopter firefighting and BA training for army hazmat teams

– as do the Belgium Air Force and the Swiss Air Force.

We also offer, amongst others things, team-building courses for military and civilian groups, cabin crew training for cabin crews and pilots, and education on our virtual training systems.

So, as you can see, there isn't such a thing as a typical day for an instructor here, which makes working at the fire and rescue training centre so interesting for me.

What is the best thing about being a fire instructor?

The opportunity to teach someone something new. And I also love the fact that we offer such a wide variety of courses, so as an instructor I never get bored – there is always something new to do.

As instructors, we also need to keep up to date on the courses we offer, develop new courses for aircraft firefighting, and review and improve course materials.

What is the main mistake you see students make?

Some of them think that becoming a firefighter is easy, but once they get all the course materials and realise how much is involved, they question whether they really need to know it all.

When we start training it is our job to make the trainees understand that the fire isn't the only thing in the room and that they also need to be aware of their surroundings. In the Netherlands we use a method called RSTV (Smoke – Flow – Temperature – Flames) for reading the smoke, the flow path, the temperature, and the flame front. This is a continuous process that all firefighters need to engage in when they go into fires.

Then there's the motivation of the people who become firefighters. In the Netherlands we have a saying that there are those who work at the fire department and those who are firefighters. There's a big difference between the two. Some people join to be with the fire department, and others are real firefighters.

What should they be taught instead?

In my view high schools have a major role to play here, and so do the job agencies. They need to educate young people on what it takes to become a firefighter and what that job actually entails.

What do you see as the main strategic development in training at the moment?

The switch from print books to e-learning. In the Netherlands we are moving over to e-learning so we need to prepare instructors for a different way of teaching. Our exam format is also going to change next year, and there will be more responsibility for the instructor.

What is your favourite piece of equipment and why?

The props we use for training, particularly the backdraft and flash-over containers. Enabling students to experience a good flash-over session or a big backdraft is one of the best aspects of my job. Our virtual reality training system is another favourite of mine because we need to be forward-looking and a virtual system makes training fast and efficient.

What sets your training academy apart from others?

We are military so our specific focus is aircraft firefighting. Our fireground is also very big – 62,500m^2. It has a structural trainer with 11 different burns inside, an aircraft fire trainer, an F16, a helicopter, and a fuel spill. Most of our burns are liquid propane so the fires burn very cleanly.

What is your favorite quote when it comes to firefighting?

It has to be our air force quote: 'One team, one task'.

ORGANISATION: NEWCASTLE INTERNATIONAL AIRPORT TRAINING CENTRE, NORTH EAST ENGLAND
NAME: GRAHAM REEVE
AGE: 47
JOB DESCRIPTION: FIRE-FIGHTING TRAINING INSTRUCTOR

How would you describe a typical course day at the academy?

Depending on the type of course, we usually prep our training venues the day before, so on the day we welcome our students and give them a hot drink before heading into the classroom. Here we complete the administration, conduct the introductions and do the safety briefing.

Then we cover PPE/RPE, carry out the pre-exercise briefing, and head out onto the fireground to conduct the exercises appropriate to the course.

After each exercise we have a debriefing session to enable all students to talk about their actions on the fireground with the instructors. Self-realisation within a structured debrief will reveal the learning points for each student.

After a break for a hot lunch, the students are ready for the afternoon session. Once this is complete, they leave the academy with a sense of achievement and we prepare for the following day.

What is the best thing about being a fire instructor?

I've been in an instructional role in the fire and rescue service now for 15 years – just over half my career. Whatever course I teach, whether it is a recruit course, a promotional course, or a revalidation course, I always feel proud that the knowledge I have imparted to my delegates might one day save someone's life – and preserve theirs – if these skills are put into practice.

What is the main mistake you see students make?

Students make a wide variety of mistakes within the training environment. I prefer to call them learning/training points, as students can learn a lot from these during the debrief. Occasionally, the overwhelming size of some of the practical incidents can distract the students from the main objectives.

What should they be taught instead?

To look at the bigger picture and not just at what is in front of them. To look at what is happening all round and act on it in a safe, calculated manner, and to believe in themselves.

What do you see as the main strategic development in training at the moment?

I see the technological advances within the industry as key to the future of operations as well as training. HRET appliances, for example, are so much more effective when they are operated by highly skilled individuals who can use them to their full potential.

Additionally, recent legislation relating to training has changed the needs of our customers, and more bespoke training is now being provided alongside the standard industry courses.

What is your favourite piece of equipment and why?

The breathing apparatus. This piece of equipment has enabled me to carry out the main part of my job, both operationally and within the training environment. Using the BA I, can enter an otherwise irrespirable atmosphere. Historically, it has enabled firefighters to save many lives, proving without a doubt that it is a vital piece of equipment within fire and rescue services around the world.

What sets your training academy apart from others?

We are extremely fortunate to have a wealth of instructional experience. Full-time instructors from a range of fire service disciplines complement the operational instructors who do the job day in, day out. This combination ensures that our customers receive the best instruction from current fire officers who understand the issues they face.

At Newcastle we also pride ourselves on providing an extremely high level of customer service. Our customers benefit from fantastic food and accommodation at our partner hotel, the on-site Double Tree by Hilton. And our region itself provides an opportunity to relax and unwind after training – customers have excellent connectivity to a busy city, and the fantastic countryside and coastline is only a few miles away.

What is your favourite quote when it comes to firefighting?

'Courage is not living without fear; courage is being scared to death and doing the right thing anyway.'

ORGANISATION: JOVELLANOS TRAINING CENTRE, NORTH SPAIN
NAME: JAIME BLEYE
AGE: 40
JOB DESCRIPTION: NAUTICAL ENGINEER AND FIREFIGHTING INSTRUCTOR SPECIALISING IN MARINE FIRE-FIGHTING, LNG SAFETY AND EMERGENCY SPILL RESPONSE

How would you describe a typical course day at the academy?

Our usual schedule is from 08.00 to 15.00, but these hours are occasionally extended if required by a particular training action. We divide the day into theoretical and practical sessions. The theoretical part usually lasts for a couple of hours, then we have a coffee break before heading to the changing room, where we provide all the necessary PPE to the trainees.

The practical drills can last over four hours and they can be exhausting, especially with extreme weather conditions, but this is undoubtedly the best part of the training.

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What is the best thing about being a fire instructor?

Meeting people. It is enriching to keep in touch and share experiences and knowledge with others whose ambition in life is saving other people's lives. I am glad to say that I have had the chance to make many friends during my job as a fire instructor. At the end of the course some trainees thank me, and I always reply: 'Thank you – you and your attitude made it possible'. It is a source of satisfaction and an emotional moment for me.

What do you see as the main strategic development in training at the moment?

We have identified a lack of specific training in marine fire fighting for land-based firefighters. Apart from the MIRGs (Maritime Incident Response Groups) most firefighters don't know how to deal with a fire onboard a ship, and a ship on fire needs a completely different strategical and tactical approach from any other kind of fire.

Most of the Jovellanos Centre training instructors have a professional mariner background, so training firefighters in marine fire fighting is one of our major achievements.

What is your favourite piece of equipment?

I think my favourite piece of equipment is the breathing apparatus, because I know when I wear the BA that I am prepared to deal with the fire. However, every single piece of fire equipment is important. I remember the first time I was inside an interior fire, and I realised that a good torch can be vital, and that the communication system must work properly. The truth is that it is not easy to choose one piece of equipment over another.

What sets your training academy apart from the others?

I know that I am working in a good academy, but when a firefighter with vast experience visits Jovellanos and tells you that we own the best fireground he has ever trained on – that's when you really realise and appreciate the kind of top academy you work at. It goes without saying, however, that our training is rather extensive because we cover LNG, LPG, marine firefighting, ARFF, dangerous goods, HUET, OPITO courses, GWO, and more. On top of that, our location in Gijón in the north of Spain is a beautiful seafaring city and a wonderful place to visit.

What is your favourite quote when it comes to firefighting?

'Train hard. Train as if your life depends on it, because it does.'

ORGANISATION: TRENTINO FIRE SCHOOL, NORTH ITALY
NAME: LUCA PARISI
AGE: 47
JOB DESCRIPTION: PROFESSIONAL FIREFIGHTER AND FIRE INSTRUCTOR

How would you describe a typical course day at the academy?

My role at the academy is to train new recruits and qualified firefighters about compartment fire behaviour.

Each instructor enters the cell with a team of two, and once inside we have four tasks. First the trainees have to go into a hostile environment, which is warm and dark. It is our role to ensure that the trainees are calm enough to move properly inside the space, and there we pull some tricks to increase stress levels.

Then we move to the second part of the cell, and the trainees have to explore the compartment, which includes a kitchen and a dining room. Then they have to go near the seat of the fire and describe it – flame colour, smoke, type of heat, and so on.

Finally, we cover air management. The trainees must continually check their air gauges on their breathing apparatus so they know how much air they have used up to reach that point, and can calculate how much longer they can remain inside in order to make a safe exit. Throughout the exercise we work to keep the trainees calm, oriented and focused on air management.

After exiting the cell, we perform a debriefing about what happened inside. This is a crucial step in driving home the concepts involved. The day ends with proper decontamination of PPE and SCBA equipment.

What is the best thing about being a fire instructor?

Seeing the spark of curiosity in my students and the will to improve.

I believe that we need to pass on the desire for change and improvement as well as knowledge to our trainees. We are not trying to create robots who respond the same way every time, but rather firefighters who think before they act, and if we can do this it means we have done a good job.

What is the main mistake you see students make?

I think that the main mistake is wanting to know why everything happens on the fireground, but that's simply not possible. There are too many factors that contribute to the development of a fire event, so the only answer we can give is: 'The situation will vary at all times, keep that in mind at all costs'. When, as a firefighter, you understand this, you can change your approach to handle whatever happens in the best possible way.

What do you see as the main strategic development in training at the moment?

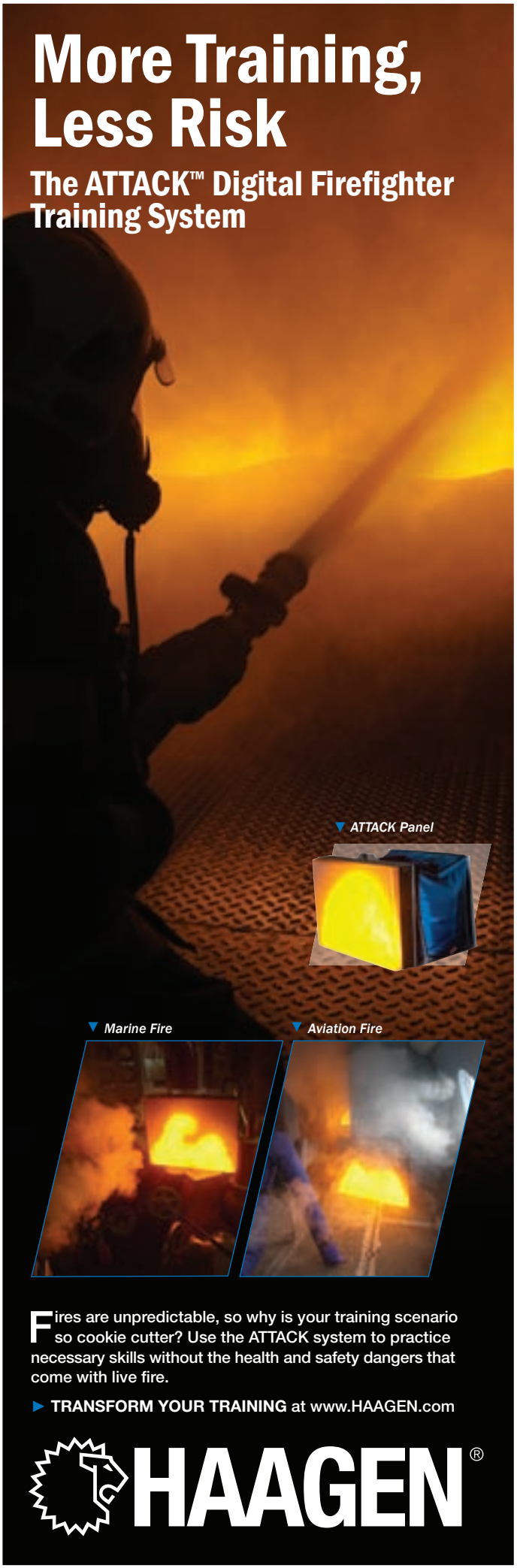
Following on from my point above, I think we need to change the sequence of procedures during training as proposed by Lars Axelsson. At the moment, the stream of topics is as follows: *fire behaviour, fire suppression, interior attack, exterior attack, ventilation.* This reflects how we currently pass on knowledge, and this order is what will remain in the minds of our students. However, surely the correct sequence should be: *fire behaviour, fire suppression, exterior attack, ventilation, and interior attack* – we only enter the compartment after we have tried to fight the fire in another manner.

What is your favourite piece of equipment and why?

The branch, because when we start talking about nozzles, most of my students think they already know everything there is to know, but this isn't the case. They usually have a lack of fundamental knowledge, and sometimes they are so focused on other equipment that they forget about this tool. When I teach them how to use it properly, I am able to reinforce their basic knowledge.

What is your favourite quote when it comes to firefighting?

'Not hot to burn, but warm to inform'. It is not about showing our students how good we are, but providing them with the most useful environment in which to learn.



LUCKY STRIKE

The Port Authority of New York and New Jersey (PANYNJ) has placed a significant order for crash tenders.

A total of 24 Oshkosh ARFF vehicles with Scania Tier IV low-emission engines have been ordered.

The latest fleet will be the third generation of Oshkosh vehicles procured by the PANYNJ. They replace a number of first-generation Oshkosh Striker apparatus that were placed into service between 2002 and 2005, which themselves replaced a fleet of T-Series ARFF vehicles that date to the 1990s. The order consists of 14 Oshkosh Striker 6x6 and 10 Striker 4x4 vehicles. Seven of the 6x6 vehicles will be equipped with a 19.8m-long high-reach extendable turret (HRET); they are the first units to be furnished with the newly developed HRET, which was first unveiled last year at the ARFF Working Group annual conference in Frisco, Texas.

The HRET features a hardened carbide steel tip, a perforated nozzle and an infrared camera. The piercing steel tip 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 agent.

The vehicles' fire-fighting systems use Halotron, dry chemical, foam and water. The Strikers also feature TAK-4 independent suspension, an Allison electronic transmission and engine power pack components accessed through walk-in doors on either side of the engine compartment.

As well as the vehicles, the Authority has also purchased the Striker Simulator, a virtual reality training system that incorporates video and illustrated environments of the vehicles in action. The system portrays different environmental conditions as well as the delivery of dry chemical, foam, water and Halotron.

The vehicles will be placed into service at John F Kennedy Airport, Newark Airport, La Guardia Airport and Teterboro Airport.

DOUBLE POWER

Germany's first Magirus Superdragon X8 with two Allison transmissions has begun operations at Stuttgart Airport.

The 52-tonne vehicle can reach a speed of 135kph, accelerating from 0 to 80kph in 25 seconds. As well as an 8x8 powertrain and a four-axle Iveco IM52X8 chassis it features a twin power pack that uses Iveco Cursor engines and Allison 4500R fully automatic transmissions.

The two engines, positioned in the rear of the vehicle, are Euro V-certified and provide 560hp with each for a remarkable total of 1,120hp.

The Allison 4,000 series transmissions maximise the power and acceleration thanks to the torque converter multiplication factor and full power shifts.

Each transmission features two integral and engine-driven power take-off provisions to ensure there is enough power for fire-fighting equipment, without the need of a dedicated power divider. This integral solution has been designed to simplify the system architecture, enhancing reliability through the reduction of components.

The Superdragon X8 features a 17,000l water tank and a 2,500l tank for foam concentrate. The roof cannon has a flow rate of 6,000lpm and a throw of up to 90m; the front cannon has a throw of over 45m.

The vehicle is capable of pump 'n roll operation due to the Allison automatic and the Magirus MPN 700 pump, driven by the left-side engine with a rated output of 9,000lpm at 10 bar.

The fire brigade at Stuttgart airport operates 24 speciality vehicles, including some 42-tonne vehicles with 1,000hp.

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The Alpha Ultra has been designed to provide high protection against electric arc but without the weight.

AVOID THE SHOCKS

Kermel has launched a lightweight fabric that provides high electric-arc protection for workers in electrical, gas utilities and galvanization industries.

The new fabric is made with non-flammable fibres, which makes it inherently and permanently resistant to heat and flame throughout its life.

This solution has been developed to meet the highest requirements in electric arc Class 2 (Europe) and HRC3 (USA) protection, with inherent heat and flame resistance properties.

The two-layer Alpha Ultra fabric, which consists of a Kermel Alpha outer shell and a Kermel Komanda lining, complies with European and US standards: EN ISO 11612 heat and flame, EN 1149-5 antistatic, EN 13034 +A1 liquid chemical, Class 2 IEC 61482-2 electrical arc, and hazard risk Category 3 as per NFPA 70E in the USA.

NFPA 70E, the standard for electrical safety in the workplace, categorises arc flash protection into four hazardous risk categories. HRC is the level of arc flash protection clothing that must be worn to protect against a minimum level of incident energy. HRC 3 requires clothing with a minimum arc thermal performance value (ATPV) of 25cal/cm^2; this value represents the energy required to pass through a fabric to cause second-degree burns.

With a weight of 380g/m^2 and an ATPV of 27cal/cm^2, manufacturer Kermel says that the Alpha Ultra is one of the world's lightest fabrics of its type.

GLOWING IMPRESSION

A new product that enhances the visibility of firefighters in smoke-filled environments has been developed.

The reflective trim is so new that Netherlands-based Retroflex sees scope to develop a new standard to cover this type of product.

Flexphor is designed to enhance visibility in environments where there is little or no incoming light, or smoke-filled environments that inhibit the performance of traditional tape. "We want to ensure that firefighters are visible in any situation, and we're aware that in dense smoke, retro-reflection alone simply doesn't work," explains Retroflex MD Allart Scholts. "Flexphor can reduce the time it takes to find firefighters in the darkness. I

US NATIONAL FIRE PROTECTION ASSOCIATION ISSUES WARNING ON FIREFIGHTERS' PROTECTIVE HOODS

In its safety bulletin, the NFPA says that firefighter protective hoods are the most penetrable piece of clothing and do not stop soot and chemicals from depositing on a firefighter's neck and head – areas that are extremely vulnerable to dermal exposure. The NFPA protective hood bulletin recommends that fire departments establish an overall health and safety program and establish practices for care and maintenance in accordance with NFPA 1851, *Standard on selection, care, and maintenance of protective ensembles for structural fire fighting and proximity fire fighting.*

"NFPA has had the back of firefighters for more than 120 years," commented Ed Conlin, public fire protection division manager. "Given the increase in occupational cancer incidents in the fire service, we feel it is best to err on the side of caution as we await additional scientific research on PPE and learn more about the absorption of carcinogens near the forehead, jaw, neck and throat."

It is well-documented that firefighter personal protective equipment is exposed to a wide range of toxins, pathogens and other hazardous substances. According to a study by the Centres for Disease Control and the National Institute of Occupational Safety and Health, firefighters have a greater number of cancer diagnoses and cancer-related deaths.

For additional information, visit the NFPA's PPE cleaning page at http://www.nfpa.org.

believe it has the potential to save many lives.''

Flexphor is made from a meta-aramid with a ripstop para-aramid and is coated with a photoluminescent mineral that absorbs light. A short period exposed to light will 'charge' the tape, which then produces a glow that can last up to an hour.

Flexphor has been certified and tested by the testing institute Aitex for use by firefighters. The company is now in discussion with PPE manufacturers about incorporating Flexphor into FR operational kits.

Bristol Uniforms is one of these, and the company has some trials in progress. ''We think its added features could make a real difference in keeping firefighters safe,''commented Bristol Uniforms' Ian Mitchell.

Fire-proof denim

A fireproof denim-like aramid fiber fabric for fire-fighting uniforms has been launched by Teijin.

Xfire Denim is produced with a proprietary technology that results in a pliant texture similar to that of denim, a universally popular fabric. As a result, the new fabric offers good comfort and design flexibility.

According to a Teijin representative, when tested according to the Japanese flammability test JIS L 1091 A-1 (a test similar to ISO15025 Procedure A), the fabric showed an after-flame of ≤1 second; an after-glow of ≤1 second; and a char area of ≤10cm^2.

The new aramid fabric's unique appearance has been designed so that its wearers can be easily distinguished from professional firefighters, when working side by side.

Teijin's flame-retardant aramid fibers provide police, firefighters and chemical-plant workers with protection and safety through the Teijinconex brand of heat-resistant and flame-retardant fabric, which is also used in the Xfire Denim.

The new fabric is available now.

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Not just any shower

The world's first emergency tank shower independently tested to ANSI standards has been introduced by Empteezy. Andrew Lawrence explains how there is much more than meets the eye when it comes to this simple but crucial safety tool.

There may be only one internationally recognised standard related to emergency tank showers but the requirements stipulated by the American National Standards Institute are so rigid that it's unlikely any others are necessary.

Emergency tank showers enable people to wash off hazardous substances that have been accidentally spilled over them, and are typically used where there is no available – or viable – plumbed-in water supply or where the water pressure is too low.

Andrew Lawrence is business development manager, Empteezy.

Why did you decide to develop and launch an emergency tank shower?

Historically Empteezy has been involved in the spill control and spill retention market, dealing with how people store liquids safely and then, should they spill them, how they deal with them.

In recent times we became aware of an opportunity we were potentially missing with the tank shower aspect. We investigated and found out that if you are providing a solution to store chemicals and respond to a spill, an emergency tank shower is a natural fit.

How was the tank shower designed?

Interestingly for a safety product, there is only one internationally recognised standard that applies, the ANSI Z358.1-2014. We thought that there was no point making a tank without showing it complies and works to a standard, so all our research was conducted around how to build something that complied.

We soon found out that ANSI rules are very rigid around water temperature, flow rate, shower-head pattern and so on. We also saw that the other products in the market self-certificated to the ANSI standard, while we decided to have it independently tested by internationally recognised company IAPMO R&T. It passed last month – which makes the tank shower unique.

What has been the reaction from the market?

The biggest seller so far has been the stainless steel framework version. That's either because of the nature of the industry, due to the aggressive nature of the chemicals being used, or due to the location, such as a saltwater environment.

We are doing a lot out of the UK in the petrochemical industry, where predominantly all the electrics have to be zone 1 Atex rated, which has been interesting.

What is the most important aspect of this type of equipment?

A key feature of ANSI's requirements is the supply of tepid, not cold, water. The temperature range as defined by ANSI is between 16 and 38°C. We set ours typically at 19°C to undercut the risk of legionella. It has been proved that standing someone under a cold shower for several minutes, never mind the 15 stipulated by ANSI, can cause hypothermic shock or death.

Why is the water storage tank so large?

To comply with the standard a shower has to produce 75.7 litres of water per minute for 15mins. That's the standard. So if you do the maths, something like 1,100 litres is the size of tank needed. But that doesn't work. You get the flow for the first, let's say 10 minutes of test, but as it gets down the flow rates drops off because you haven't got the pressure from gravity to make it work.

We tested several sizes and we eventually found that 2,000 litres of water are required to maintain the pressure and flow rate. Anything below that will not do it, unless the tank is connected to a pump, which is done for restricted spaces such as the offshore industry.

How is the tank shower delivered and what preparations are needed?

We can ship ready to go or in two sections, where all that is necessary to do is bolt together the lower section of framework to the top section. In an ideal world it is sited on a concrete base because it needs to be bolted to the ground. We've had the unit wind-load tested independently and can provide data; you could attach guide wires if conditions warranted it.

Finally, it's filled with water by a hose from the mains or a pump from a bowser, and connected to an electrical supply.

What are the options?

These include electronic temperature and level gauges, alarm systems and heat trace to stop the pipework from freezing.

Wherever there is a risk of pipework freezing you need heat trace to ensure the water supply. This effectively consists of wrapping an electrical wire around the pipework and then lagging it in a jacket; the small amount of current used stops the water in the pipe from freezing.

For hot climates you can have a drain valve that drains the pipework ensuring no water remains in the pipe, eliminating the risk of scalding the user. As tepid water is still necessary in hot climates we attach a chiller that brings the water down in temperature.

Where next with the tank shower?

Our tanks showers are available through our own operations in the UK, Belgium, Italy, Spain, France and Germany and we have recently appointed an export director who looks after our distribution channels across the globe with the exception of the USA, where we have partnered with Speakman.

Hazmat safe

Stress-free and effective decontamination operations are achievable, writes Dr David Crouch of Scott Safety.

A new lightweight and portable system that can be used to decontaminate vapours, liquids and particles is a modern development for dealing with today's hazmat challenges.

Innovation in building design and construction has changed the operational environment that a responder may experience; an emergency in a building that is hundreds of years old results in different threats to a fire in a modern building. Where older buildings may contain asbestos or lead-based materials in their construction, modern materials such as nylon, polystyrene and polyvinyl chloride can degrade in a fire, exuding toxic gases as well as cancer-causing particulate materials. Failing to prepare the correct cleaning and decontamination protocols can result in long-term damage to first responders' health. However, decontaminating the environment places a significant physical and psychological burden on the operator, not least because many scenarios where fires and hazards can occur are complex. Portability and reach, therefore, are extremely important factors when it comes to the deployment of decontamination systems.

At just 22kg in weight, the Light Decontamination System is a portable yet powerful solution that acts to decontaminate chemical, biological and radiological vapours, liquids and particles simultaneously in as little as five minutes. Using new atomisation technology, the LDS creates a fine mist that ensures an even and consistent coverage, fumigating environments as large as 500m³.

In addition, the water payload of the LDS enables the system to be used for Class A and B firefighting applications as well as for smoke scrubbing.

The system is not limited to fire fighting or decontaminating infrastructure. It can also be used to quickly decontaminate responders and their equipment following hazardous materials incidents such as fire or releases of hazardous materials at industrial locations.

As the industry also learns more about the long-term effects of firefighter exposure to carcinogens and the link to occupational cancer, decontamination of personnel and their equipment at the incident scene is also a highly realistic application, enabling personnel to return to the station in uncontaminated suits.

Dr David Crouch is associate director, product management for military and civil defence, Scott Safety.

Check the facts

Fluorine-free foams are not as effective as AFFF agents at extinguishing flammable liquid fires, writes Tom Cortina of the Fire Fighting Foam Coalition.

Tom Cortina is executive director of the not-for-profit trade association FFFC.

AFFF agents that contain fluorotelomer-based fluorosurfactants are the most effective foam agents currently available to fight flammable liquid fires in military, industrial, aviation, and municipal applications.

This fact that has been consistently proven in fire tests done over the past 30 years and fire tests that are being performed today. As such it is puzzling that one or two companies continue to make statements at public meetings that AFFF agents are no longer needed and can be fully replaced by fluorine-free foams. It is confusing to regulators that need technically correct information on which to base policy decisions and damaging to the credibility of the fire protection industry. It is also surprising considering that these same companies continue to sell AFFF agents, we assume because their customers demand AFFF based on their own fire testing and need for adequate fire and life safety protection.

All major foam manufacturers produce and sell both fluorinated and fluorine-free foams. On the other hand most foam manufacturers neither produce nor sell fluorochemicals, and thus have no vested interest in selling fluorinated foam over fluorine-free foam. Yet almost none of these companies promote and sell fluorine-free foams as directly equivalent to fluorinated foams because fire testing and the experience of their customers provides clear evidence that they are not equivalent. Below we summarise some recent test data and events that continue to affirm this conclusion.

At the 2016 American Chemical Society Symposium, the United States Naval Research Laboratories (NRL) presented test data comparing AFFF agents to fluorine-free foams[1]. In pool fire tests, an AFFF agent achieved extinguishment in less than half the time (18 seconds) compared to fluorine-free foam (40 seconds). In foam degradation tests, fluorine-free foam degraded after 1-2 minutes while AFFF lasted 35 minutes before degrading. Similar results from a series of foam degradation tests on AFFF agents and fluorine-free foams were published in a trade magazine in 2012[2].

Fluorine-free foams are inherently oleophilic (fuel attractive). In the absence of oleophobic (fuel-repelling) fluorosurfactants, fluorine-free foam can easily pick up fuel and the contaminated foam degrades quickly and becomes flammable. This fuel contamination problem compromises the fire performance and severely limits the application of fluorine-free foams.

Previous testing by NRL in 2011 showed that extinguishment times for AFFF agents on pool fires were on average 77% faster for gasoline and 70% faster for heptane when compared to fluorine-free foam[3]. Both the 2016 and 2011 NRL testing confirm that fluorine-free foams are unable to pass the fire tests necessary to meet the requirements of the US military specification (milspec). Foam agents must meet the requirements of the milspec in order to be listed on the US Department of Defense qualified products database (QPD) and used for military applications[4]. The Federal Aviation Administration requires all US airports to carry AFFF agents that meet the milspec and are listed on the QPD[5]. In addition many national authorities in other countries require the use of AFFF agents that meet the milspec.

In July 2016 the Singapore Aviation Academy (SAA) and the International Aviation Fire Protection Association (IAFPA) jointly organised a fire-fighting foam seminar[6]. The major focus of the seminar was on the advantages and disadvantages of fluorine-free foam versus short-chain (C6) AFFF agents. One of the highlights of the seminar was a planned fire test demonstration scheduled with fluorine-free foam on an ICAO level B fire. This was of great interest to many of the delegates, some who have had difficulty replicating tests showing that fluorine-free foams can pass ICAO level B. Unexpectedly, the planned demonstration of fluorine-free foam was run instead with a short-chain (C6) AFFF. According to the company sponsoring the fire test demonstration, the fluorine-free foam test was not undertaken because "too many environmental factors were not under our control." Not surprisingly, several delegates noted: "those variables usually happen during fire incidents." The short-chain (C6) AFFF agent had no problem extinguishing the ICAO level B fire in the required time, despite the extenuating environmental factors.

Also during this seminar, Spanish foam manufacturer

	FFF (F3)					AFFF				
Test/Fuel	1	2	3	4	5	1	2	3	4	5
Gas. 95O	YES	NO	NO	NO	Late	YES	YES	YES	YES	Late
Heptane	YES	NO	NO	YES	Late	YES	YES	YES	YES	YES
Jet A1	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Diesel	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

NB: 1-5 above represent five unique, commercially available AFFFs and F3 foams

Figure 1: foam test results presented by Auxquimia at the fire fighting foam seminar organised by SAA and IAFPA in July 2016.

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Right and page 22: the US Navy Technology Center for Safety and Survivability carries out foam tests on the ex-USS Shadwell in Mobile Bay, Alabama.

Auxquimia presented results from a series of new fire tests run on five commercially available short-chain (C6) AFFF agents and five commercially available fluorine-free foams[7] (see Figure 1, p22). The tests were run with four different fuels: gasoline, heptane, Jet A1, and diesel. The results showed that AFFF agents performed significantly better than fluorine-free foams on all fuels except diesel. None of the fluorine-free foams were able to extinguish the Jet A1 fire, which is the fuel used in the ICAO fire tests that determine the acceptability of foams for airport use in many countries.

The fire protection industry fully supports the goal of protecting the environment and is committed to minimising emissions of fire protection agents through the implementation of best practices[8]. The overriding concern of the fire protection industry, however, is the reduction of risk to people and property from the threat of fire through the use of products and systems proven to be effective. With the aim of ensuring that both of these goals are achieved, foam manufacturers have transitioned to the use of only short-chain (C6) fluorotelomer-based fluorosurfactants that are low in toxicity and not considered to be bioaccumulative according to current regulatory criteria. For many manufacturers this transition has occurred years ahead of any regulatory requirement.

It is one thing to argue that protection of the environment requires that users accept an increase in risk from potential fires by using less effective but more environmentally benign fluorine-free foams. This debate has been occurring within the fire protection industry for the past 15 years and is likely to continue in the future. It is something completely different, however, to argue that there is no risk in making the switch based on exaggerated and unsubstantiated claims as to the effectiveness of fluorine-free foams.

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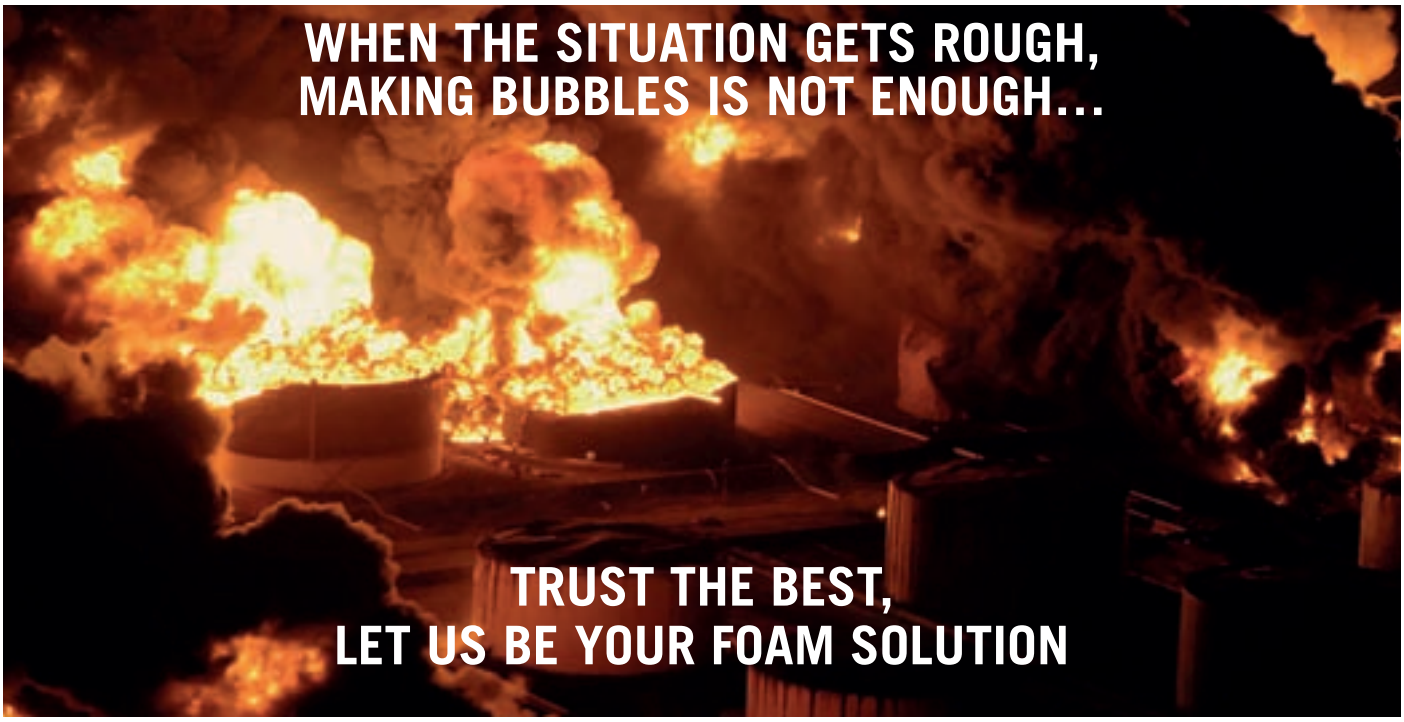

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At the heart of it

V Frank Bateman examines the possible outcomes of dealing with flammable liquid fires without aqueous film-forming foams.

The definition of the end goal plays a prominent role in any discussion about foam. While many have long believed that extinguishment is the end goal, it never is.

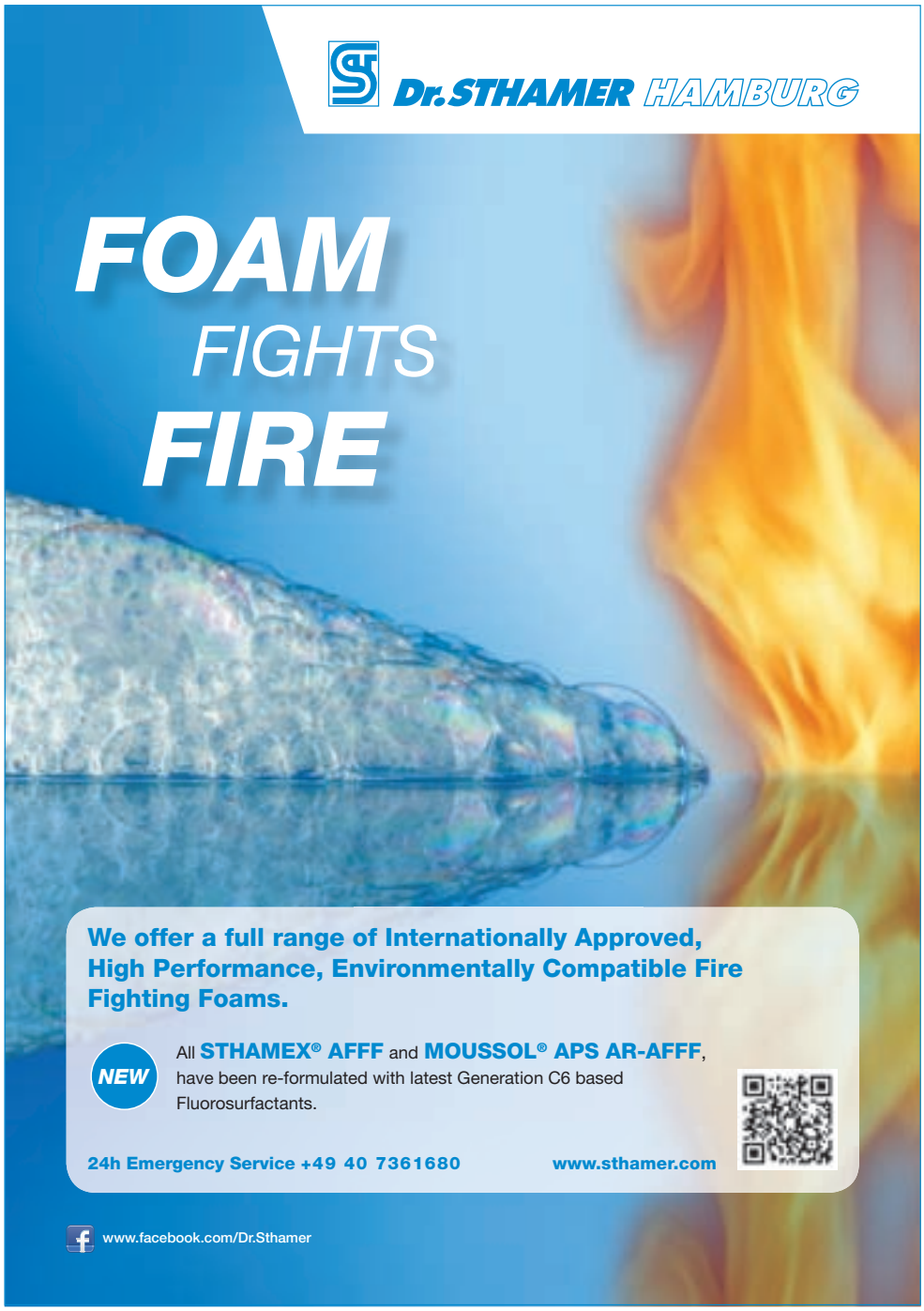
Consequently I found it necessary to define the end goal as: ''The timely and effective restoration of normal conditions within the limits of acceptable risk''. Notice the absence of the word extinguishment – it doesn't apply here. In fact, when using RECEO (Rescue, Exposure, Confine, Extinguish, Overhaul and Ventilate, Salvage) as an incident prioritisation matrix, extinguishment is fourth out five priorities. As an example, if extinguishment was the end goal, responders would consider their work done after prematurely extinguishing an LPG spraying fire before first isolating the source.

Along with many other reasons, we have been able to achieve the end goal (restore normal conditions) with high-quality AFFFs because of their ability to be affective from greater distances, thus increasing safety for the firefighter. The accepted shorter life of foam blankets are greatly offset by ability to accomplish fire extinguishment while using less foam concentrate. Post-extinguishment reapplication periods could be extended by the changing over to aspirating delivery devices that produce higher-quality and longer-lasting blankets.

Entering a pooled fuel is considered within the limits of acceptable risk by many response agencies. The primary reason for this is the safety provided through the use of high quality AFFF/AR-AFFF products. Without it, entry into this type of hazard should not be considered.

If memory serves, the final acceptance test for AFFF for use by the US Navy was conducted at what was then Miramar Naval Base in San Diego. I still use the video produced to show that appropriately attired ARFF crews and attack lines could be advanced during application for fire fighting/simulated rescue efforts into the fully involved test fire. The fuel load was the equivalent of a full load of JP4 for the largest military aircraft in service at the time. Within seconds of the simulated arrival at the scene, firefighters had advanced hand-lines well into the liquid fire and were nearing the fuselage of the mock up training prop.

All of the above has been possible since the 1970s with AFFF and AR-AFFF. At present, there's simply no alternative with anything approaching the performance or safety for the users. I am at the end of a very long career in the profession I love and I'm no longer responding to fires in anger; however, I cannot remain silent while we let this happen. For me it's personal. My son is the fire



Entering a pooled liquid spill or fire without a high-quality AFFF would not be an acceptable risk.

chief of a major US oil refinery. One of my grandsons is presently considering following in the family tradition of joining the fire service; and yet another is in training to become a Damage Controlman in the US Navy.

If science can produce a suitable replacement for the high-quality fluorine-based concentrates in use today, I'm all for it as long as performance is not sacrificed in the process. If we are forced into using one of the presently available F3 fluorine-free foams (and my company makes one), a lot of how the fire service handles the threat of flammable and combustible liquids must change, which I will now touch upon.

Without a high quality AFFF product, entering a pooled liquid spill or fire to carry out a victim rescue or close flowing/spraying valves should be considered beyond the limits of 'acceptable risk'. This alone would require a complete overhaul of how we train. Without the performance of a foam the equal of high-quality AFFF's, the old term of 'surround and drown' and the newer term of 'hard from the yard' will be left to guide the development of new tactics. What we don't want is to return to the requirement of using aspirating equipment for foam delivery. This would mean more energy consumption (due to water-pressure drop); shorter reach; different tactics; and additional manpower requirements.

Any replacement for AFFF would to be at least as efficient as the AFFF's now is use by most in the flammable liquid response arena. Poor performance of a successor to AFFF could cause foam inventories to skyrocket along with all the related logistical requirements. AFFF's were considered to be up to the task of protecting storage tanks while they and other hazards continued to increase in size.

As tank diameters have continued to increase, and the NFPA and others in the opinion of the response community have failed to keep pace, fire responders have developed their own application minimums. Without AFFF's, rates will have to be increased again but this time by some yet-to-be determined exponential. This, of course, assumes that with greatly increased delivery capacity and sufficient inventories, success (the end goal) is possible.

Last is the development of 'compatibility criteria' for dealing with greatly varying concentrate viscosities; will the hardware required be available to all those who might be forced to use the concentrate? If not truly compatible, will the result be the loss of performance and its impact on firefighter safety? We have been spoiled with AFFF's nearly indefinite shelf-life, and we are presently comfortable with their ease of handling and wide temperature range for accurate proportioning.

Approval of any AFFF replacement must include discussion of the impact the new concentrate will have on the environment. Most fluorine-free foams are many times higher in aquatic toxicity than C6 AFFF's that contain the nasty stuff that doesn't easily break down. The new C6 AFFF family, the chemical experts say, are much safer to use – but I'll stick to fire fighting.

V Frank Bateman is class B foam marketing and business development specialist at ICL Group. He has over 30 years' experience in the field of fire protection, starting his career as a US Coast Guard Reserve Commissioned Officer assigned to Marine Safety Office, San Francisco. He has been a firefighter; fire inspector and arson investigator as well as worked as a special hazards representative for the design of fire protection systems.
His qualifications include NFPA 1041 & 1081 Pro Board Advanced Exterior Fire Brigade and NFPA Pro Board Fire Instructor II. He serves as adjunct instructor at New Jersey State Fire College; Texas A&M Oil fire Training School; and UNR Fire Training Academy. A past president of San Bernadino County Fire Prevention Officers Association, he has also served on NFPA committees formulating foam-related standards and co-authored standards including NFPA Standard #1405 - Land-based firefighters who respond to marine vessel fires; NFPA Standard #1925 - Marine firefighting vessels; and API's Guide for fighting fires in and around petroleum storage tanks.

South Australia to ban PFOS and PFOA

Ian Hunter, Environment Minister for South Australia

Environment Minister for South Australia Ian Hunter has announced that the Environment Protection Authority is to begin working with industry to determine how to ban PFOA and PFOS.

The ban will apply to the use of fire-fighting foams containing PFOS or PFOA or any other chemicals that degrade to PFOS or PFOA.

While the use of fire-fighting foams containing PFOS and PFOA have been largely phased out in South Australia, some stockpiles of these foams still exist.

This measure aims to eliminate uncertainty about their future use and potential contamination risks to waterways and groundwater.

"By permanently banning foams containing these chemicals we are sending a clear message that chemical usage that poses a threat to waterways and groundwater will no longer be tolerated in this State," said Minister Ian Hunter, who added: "I want to reduce any harmful impact on the environment, and any potential harm to South Australians."

South Australia is following in the steps of the State of Queensland. In July last year, Queensland published a new operational policy for fire-fighting foam with highly restrictive management requirements. Queensland, home to the Great Barrier Reef, also requires any existing stocks of foam containing PFOS and PFOA are withdrawn from service and replaced with alternatives.

Perfluorinated alkylated substances (PFAS), also known as perfluorinated compounds, are manufactured chemicals that do not occur naturally.

Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are specific types of PFAS that are of emerging concern in Australia and internationally.

In 2010, PFOS was among nine new chemicals added to the Stockholm Convention on the Persistent Organic Pollutants list. These chemicals had historically been used for a range of industrial applications since the 1950s, mainly in firefighting foams for liquid fires at airports and major hazardous facilities including oil refineries.

PFOS and PFOA in fire fighting foams in South Australia have been largely phased out and replaced by other chemicals that break down faster.

The South Australian Metropolitan Fire Service has stopped using fire-fighting foams containing PFOS and PFOA and has replaced them with alternatives.

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Into the blue

Foam manufacturer VS Focum has developed a blue dye for its Silvara family of fluorine-free foams.

Bluecue technology has been specifically designed to enable foam users to quickly ascertain that the water/foam ratio is correct while also providing visual confirmation of the stability of the finished foam.

For the last 12 months VS Focum has been in collaboration with a number of environmental organisations to research a dye that was not only fully biodegradable and compatible with foam, but also had zero impact on the environment while being easily removable with water.

Bluecue also seeks to address concerns in the industry regarding the performance of fluorine-free foams during difficult scenarios such as tank storage protection.

The blue dye enables users to visually and quickly establish the performance and stability of the fluorine-free foam being used.

The dye has been created for the Silvara* family of foams, which are generally used at 1% in contrast with the 3/6% of traditional AFFFs. As a Newtonian foam Silvara has a low viscosity, achieving extinguishment through the interaction of its ingredients as opposed to through the fluidity and water-holding properties of traditional foam.

There are three key advantages of the new technology, says VS Focum. First, any induction ratio variation can be instantly recognised; the foam created can be quickly interpreted as correctly mixed or not. Overdosification and underdosification is easily seen with the use of an accompanying colour chart, providing a reliable warning if the foam installation is inducting the foam correctly.

Secondly, the blue dye provides a much more obvious indication of drainage time, a key quality when gauging the foam quantities necessary to establish a good burnback resistance. The bright blue colour highlights the quantity of foam that is lying on top of the fuel.

Thirdly, the blue dye helps with the environmental aspect of clean-up operations. Any foam that has been applied in a real fire scenario or during training has to be diluted several times before it can be treated in a sewage treatment plant; the blue dye will assist in recognising when the correct dilution point has been reached.

The new technology is expected to be particularly useful in scenarios involving hydrocarbons (Silvara ZFK at 0.5%); hydrocarbons with a small portion of polar solvents (Silvara APC 1 – FFF/AR 1x3%); and 50/50 ratio hydrocarbons/polar solvents (APC 3 – FFF/AR 3x3%).

All VS Focum's Silvara foams are now available with the option of including the new Bluecue technology at no additional cost.

** Silvara 1 was certified to EN-1568-+3 (Class IB) in 2012; Silvara K3 was certified to ICAO-B in 2014; Silvara ZFK to EN 1568-1+3 (IB) in 2015; Silvara APC1 to EN 1568-1+3(IB)+4 (IB: acetones) in 2016; Silvara APC3 to EN 1568-1+3(IA)+4(IA: acetones) also in 2016.*

CERTIFICATION FOR SOLBERG

Foam manufacturer Solberg has received UL Canada Category 3 product certification for foam concentrates Arctic 3 and 6% aqueous film-forming fire-fighting foam.

In addition to the latest certification, the two foams hold UL listings in accordance with UL 162 (*Standard for safety for foam equipment and liquid concentrates*); ULC S564 (*Standard for categories 1 and 2 foam liquid concentrates*), as well as Qualified Products List status for US military specification,

Arctic foam concentrates are PFOS-free synthetic fire-fighting foam concentrates used to extinguish Class B hydrocarbon fuel fires. They have been C6 fluorochemical based since 2012, making Solberg the first foam manufacturer in the Americas to offer commercially available foam concentrates compliant to the 2010/2015 US EPA PFOA Product Stewardship Programme. Under this programme, fluorochemical manufacturers voluntarily agreed to a 95% reduction of C8 and longer homologues by year-end 2010, and a 100% reduction by year-end 2015.

"After months of development work and hundreds of fire tests we have come up with product formulations that are superior in every aspect of performance. Further, they have the added value of being multi-agency certified including Mil-Spec and ULC Category 3, thus serving the aviation industry in both Canada and the United States with a single formulation for each type concentrate," said Mark Siem, research chemist, Solberg.

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Foam scrutiny in Australia

Nine hundred foam users in Australia are to be surveyed about fire-fighting foam.

The Government of Queensland is extending its efforts to remove contamination-causing per and poly-fluoroalkyl substances (PFAS) in the state.

Situated in the north-east of the country, Queensland is the second-largest state in Australia and is home to six World Heritage-listed preservation areas including the Great Barrier Reef. The Environment Minister of Australia's Queensland Government has initiated the survey to identify the remaining users of fire-fighting foam containing PFAS.

Minister Steven Miles said the survey would build on the work undertaken last year when the Environment and Heritage Protection engaged with the major industries and facilities in Queensland which historically had been primary users of the foams. "The Department of Environment and Heritage Protection (EHP) will now broaden its engagement with industry by conducting this survey across activities that are likely to hold stocks of fire-fighting foam on-site," he said.

Dr Miles said EHP will survey some 900 operators via email or post to identify what entities have stocks of foam, the quantities and type of foam and the storage methods on various sites.

"I urge Queensland's commerce and industry representatives to participate as this will greatly assist us in determining the right priorities and approaches to continue managing this issue," he said.

"This survey is part of the government's ongoing response to the issue of PFAS contamination, and parallels the Federal Government's management of historical PFAS fire-fighting foam use at defence and civilian airports and surrounding environments. In July last year we introduced a policy to ban new stocks of fire-fighting foam that may contain PFAS and have informed commerce and industry that any existing stocks must be withdrawn as soon as possible.

"As part of our ongoing response to the issues, we are also actively reviewing the locations and scale of fire-fighting foams throughout Queensland that may contain PFAS and engaging with commerce and industry to ensure they know and understand their obligations," he said.

Dr Miles said the Federal Government had 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.

"It is our expectation that as the work progresses, the Federal Government will honour its responsibility and undertake any remedial action that is required," he said.

A seminar on the implementation of Queensland's Environmental Management of Firefighting Foam Policy took place in Brisbane 21-23 February 2017, providing guidance for operators transitioning from older foam formulations to best-practice modern AFFFs or fluorine-free products. A report on the seminar will be published in the next issue of *IFJ*.

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DUPONT AND CHEMOURS AGREE TO SETTLE PFOA SUITS

A multi-million US dollar deal will be used to settle 3,550 lawsuits in Ohio and West Virginia.

DuPont and spin-off company Chemours will pay US$670 million to settle 3,550 lawsuits by residents who say they became sick after drinking water contaminated by perfluorooctanoic acid (PFOA) released from a former DuPont plant in Parkersburg, West Virginia. DuPont and Chemours will each pay US$335 million of the settlement; the deal could make it easier for plaintiffs in other regions to pursue similar cases involving PFOA, a processing aid used until 2015 to make fluoropolymers such as Teflon products. PFOA is also found in aqueous film-forming foams (AFFF) used in fire fighting, although its usage as an ingredient has been curtailed over the last few years and replaced with so-called C6 chemistry.

"DuPont's settlement offer of $670.7 million for the 3,550 local residents harmed by C-8 represents an enormous step in the right direction, and we are cautiously optimistic that the company will prevent any further delay, that this offer will be approved by the plaintiffs, and that this long-awaited promise will finally be fulfilled," commented Harold Bock, advisor to community-based organisation Keep Your Promises; "As of this announcement, no checks have been written and no compensation has been paid. Folks who have already had their days in court, including Carla Bartlett, David Freeman, and Kenneth Vigneron, have had their awards bogged down in appeals. For DuPont and Chemours, who have shamelessly dragged this crisis out for decades, it is time to make good on this settlement offer without any further delay."

In July 2015 Dupont completed the separation of its Performance Chemicals segment through the spin-off of The Chemours Company.

DuPont is about to merge with Dow Chemical and will subsequently split into three distinct companies.

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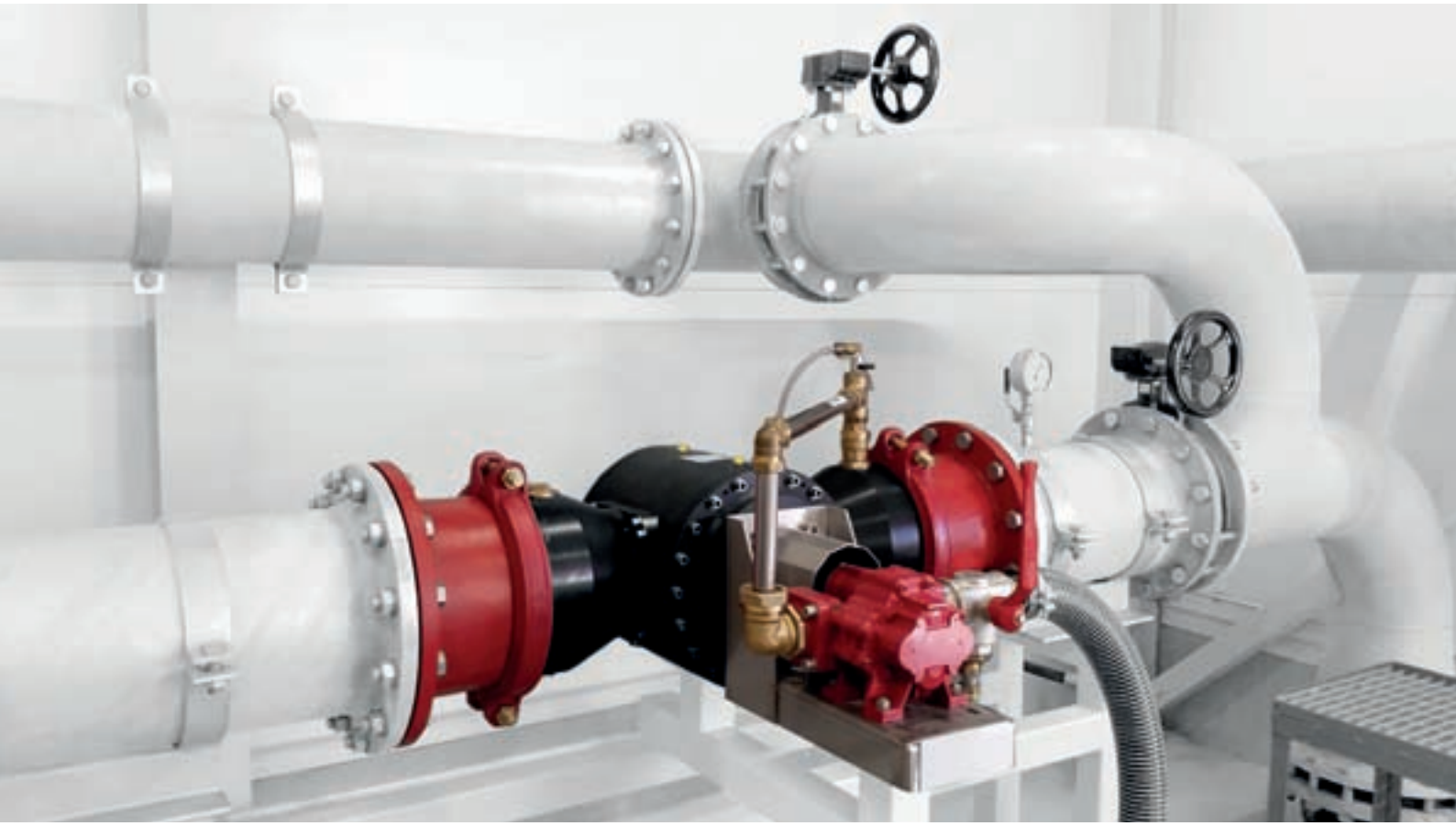

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AMSTERDAM'S FLOATING PUMP

The City of Amsterdam Fire Department has taken delivery of a new vessel designed to provide fire water for land-based fire-fighting operations.
The 17.6m Jan van der Heyde IV was constructed by the Damen Shipyards Group based on a preliminary design from C-Job Naval Architects, with a detailed design and lines plan also from Damen.
The fire-fighting backbone of the vessel is provided by two fire pumps manufactured by Nijhuis Pompen of the type NC1-200.520A. Driven by the twin 368kW diesel main engines, these pumps can each deliver 14,000lpm to two fire monitors at a maximum pressure of 10 bar. Each monitor has a flow capacity of 7,000lpm at 10 bar with a 90m throw.
Although the vessel is equipped to fight multiple fire-types from the water, it does not however carry fire-fighting foam.
Supplementing its fire-fighting duties, the Jan van der Heyde IV is equipped with two 3,000lpm hydraulic pumps also driven by the main diesel engines. These can be called on to pump water out of flooded boat houses or other vessels.
The vessel's hydraulic system also powers the two stern propulsion thrusters, the bow thruster, the lifting installations of wheelhouse, the lighting masts and the storage box on the aft deck.
The Jan van der Heyde IV has a top speed of 15kph and, due to the speed restrictions in the city's canals, it will not be used as a 'first-on-the-scene' responder by Amsterdam's fire department. Its main role is to supply the fire trucks on the road with an ample flow of water.
The new vessel's name continues Amsterdam Fire Department's tradition of naming its firefighting boats after its founder; Jan van der Heyden was an engineer who made significant contributions to contemporary fire-fighting technology, improving the fire hose, modifying the manual fire engine, writing the first Dutch fire-fighting manual and reorganising the volunteer fire brigade.

A MODULAR CONCEPT TO SIMPLIFY SUPPLY

A Dutch pumps manufacturer has introduced a modular concept for large fire-fighting mobile pumps that complies with European clean emissions requirements three years ahead of their introduction.
The modular concept being pioneered by BBA Pumps aims to speed up and simplify the supply of mobile fire pumps to end users. It is also being driven by stringent European emissions legislation that requires diesel-powered equipment to comply with the so-called Stage V requirement from 2019.
Work on the modular concept started on smaller pump sets several years ago, but from 2015 the company began focussing on large pump sets, in the power range 100kW – 560kW. The biggest challenge, which consisted in adapting the engine power required by the bigger pumps, has been achieved.
Now the end user only has to specify his requirement in terms of flow and pressure – for example a flow of 800m³/h and a head pressure of 15 bar – to be matched with the right solution, following a technical consultation. The appropriate engine module is then selected according to the expected power consumption, which includes after-treatment system, tanks, gear boxes and control panel.
Finally, the pump and engine modules are fitted on the pre-specified frame; connected to each other with a cardan shaft; and tested.

PATENTED FOAM PUMP WITH UL LISTING AND FM APPROVAL

Manufactured by Fire Lion Global, the FP Series has been designed to run smoothly and quietly on foam trucks, foam tenders and fixed foam systems.
The new foam pump, which has a six-year warranty and is fully compliant with NFPA 20, is capable of rotation in either direction without modification and is rated at 18-bar operation as standard.
It is made with high-performance duplex stainless steel shafts that can withstand flushing with sea water and the use of all types of foam concentrates.
An easily replaceable single shaft seal is capable of dry operation for ten minutes; it comprises a stainless casing with double PTFE lips that allow for hydro test pressure to 24 bar without leakage. The shafts are supported by composite bushings that are field replaceable and capable of extended operation on water or foam concentrate.
Furthermore, the pump rotors are made from admiralty bronze and composite materials that provide no tooth-to-tooth wear or corrosion.
Foam pump connections are groove, NPT or ANSI flange with O-ring seals for leak-free operation and simple field replacement.

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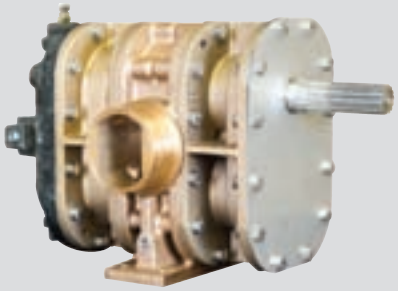
KEEPING IT IN PROPORTION

Manufacturer of foam proportioners and monitors Firedos has teamed up with distributor Hawkes Fire to cover the UK and Ireland.
Hawkes Fire will distribute Firedos' FM-approved foam proportioning unit for mobile and fixed applications as well as the German manufacturer's newly launched range of monitors.
A benefit of Firedos's water turbine proportioners is the ability to recirculate foam concentrate back to the holding tank whilst carrying out maintenance checks, using only water flow and pressure.
According to the manufacturer, the equipment's high proportioning accuracy makes it ideal for the new generation of 1% foams, as there is no unnecessary waste or loss of extinguishing power.
The UK distributor will also sell the Firedos family of monitors, which provide flows ranging from 1,000lpm to 60,000lpm. These monitors have been developed with a unique flat, oval design that maximises throw distance by minimising hydraulic turbulence.

PRIMED AND READY FOR ACTION

When a fire started at the SUEZ Chullora Resource Recovery Park waste recycling plant 15km west of central Sydney, Australia, it was clear that this was going to be a challenging job requiring large quantities of water.
It was one of those fires where the water flow from the nearby hydrant was never going to be enough.
The fire broke out on 23 February and quickly engulfed one of the large buildings on the site. More than 100 firefighters from 20 fire stations across Sydney battled the blaze. The 120x70m building contained highly flammable materials including carpet, plastic, cardboard and paper.
The fire produced enormous amounts of thick black smoke that could be seen from the other side of Sydney, 25km away.
Fire and Rescue New South Wales evaluated, coordinated and acted quickly by deploying their Hytrans Bulk Water Transfer System, which can transfer large quantities of water quickly over long distances.
Two remote hydrants were connected to a 152mm yellow hose, and pressure was boosted by a Hytrans hydraulic pump.
The yellow hose was deployed at nearly 40kph, and close to the fire a manifold was connected splitting the flow into five 70mm lines that then fed monitors and fire appliances. This configuration gave their colleague firefighters from Station 97 and many others a continuous flow of 2,500lpm to help extinguish the fire and prevent further spread.
This long-distance mobile water supply system over more than 1,300m was set up in approximately 20 minutes by two F&R NSW firefighters, Michael Harvey and Peter Murray.
To achieve the same water flow over this distance would have required multiple fire appliances and many lengths of 70mm hose.
Due to the quick reaction of the firefighters the blaze was contained to the waste recycling centre within an hour and a half, and most of the fire was extinguished during the night, although smoke from small isolated fires was still in evidence on 25 February.

The mechanical recovery of 1,300m of large-diameter 152mm hose took three operators less than 90 minutes.
F&R NSW's Bulk Water Transfer Sydney had been busy of late. Only the week before it had been deployed to de-water a flooded car park at a mixed-use building in South Sydney.
Around 11 cars had been flooded; the crew were able to successfully and quickly de-water the flooded carpark so that building recovery could begin.



PUMP FOR LIFE

The first of a series of pumps for fixed foam systems from Trident Emergency Products has received UL listing.
The Titan GP160 foam pump becomes the first of seven positive displacement rotary gear foam pumps models that will be UL listed.
The GP160 foam pump is a full 3-inch ported pump rated for full-time operation up to 300psi at 1,800rpm.
Eight versions of the are pump available, including upper or lower shaft positions for electric motor; diesel engine; PTO drives; cast iron mount for hydraulic drives; and cast iron bell housing mount for direct engine mounting. All pumps are available in CW/CCW rotation configurations.
The pump features timing gears to synchronise the two pumping rotors, ensuring no rotor-to-rotor contact and allowing for run dry conditions without damage. Water can be used for calibration, testing, and training, in lieu of foam concentrate. In addition, as an oil bath splash system lubricates the timing gears and as each pump shaft/rotor assembly is supported by two double-row spherical roller bearings, no regular greasing maintenance is required. In addition, as each pump shaft/rotor assembly is sealed into the pump body by two silicon carbide mechanical seals, foam concentrate cannot come into contact with the pump shaft.
The UL listing of the GP160 is expected to be quickly followed by the same listing for the GP120 and GP200 models.

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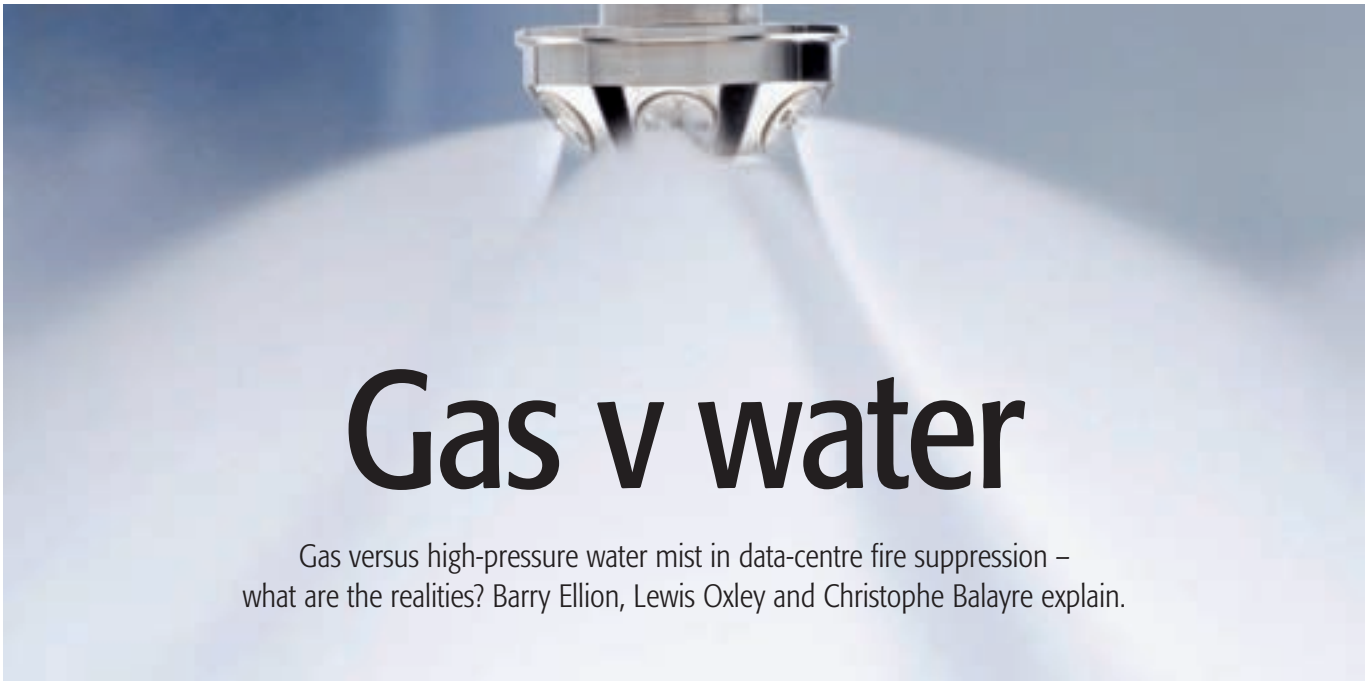


Gas v water

Gas versus high-pressure water mist in data-centre fire suppression – what are the realities? Barry Ellion, Lewis Oxley and Christophe Balayre explain.

Barry Ellion is director at Capitoline, Lewis Oxley is commercial manager at Firework Fire Protection, Christophe Balayre is country manager at Danfoss Semco.

The fighting of electrical fires with water is counterintuitive and yet water-based systems are increasingly being used in European data centres – how can that be? First, we need to consider the problem: the possibility of component failure causing an electrical fire in a manned data centre operation where the consideration of staff safety is closely followed by the need to bounce back quickly from a fire-induced outage.

The current range of options for data centre fire suppression takes in four approaches. First is permanently reducing the oxygen content of the room to below 14% by injecting nitrogen (known as the hypoxic method). Second, when a fire starts, injecting an inert gas into the room to reduce the oxygen level to below 14%. Third, injecting a halogenated gas into the room when a fire starts, which both reduces the oxygen content and interferes with the combustion process. And lastly, spraying a fine high-pressure water mist onto the burning area, which both cools and reduces the oxygen level locally.

As effective as gas release undoubtedly is, however, it has several consequences. Since all the gas is released from every incident (even for a small localised fire), it is a highly committed solution whose reset costs are considerable both in time and money. In addition, the data-centre structure has to be either purpose-built with gas-based suppression in mind, or it has to be retrofitted to provide the semi-pressurised environment required to make gas-based suppression an effective solution.

By contrast, a high-pressure water mist system requires a network of stainless steel piping and nozzles which only release at the point of the incident, leaving the remainder of the data centre operations and equipment unaffected, requiring no pressure seals or evacuation of personnel, and involving minimal reset times without the associated high cost. Furthermore, compared to conventional gas suppression, a room protected by water mist does not require pressure-proofing to the same level, eg by the addition of overpressure plates penetrating the external walls.

While gas-based systems require that the ventilation system to the room be shut down to contain the gas and to prevent oxygen feeding the fire, such control is not necessary to the same extent for a water mist fire suppression system. Indeed the ventilation can remain running and assist in smoke removal.

One salient misunderstanding regarding water mist relates to water-filled piping systems in computer rooms leaking and dripping onto equipment. This, however, is impossible because the pipes remain empty up to the point of a fire-alarm condition; only then is water released into the overhead piping system. This, known as a 'pre-action' system, also helps to reduce false alarms and unnecessary discharge of the suppressant. This is because two separate events must happen to initiate nozzle discharge. First, the detection system must identify a developing fire and then open the pre-action valve. This allows water to flow into system piping, which effectively creates a wet pipe system. Second, the glass bulbs on the nozzles must have burst as a result of high temperature, which means that only the areas affected by the fire are actively sprayed with water.

It is also worth bearing in mind that gas comes with a certain amount of political and regulatory baggage, especially in Europe.

The 1989 Montreal protocol banned the family of gases, known as chlorofluorocarbons (CFCs) and their brominated cousins are known as halons. As of 1 January 1994, the US has

The compact Sem-Safe high-pressure water-mist pump unit. Top: a Sem-Safe high-pressure water-mist nozzle in action.

banned the production and import of halons under the Clean Air Act. The EU ban on the use of halons in fire extinguishers came into force in October 2000 and was implemented in the UK in 2003 (although some 'critical' applications are still allowed).

The market splits into two regarding gas systems that are approved for fire suppression.

Inert gas systems, which work by reducing the oxygen content of the room to around 14%, are regarded as a green solution because they effectively reuse existing elements from the atmosphere. However, they require large volumes of gas and, as mentioned, the room needs to be sealed and able to deal with the large pressure event that a gas release will initiate.

The other method works by a combination of chemical and oxygen-reduction means using either hydrofluorocarbons (HFCs) or fluorinated ketones, as listed in the widely recognised NFPA 2001:2015 *Standard on clean agent fire extinguishing systems*. Although there isn't an exact European equivalent list, there is the 'F-Gas' Directive, which only allows gases with a zero ozone-depletion potential. The F-Gas Directive lists HFCs and PFCs (perfluorocarbons) that are allowed to be used in the EU. Although this includes familiar brand names such as HFC227ea (FM200) there is no list that specifically authorises inert gases or fluorinated ketones.

Unlike sprinkler and gas systems, high-pressure water-mist systems require full-scale fire testing to demonstrate their efficacy. Currently, there is only one internationally recognised standard, FM Global 5560 (2016) Appendix M and N, which reflects the real-life conditions within a data centre by also taking into account forced ventilation.

There is a potential problem with HFCs because the Global Warming Potential of a substance is now coming under increased scrutiny.

Politicians are now considering the GWP potential of substances; this led to the meeting on 14 October in Kigali, Rwanda, of the Ozone Secretariat for the Vienna Convention for the Protection of the Ozone Layer and for the Montreal Protocol on Substances that Deplete the Ozone Layer.

GWP is the ability of a substance to trap the sun's heat within the atmosphere and not allow it to radiate back into space - the 'greenhouse effect'. The popular HFC fire suppression gas HFC227ea, for example, has a GWP rating of 3,220, compared to CO2's 1.

High-pressure water mist technology has a number of advantages over gas-based fire systems.

The outcome of the Kigali meeting is the intention to reduce HFCs dramatically in the environment. While the main target is the air conditioning industry, the fire suppression industry is expected to be caught up in the slipstream.

According to reports, richer economies like the European Union, the US and others will start to limit their use of HFCs within a few years and make a cut of at least 10% from 2019.

Some developing countries, including nations in Latin America and island states, will freeze their use of HFCs from 2024. Other developing countries, specifically India, Pakistan, Iran, Iraq and the Gulf states will not freeze their use until 2028. China, the world's largest producer of HFCs, will not actually start to cut its production or use until 2029. India will start even later, making its first 10% cut in use in 2032.

This leaves inert gases, fluoroketones – which have a GWP of 1 just like CO_2 – and water-mist fire suppression.

To sum up the advantages of high-pressure water mist: it's an approved and certified solution with no issues of ODP or GWP; the room does not have to be sealed in the same way that a gas suppression system requires; there is no overpressure impact on a structure; ventilation does not need to be turned off; there is no safety impact upon people in the data centre; and a localised response to a fire can be provided.

HIGH-PRESSURE MIST FOR THE CLOUD

A high-pressure water mist fire protection system has become the first of its kind to receive FM Approvals certification for protecting data halls and subfloors from a fire.

Marioff's Hi-Fog has been verified in full-scale fire tests for use in ventilated conditions as well as in the narrow spaces under the raised floor of a data hall.

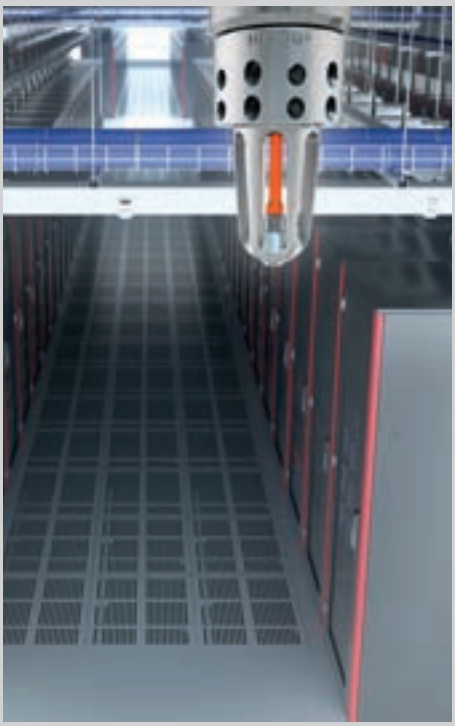
The new system is equipped with a pre-action security mechanism which can help prevent accidental water leakages and false discharges in data processing equipment halls. According to its manufacturer, the system also uses much less water than traditional sprinkler systems or low-pressure water mist systems, minimising potential damage to equipment as well as downtime.

The Hi-Fog addresses the requirement to keep data centres operating at all times even in the challenging environment caused by high airflow and the increased power density of servers. The resulting high-pressure water mist efficiently suppresses, controls and cools down fires in ventilated conditions and in the narrow spaces under the raised floor of a data hall.

In 2016, FM Approvals identified the increased fire risks in data centres and upgraded its FM Standard 5560, a detailed document covering water mist systems, with data center-specific test protocols.

New areas covered by the upgraded FM Standard 5560 include protection of data processing equipment above/below a raised floor; combustible loading of cables and cable trays; and challenges of ceiling height, obstructions, and impact of ventilation.

"Marioff is proud of this certificate by FM Approvals. It is a logical add-on to our impressive list of approvals and shows that Hi-Fog is a performance-based solution now formally certified to protect modern data centres as well," said Henri Simula, global account manager, Marioff Corporation. "In addition to Hi-Fog's superior firefighting capabilities, another benefit is there are no expensive refill costs, which are typically found with gas suppression systems."



Keep in business

Data-centre operators are facing a unique challenge: how to put out a fire without putting out their business.

Kurt Werner is business development manager at 3M Electronics Materials Solutions Division.

With the cost of data-centre outages now at US$11,000/minute[1] and rising, even a small fire in a server rack or wiring chase can cause serious economic damage if service to customers is interrupted. The problem is, some of the fire protection solutions employed in data centres and other computer facilities may themselves pose a threat to the delicate electronics they were designed to protect – a threat as potentially damaging to data centre operations as fire.

This requires alternative ways of thinking about fire protection. Conventional water sprinklers are an effective solution against structural fires; however, deluging a server room with water can result in enormous losses – both in terms of equipment destruction and in costly interruptions of service. In recent years, water mist technology has been promoted as a less damaging alternative to conventional sprinklers. As the name implies, this technology uses a very fine, almost fog-like spray that uses less water for extinguishment, theoretically making it less likely to damage electronic equipment.

Even so, water mist is still water. A prolonged water mist discharge can cause significant damage to electronics, papers and other valuable assets, resulting in costly business interruptions. But direct contact with liquid water is not the only threat to electronics posed by water-based systems. Discharging a water mist system in an enclosed space can significantly raise the humidity above specified levels, potentially compromising hard disk drive performance.

In guidelines for *Mission critical facilities, technology spaces and electronic equipment*, published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, it is recommended that equipment in data processing environments be powered down when relative humidity levels exceed 80%. Findings from a study conducted by Rutgers University[2] suggest that relative humidity is the biggest negative factor in hard-disk reliability, even when the data centre is operating within industry standards.

Recognising the risks to data-centre operations associated with water-based fire protection systems, FM Global makes

this statement in their Data Sheet 5-32: 'When it is essential to reduce equipment damage from an incipient fire to minimum possible levels, or to facilitate the return to service, provide an FM Approved clean-agent fire-extinguishing system with detection to protect the data equipment within the data-processing equipment room. This is to supplement the automatic sprinkler or water mist system protecting the facility or raised floor.'

In general, clean agents can be divided into two broad classes: halocarbons (sold under trade names such as 3M Novec 1230) and inert gases (typically a mixture of nitrogen, argon and carbon dioxide.) For data-centre applications, clean agents can eliminate the risk of downtime posed by water-based systems. There are substantial differences, however, between inert gas systems and halocarbon systems including the volume of gas used, the duration of discharge, the pressures at which they operate and the noise they make upon discharge.

In recent years there have been a number of documented incidents around the world in which hard disk drives have failed following the actuation of inert-gas fire-suppression systems[3]. When these problems first began to surface around 2007, it was initially thought that the sudden pressure increase during an inert gas discharge might be the cause of reported HDD failures. However, tests performed by Siemens[4] and others show that overpressures even greater than those which occur during system discharges had little or no impact on HDD performance.

Today, an increasing body of evidence indicates that noise and vibration are likely contributors to HDD failures. That's because high decibel levels at specific frequencies transmit vibration into HDD spindles and actuator axes, causing read/write elements to misalign and fail. Current generation HDDs cannot tolerate more than 12 nanometers of misalignment[5]; designs of newer-generation HDDs with more densely packed components tend to be even more sensitive to noise-induced failures. While more research needs to be done, to date there have been no reported instances of halocarbon clean-agent system discharges that have resulted in HDD damage.

During an inert-gas system discharge, gas under pressure is released at a very high velocity, generating noise that can exceed 120dB as it leaves the nozzles[6]. Research studies have demonstrated that hard disk drives may experience failure when exposed to high sound levels at specific frequencies. Conversely, systems using halocarbon agents are typically discharged at lower nozzle pressures than those designed for inert gas, thus producing less noise.

A number of steps can be taken to mitigate the noise problems of inert gas systems. These include adding noise insulation to server cabinets; adding additional nozzles; moving HDDs further away from nozzles; and retrofitting with new types of nozzles that are designed to reduce their acoustic footprint.

Ultimately, the strengths and weaknesses of any fire protection technology must be evaluated for their suitability based on the unique circumstances of each application. But for many in the data-centre industry, halocarbon clean agents offer the best first line of defence against the threat of downtime from a fire.

(1) "Cost of Data Centre Outages," (2016) Ponemon Institute, quoted by www.itracs.com

(2) Manousakis, I., Sankar, S., McKnight, G., Nguyen, T. D., and Bianchini, R. Environ-mental Conditions and Disk Reliability in Free-cooled Datacentres. In Proceedings of the 14th USENIX Conference on File and Storage Technologies (2016).

(3) Green, K., Nickerson, M. (2013) Clean Agent Fire Suppression and Hard Disk Drives (p. 6). IBM Corporation

(4) "Potential problems with computer hard disks when fire extinguishing systems are released," (2010), Siemens Switzerland Ltd. Building Technologies

(5) Green, K., Nickerson, M. (2013) Clean Agent Fire Suppression and Hard Disk Drives (p.9). IBM Corporation

(6) "Potential problems with computer hard disks when fire extinguishing systems are released," (2010), Siemens Switzerland Building Technologies

THE GOLD STANDARD FOR DATA

A former gold vault in southwest Germany now contains a high-security data centre protected by inert-gas extinguishing and oxygen-reduction systems, writes Katharina Bengsch.

When data centre specialist Darz sought to construct a high-grade data centre infrastructure to Tier 3+ it sought a gold standard in fire protection – quite appropriate for a company whose motto is: "Data is worth more than gold".

IT provider Darz offers a full range of solutions ranging from managed services to high-security data-centre solutions. Its data centre in the city of Darmstadt, around 20km south of Frankfurt, Germany, occupies the former vault of the Hessian State Bank. It probably has the highest on-site security level of any data centre in Germany; between 1988 and 2005 the centrally located building with its striking white facade held the Hessian State Bank's gold and cash reserves.

As a fire protection solution the Firexting inert gas extinguishing system was selected because fires would be extinguished without leaving a residue; equally, as a natural component of air, nitrogen is non-toxic and is easy to store in cylinders.

At Darmstadt, fire system specialist Wagner decided to take the concept of protection a step further. Conventional nitrogen extinguishing systems can produce sound pressure levels of over 130db(A) from the gas rapidly rushing through the extinguishing nozzles, causing vibrations that can seriously damage hard disks. The indirect damage from this is often much worse than the fire damage itself, not only in the form of temporary server failures, but also due to data damage or loss. Wagner solved this problem by developing special sound absorbers (Firexting Silent) that reduce the sound pressure to approximately 98dB(A).

Flow regulators were attached to the extinguishing agent cylinders in order to minimise pressure spikes during the start of the extinguishing process. This soft flooding device also considerably reduced the size of the pressure-release vents needed. It meant that a single on-site F90 conduit system was enough to provide pressure relief for all extinguishing zones on the first basement floor of the Darz; only one opening was needed for the relief of pressure in the entire first basement floor.

The hermetically sealed vault of the Darz was protected through a fire-prevention system in the form of oxygen reduction. This keeps the oxygen level at 15.9%, which is below the ignition threshold of typical IT materials. At Darmstadt, Wagner's patented Oxyreduct system generates nitrogen from the air in the room, which is then fed by the ventilation system into the protected area.

Wagner project manager Michael Leibner recalls some of the challenges in working in a bank vault, "We had never worked in special bullet-proof concrete before that. The drillings we had to make in this extremely hard material were a real stress test for all the equipment we used. We also had to proceed with extreme caution. Staying on schedule under these conditions was a real challenge."

Katharina Bengsch is editor (marketing) at Wagner.

Sounds of inertia

Research by Tyco and Michigan Technological University has resulted in a quiet inert-gas nozzle as well as a sound-pressure calculation tool, writes Alan Elder.

Alan Elder is fellow for engineered systems at Tyco Fire Protection Products.

To gain a greater understanding of the impact of acoustic energy on hard drives, Tyco Fire Protection Products has conducted a holistic study of HDD performance with respect to acoustic energy, room acoustics, and suppression system nozzle acoustics.

While installing an inert gas fire suppression system is one option to provide effective protection for data centres, understanding the application requirements is key. These systems have shown, through discharges in the field, that HDD performance may be reduced, or permanent damage may occur to this sensitive electronic equipment as a result of exposure to high acoustic levels.

The sound output of fire suppression systems is dependent on many factors, including discharge duration, peak agent flow rate, valve technology and many others. To develop an inert gas suppression nozzle with a low-sound power Tyco carried out research and modelling of inert gas agent flow. In collaboration with Michigan Technological University, the team focused on the fact that every hazard area protected by a fire suppression system yields varying sound path absorption properties. Data centres should have room acoustic calculations performed to ensure the fire-suppression system installation meets the sound performance requirements to help reduce the risk of HDD degradation should the system discharge. The sound pressure level calculation method requires the use of advanced acoustic formulas to determine the sound absorption between the fire-suppression system nozzles and the data-centre HDDs.

The result of the acoustic research is a novel tool that performs acoustic calculations for data centres: the Tyco acoustic calculator. The calculator helps estimate the sound pressure level generated by an inert gas suppression system using the Tyco acoustic nozzle at the location of the HDD. The operation is simplified through the use of drop-down menus that list the suppression system's parameters; the room materials; and the equipment within the data centre. This enables Tyco's technical services team to perform calculations tailored to each installation.

When used with the acoustic nozzle, the acoustic calculator is a substantial advancement for addressing the acoustic challenges of data centres; it provides an effective solution that can reduce sound exposure to sensitive HDDs. In addition, due to the acoustic nozzle's extensive area coverage, it may even enable the designer to use significantly fewer nozzles and piping.

To find out more about the findings of the research study visit www.hygood.com/Literature/White-Paper-on-Protection-of-Data-Centres.pdf.

ARCHER'S SOPHISTICATED FIRE COVER

Protecting the UK's most powerful supercomputer was a challenge that was faced head-on by installer Automatic Protection.

The US$53-million (£43m) Advanced Research Computing High End Resource (ARCHER) system is located at the University of Edinburgh, Scotland. It is capable of over one thousand trillion calculations every second and it carries out complex computations for multiple research and industry projects in the UK.

The first challenge encountered by Automatic Protection, an authorised Hygood distributor specialising in automatic fire suppression and extinguishing systems, was selecting the most suitable fire suppression solution for the ARCHER.

Hygood's clean agent Sapphire system with Novec 1230 was selected as the most suitable fire suppression system to protect the data-centre room for a number of reasons. Firstly, the extinguishing agent Novec 1230 has a low environmental impact, having zero Ozone Depletion Potential and negligible Global Warming Potential. Secondly, the fluid can be used in occupied and/or enclosed areas; toxicity studies have established that the Novec 1230 agent is very low in both acute and chronic toxicity, with high safety margins between its normal use concentrations and the no observable adverse effect level.

Lastly, the fast-acting clean agent solution is designed to rapidly absorb heat to the point where combustion ceases. Once actuated, the system delivers the extinguishing agent within 10 seconds, stopping fires before they have the chance to spread.

Stuart Harrison, director at APL, highlighted that space was a major challenge for the ARCHER project, because gas cylinders could only be installed at the side of the building, where the HVAC units were located, "Selecting the Sapphire system for this project was the most effective solution due to its green properties and, as we had limited space in the room for the cylinders, we had to design the system around the HVAC set-up. With Sapphire, we had the option to position the containers around the room in the spaces available, whereas an inert system would just not offer this kind of flexibility."

In order to accommodate for the limited free space available, the team at APL used a modular design for the system, which resulted in the cylinders being placed in between the HVAC units, which kept installation costs and piping down to a minimum.

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Sensitive to data

Cooling equipment that also disperses smoke during a fire is just one of the many challenges faced by modern fire protection systems, writes Chris Downing of Siemens.

Data centres are radically different from conventional environments in terms of airflow and cooling techniques, which means that traditional fire detectors are too slow and insensitive to respond to a fire event. While an increased airflow is an important areas where data centre managers can make significant energy savings, it also causes heat and smoke to cool and disperse, affecting the principles on which conventional detectors can respond. In addition, the replacement of air without recirculation prevents smoke from accumulating.

Chris Downing is data centre account manager for Siemens Building Technologies UK.

Unlike conventional smoke detection, aspirating smoke detectors actively draw smoke to the detector through holes within a piping system strategically positioned throughout the protected area. This offers a higher level of protection than standard systems, which can only respond if smoke can actually reach the detection element, which can be too late.

The innovative dual wavelength technology used in Siemens ASD systems differentiates between dust and smoke, delivering an instant warning of potential fire. If smoke is detected, alert signals are processed within milliseconds. A further advantage is that ASDs can also be used in computer cabinets to alert on the overheating of cables or individual components.

The detectors offer up to three environmental modes of operation: ultra sensitive, auto-discrimination and robust, plus an alarm threshold can be defined and programmed. These configurable levels of alarms enable investigation at the earliest smouldering stage of a fire when it is easily addressed and further risk can be averted. Such is the reliability of the unit, it can be configured to ultimately release gas extinguishing suppression systems where conventional detectors may require several alarms before release.

Regarding extinguishing systems, gas systems are often the optimum method for data centres. Sprinkler systems offer a level of protection of people and buildings but may destroy vital equipment and they can be slow to react, particularly where a bulb needs to operate; the bulb needs to reach a certain temperature before it will react.

Water mist is considered suitable by some, subject to their attitude to risk; whereas gases can prevent the smouldering fire from ever bursting into flames, water mist is only really effective on large, very hot fires and no data centre manager would want a fire to escalate to that point.

The extinguishing properties of inert gas systems are based on displacing oxygen in the protected area, which reliably extinguishes the fire and prevents reignition or prevents flaming fires in the first place. Depending on national regulations and the risk of fire, the oxygen level will be reduced to a value typically above 10%, which allows the design of a system that is safe for people, so that it can be left in the automatic mode at all times. As the gases are chemically inert, valuable data equipment remains undamaged.

Overpressure vents are used to limit pressure within the protected space by allowing the corresponding air volume to be displaced outside the room. Depending on the pressure resistance of the room, the design criterion for the overpressure vents is typically from 1 to 3 bar for normal building construction.

Where cleanliness of the extinguishant agent is paramount, and collateral damage unacceptable, there is a range of inert gas and chemical extinguishing agents to suit the particular needs of the data centre. Their human-safe design concentrations enable high levels of protection, whilst maximum agent retention delivers the longest possible protection, which is crucial to today's high-availability

The Sinorix nozzle reduces noise levels without affecting the gas flow rate.

applications. Varying levels of smoke and fire by-products are also flushed during the discharge, reducing any resulting damage.

Nitrogen is the most effective inert gas for room and void protection; its retention characteristics are second to none and application examples include communications systems, data processing and computer rooms. Argon is also present in the atmosphere but is far denser than air, so is typically reserved for specialist applications such as hazardous environments and metal fire risks.

Chemical agents have storage space benefits, so also need to be considered.

In comparison, carbon dioxide, whilst highly efficient, is toxic and generally used to protect production lines and unoccupied areas where effective protection is required for water and contaminant-sensitive areas. CO_2 is typically used to protect transformers, switch rooms, generators and turbines, or directed at a specific object, such as food processing lines, a cutting tool, or within machinery.

Developments in IT have meant that new, higher capacity hard disk drives (HDDs) can be susceptible to the sound energy associated with an extinguishing system discharge. HDD malfunctions can range from automatic shutdown to more severe disturbances, with a corresponding loss of data. To mitigate this issue, Siemens has developed a silent discharge nozzle which reduces the physical sound energy and moves the frequency of the sound away from the specific spectrum identified as crucial, to protect HDDs and entire storage systems within data centres.

Gas-extinguishing systems have two main sources of noise: the acoustical alarm devices used to warn people to leave the area before the extinguishing agent is released and the 'flooding' that refers to the discharge of the extinguishing agent through a nozzle at high pressure.

Siemens has defined the different sensitivity levels of modern hard disk drives in the sound spectrum: HDDs are rarely sensitive to noise in frequencies below 500Hz; certain hard disk drives demonstrate a sensitivity to noise in 500-1.6kHz frequencies; the most critical range in the spectrum is 1.6-8kHz. Although certain HDDs demonstrate sensitivity to noise in the range 8kHz to 12.5kHz, above that they are insensitive to noise.

The focus of all silent extinguishing concepts for inert gas extinguishing systems is the nozzle, the place where most of the discharge energy is converted to acoustic noise. The Sinorix silent nozzle reduces the noise level at the source without affecting the gas flow rate and distribution of the nozzle.

A practical example of the effectiveness of the technology is a London wealth fund management company that suffered a loss of HDDs due to the noise from the operation of their fire extinguishing system and subsequently upgraded their system to include Siemens silent extinguishing technology. Their concerns were significant as the total cost of the outage was not just the physical HDDs, but also the disruption to the normal business stoppage and data loss. Furthermore, they contracted acoustic experts to test the new Siemens system and ensure its effectiveness. The real test, however, arose less than a year later when a fire broke out in their computer room and their new system performed admirably, just as expected; rapid extinguishing resulted and there was no loss of HDD function and all other IT services were unaffected.

By adopting a proactive and preventative safety approach and utilising fully integrated fire safety solutions that protect all operational processes, data centre managers will ensure the integrity of their data, building and assets whilst maintaining maximum uptime and business continuity.

Digitalisation and the impact of a new European services standard will be highlighted during the annual Euralarm Symposium taking place in London in May. Programme organiser Lance Rütimann outlines some of the key themes.

Building on last year's focus on the impact of new technological developments in BIM and IoT this years' event will look into the future of fire and security services across Europe and the business opportunities created due to new standards and the digitalisation of services.

What is the main objective of this year's symposium?

To make two trends visible and tangible for the market so the participants can decide on their next steps.

The first part of the Symposium will concentrate on the consequence of the removal of trade barriers, which simplifies cross-border movement for service providers in Europe; this goes from design through to maintenance. Whether product-related or adding value, standard quality levels for service delivery to end users remain consistently important.

The introduction of the EN 16763 European Norm Services for fire safety systems and security systems in 2017 has the purpose of ensuring that all players answer to the same requirements and deliver quality customer experiences.

The second session will investigate the question of how to make the most out of the already existing fire and security digital market. We are in an era of digitalisation where certain services can be provided from almost any remote location. An example is helping a customer operate their system, but remote access can also enable making small modifications or changes in the configuration. This development towards digitalisation will improve the response times and the quality of the service as well as add significant value to customers through monitoring of systems remotely, which enables predictive maintenance. In simple words, we call and set up a meeting with a customer or schedule a service call before the client even knows that there will be a problem.

What are the expected consequences of the new norm?

Companies working on the fire and security services systems would be required to meet the European services standard. This has the potential to bring a more reliable quality level, which is expected to be mirrored in the way a system is designed, installed, commissioned, handed over and maintained. Depending on the local legislation, fire and security services having problems with a particular subscriber could make an enquiry at the company that is working on the system look if they have the proper qualifications.

What the services standard certainly also means for end users is that they are now able to put certain requirements into their procurement guidelines. So when procuring services for fire safety or other systems they could require that the company that is offering these services would provide a certificate. This will certainly help to define and maintain overall quality levels.

What's in it for fire and security services?

The digitalisation allows faster access to fire and security system to get data that allows to make better decisions. We envision that this will also enable fire and security services to receive more detailed information that will impact tactical decisions during an intervention. Is a fire alarm real or is it false? Does the alarm go on the third or first floor? Is it at the back of the building or the attic? Is there more than one detector? What type of apparatus and how much of it is needed? These questions could then be answered better.

The Euralarm Symposium will take place 8 May 2017 at the Holiday Inn London – Kensington. It is open for all stakeholders in the fire safety or security markets, including installers, system integrators, manufacturers, end users, facility or property managers, certification bodies and other interested groups.

More information on the programme can be found on www.euralarm.org.

The SMART protocol

A new test protocol based on the concept of simultaneous monitoring, assessment and response technology (SMART) is about to be published – and it is expected to kick-start innovation in fire protection for high-risk areas.

SMART sprinklers use multiple sensors and programmable logic to extinguish fires more quickly with less water, theoretically enabling warehouses to be bigger, use less expensive water systems and store more challenging materials.

The only practical alternative using current technology entails sprinklers with large orifices and high pressures of water, which require larger water-storage facilities and more pumping capacity and therefore lead to higher costs.

"The new concept," explains Dr Louis Gritzo, vice president and manager of research with FM Global, "is that if a fire can be detected early enough and a certain prescribed number of sprinklers can be activated right in the fire zone, then the fire can be quickly suppressed with the least amount of water. These were the two drivers and then came the idea, well, now electronics are more reliable and more acceptable."

The system effectiveness was first studied and documented in two technical reports led by Dr Yibing Xin of FM Global, *SMART sprinkler protection for highly challenging fires – Phase 1: system design and function evaluation,* and *SMART sprinkler protection for highly challenging fires – Phase 2: full-scale fire tests in rack storage*. Subsequently, the reliability and cost-effectiveness of this technology were investigated by FM Global, and the results publicly published in the report, *Evaluation of the availability of the SMART sprinkler system*.

The reliability research compares two sprinkler scenarios, one where a fire occurs in a warehouse with conventional risk conditions and a conventional sprinkler solution; and another where the fire-risk conditions are outside the scope of existing FM Global protection recommendations, but where the building is protected by SMART sprinkler. The latter scenario is a warehouse storing paper rolls in stacks taller than 12.8m, compared to a warehouse storing standard materials at a height below 12.8m.

The reliability report contains three main conclusions: firstly, that the availability of both wired and wireless SMART sprinkler configurations (ie their ability to operate when called upon) – is 86% and 83% respectively, compared to 97% for an established, traditional sprinkler system.

Secondly, that the gap between SMART sprinkler availability and that of traditional sprinklers can be roughly halved by increasing inspection, testing and maintenance from once to twice yearly. Lastly, that the estimated lifetime cost of inspection, testing and maintenance of traditional sprinklers is 50% lower than that of SMART sprinklers.

The report also estimated that for a 5,000m^2 warehouse, the cost of installing traditional sprinklers would be around US$280,000, compared to US$710,000 for wired SMART

SMART could potentially begin a renaissance in fire protection for industrial facilities.

sprinklers and US$740,000 for wireless SMART sprinklers.

As commercially available SMART sprinklers don't exist yet, the SMART sprinkler used in the research – which also houses the fire detector – was specifically designed to test the concept and to enable experimentation to begin, as documented in the two reports studying system effectiveness. "We started with some fairly small storage arrangements in a small burn lab in our research campus in Rhode Island to develop the algorithm that takes the sensor data, analyses it and locates the fire," explains Gritzo. "That is one of the key pieces to this system, and it has to be robust and accurate. That was one of the key breakthroughs. The second breakthrough was how to determine how many sprinklers you need to activate."

Following the development of the algorithm plus the identification of the number of sprinklers required to extinguish a small-scale fire, the experiments studying system effectiveness continued in a larger burn laboratory. Here the technology was applied to a number of storage scenarios of increasing ceiling height to prove the concept in different scenarios, relative to current sprinkler protection technology. The testing was so successful that FM Approvals is quickly moving towards a new test protocol for SMART, even if SMART solutions are not yet available. "We've done a proof of concept, we've assembled a system, we've published its characteristics and how we were able to achieve success with that system."

Gritzo admits that it's not exactly typical to create the approval system before the technology is available. "But it represents the kind of innovation that our research programme specialises in. We identify needs that our clients have that are not being served by the industry. Many times it's caused by doubts about the viability of those approaches. If nothing is happening we'll invest on behalf of our clients in innovative solutions and then we'll share those."

Depending on the reaction from the product manufacturers and the kind of systems that are developed, the protocol may be further adapted to accommodate any particular features. "We made the decision that, for proof of concept, we would start with co-locating the detectors and the sprinklers in one unit, to make it simpler. An innovative manufacturer may have another solution to bring to market and we can adjust the test protocol accordingly.

"So at this point, we are looking forward to seeing manufacturers put products together and going to FM Approvals to get them tested and certified." As the commercialisation process rolls on, Gritzo expects that the figures relating to the cost of SMART sprinkler systems, as outlined in the research report, will decrease, as will the gap in reliability between traditional and SMART sprinklers.

The main point, however, should not be forgotten. "The real shining star here, however, is that even though our current reliability analysis shows that the reliability is lower than a current sprinkler system, here is a new opportunity to protect things that can't be protected," says Gritzo. "What we have here is potential for a renaissance in terms of fire protection for industrial facilities; to take those digital systems that have become pervasive everywhere else in the world and use them to really improve fire protection.

"I would put this as an important first step in the evolution of the fire-protection industry for high-challenge industrial applications." Once the test protocol has been published by FM Approvals, it will then be up to the fire industry to rise up to the challenge of the digital world.

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Big in Kuwait

Inert gas suppression system manufacturer Fire Eater and its Kuwaiti partners O&G and Gulf Safety have won significant contracts to install Inergen systems for three projects of the Kuwait Oil Company.

Being able to supply 140-l cylinders of inert gas was a significant factor in the award of the fire suppression element of a US$4-billion project in Kuwait.

Inergen (or IG-541) consists of clean air gases Nitrogen (52%), Argon (40%) and CO_2 (8%) and it extinguishes a fire by reducing oxygen levels from 21% to 12.5% within the protected area. Inert gas systems such as Inergen are often the suppression material of choice in the oil and gas sectors.

For the first project, the Manifold Group Trunkline, Fire Eater is supplying 408 x 80-litre Inergen cylinders with main and reserve directional valve systems that will be installed in 17 substations.

The MGT is an EPC project valued at approximately US$780 million and is integral to Kuwait Oil Company's plans to increase and maintain crude production over the next five years.

Three new gathering centres capable of producing around 100,000 barrels of oil per day, together with associated water and gas, form part of the broader project. These are already under construction in north Kuwait and due for completion towards the end of 2017. The MGT system will provide the feedstock to each of the gathering centres via three independent networks of intermediate manifolds and pipelines.

For the second project, involving Gathering Centre 31, Fire Eater will be supplying Inergen systems incorporating main and reserve directional valve systems with a total of 336, 80-litre cylinders. Located 70km north of the city of Kuwait, GC31 is one of three gathering centres being constructed to support KOC's oil production plans. The project is valued at approximately US$809million and is scheduled to be completed over a period of approximately three years.

At the time of writing these two projects were progressing well with cylinders and associated equipment arriving from Denmark in December and installation completion predicted for the end of Q1.

The third project, the Lower Fars heavy oil development programme, is valued at over US$4 billion and its scope of work covers green-field and brown-field facilities and EPC.

It includes a pipeline of almost 162km to transport heavy crude from the central processing facility at the South Ratqua Field in north Kuwait to South Tank Farm located in Ahmadi, south-east Kuwait, from where KOC has the option to send it to the proposed Al-Zour refinery in the south.

When completed and fully operational it is expected that the Lower Fars heavy oil project will yield 60,000 barrels of oil a day.

Fire Eater's Inergen systems incorporating main and reserve directional valve systems will be installed in order to protect 10 substations. A total of 952, 140-litre 300 bar cylinders will be installed for Lower Fars. At the time of writing 90% of the equipment had been manufactured, scheduled for installation by the end of Q2.

For Fire Eater general manager (MENA region) Jamie Anderson, winning the orders has been quite a challenge due to the competitive environment and the fact that many markets in the region are currently flat due to the low price of oil. "Everyone has been focussing their attention on Kuwait because it has continued to invest. Kuwait has been the success story for many companies."

The key to Fire Eater's success in the area, remarks Anderson, has been working closely with local partners O&G and Gulf Safety.

Following the start of the partnership in 2012, the close cooperation soon after resulted in Fire Eater successfully gaining local approvals from Kuwait Fire Defence in 2013. While Fire Eater provides the materials and system support, the partners carry out the installation, supervision, commissioning and maintenance (if required).

A competitive advantage for Fire Eater as regards the Lower Fars project – the largest installation of its type for the company to date – was the ability to offer 140-litre cylinders instead of the more common 80-litre alternative. This enabled the company to remain competitive by reducing the costs related to additional components such as piping and valves. "They specified inert gases for all three projects. We didn't

A total of 952x 140-litre cylinders are being supplied for the Lower Fars project in Kuwait.

compromise the system in any way, we just used different engineering methods to win the project, namely using 140-l cylinders as opposed to 80-l ones which resulted in cost savings and footprint of storage area. We could have done it with 80 litres but we would have had 1,100 of them, and then you add the associated components, which is where the cost is.''

While 140-litre cylinders, larger and bulkier than the 80-litre versions, could be assumed to be more easily accommodated in the Middle East than space-constrained Europe, Anderson notes that they are becoming increasingly popular in Europe, South Africa and south-east Asia. ''We did try to offer them for the other two projects but the 80-litre version had been specified in the tenders. Sometimes it just comes down to the fact that 80-litre cylinders are more widely available than 140, which opens up the field to more competition.''

To meet the requirements of the tenders a filling plant in Kuwait was approved and audited by Fire Eater's engineers in Denmark in June 2016, who then trained personnel from O&G.

While the Middle East has not generally been noted for its environmental approach in general, being solely focussed on inert gases is providing Fire Eater with a competitive advantage, says Anderson; ''Things are changing, and quite dramatically so. The countries want to change and prove that they are moving in that direction, which is helping us.''

Inert gas systems such as Inergen are popular in the oil industry.

Archimedes in practice

Fire fighting and the Archimedes principle of buoyancy, by Ragnar Wighus.

Traditional fixed fire-fighting systems such as sprinkler and deluge systems use the cooling ability of water and the wetting of combustibles to fight fires; the more water, the better the effect. In contrast, water mist systems use the inerting effect of water vapour in addition to the cooling effect. Ceiling-mounted nozzles result in water droplets flowing (with gravity and momentum from the nozzle exit) against the buoyancy-driven flow of the fire and smoke plume.

However, the local environment and the size of the water droplets in the extinguishing media both have a big impact on fire-fighting effects.

A water-mist fire-fighting system within an enclosure shows the recirculating movement found in the typical flow pattern of combustion products. The fire source causes an upward flow due to buoyancy as well as a downward flow at the sidewalls. Here, the fine water mist spray follows the downwards flow at the sides and is entrained in the fire plume, eventually leading to fire extinguishing. In an open environment, where there is no downwards flow, the most effective way to apply the water mist is directly onto the base of the flames.

As would be expected, fire-fighting effects are also dependent on the size of the water droplets. In a compartment fire with ceiling-mounted nozzles, the largest droplets will penetrate the fire plume; there they will be heated but not fully evaporated, cooling objects and reaching the fire base due to the effect of gravity. The smallest droplets, however, will rapidly follow the hot smoke and they will probably evaporate without cooling the base of the fire. The medium-sized droplets, in contrast, can penetrate the fire plume, enter the flames and may also evaporate inside the flame zone.

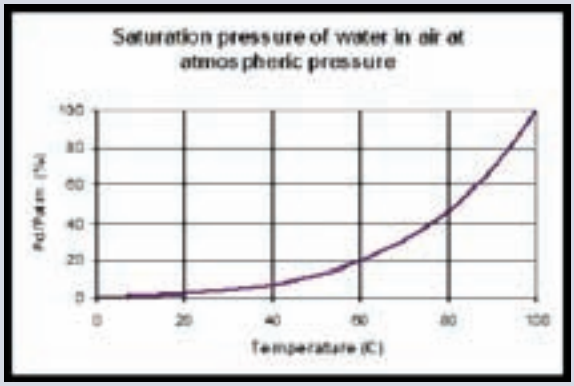
Medium-sized droplets are considered the most efficient or water-mist applications because of the combined effect of cooling and inerting, which is obtained when the droplets evaporate after being entrained into the combustion zone.

For water to act as an inerting gas a concentration of approximately 30% water vapour concentration is required in the atmosphere. The graph below shows that this can only occur if the temperature of air/water vapour mixture is approximately 70°C; at a temperature of 20°C, vapour concentration can be a maximum of 2%.

This vapour concentration is not the same as the oft-quoted relative humidity of air, which is the ratio of the partial pressure of water vapour to the equilibrium vapour pressure of water at a given temperature.

To achieve an inert atmosphere in a compartment, therefore, an air temperature of around 70°C is necessary, which is perfectly possible in a fire situation. Water evaporates at all temperatures, even below the boiling point (100°C), but the limit of how much water will be in the atmosphere is as per the saturation pressure graph, shown below.

It is also worth noting that a medium-sized droplet flowing upwards along with the gases inside the plume will be in contact with the hottest part and therefore will evaporate the fastest. Once upwards momentum inside the fire plume is lost, the droplet will again fall down, effectively leading to the 'recycling' of the non-evaporated part of the water droplet.

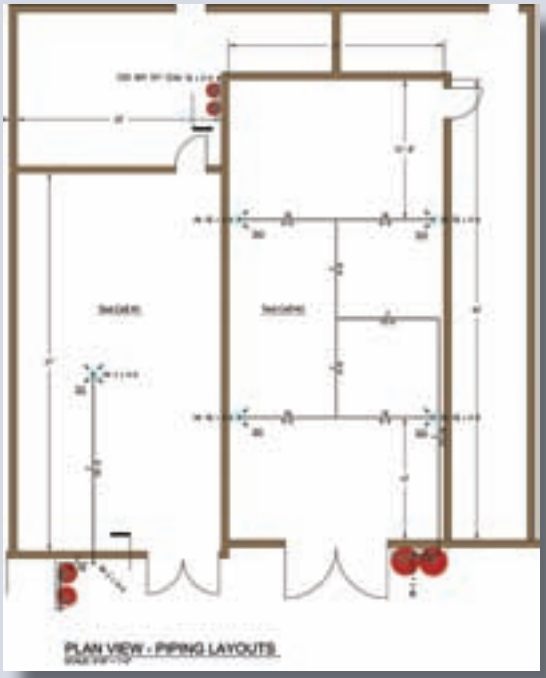


Ragnar Wighus, chief scientist at SP Fire Research Norway, is also chair of the International Water Mist Association.

The Archimedes Club is an informal gathering of the International Water Mist Association. A prospective member has to have used the principle of buoyancy to improve the performance of a water-based fire-fighting system. Archimedes' principle states that the upward buoyant force exerted on a body immersed in a fluid (ie liquid or gas), whether fully or partially submerged, is equal to the weight of the fluid that the body displaces and acts in the upward direction at the centre of mass of the displaced fluid.

In the test cells

Working closely together with engineers and distributors is essential when evaluating a new configuration or restructuring an older system, writes Fred Hildebrandt of Janus.



Fred Hildebrandt is director of sales at Janus Fire Systems

The importance of collaboration was shown recently when a significant customer of a US-based distributor of Janus Fire Systems found that five automotive test cells were protected by Halon 1301 systems that had been installed in the mid-1980s.

The systems were well maintained but the end user was highly concerned that a Halon discharge would be detrimental to the environment. There were a number of challenges involved in the project, not least of which was that the test cells were a profit centre so disruption of protection had to be minimal. In addition, original design drawings and calculations were not available; and parts for the system control panel and mechanical components had been discontinued long ago.

Assessing the installed systems together, the Janus team and the local distributor found that the piping was visible and in good condition, which enabled the development of an isometric representation of the installed piping.

Each hazard was carefully surveyed to determine the volume and fuels within the hazard area. The inspection confirmed that to minimise downtime the Halon 1301 systems had been installed in the main and reserve locations, affording protection even after a system discharge. In one of the cells, it was found that recently added equipment had blocked the discharge nozzle, which would negatively impact the distribution of the Halon 1301 throughout the hazard area. To future-proof the new system, additional 90° degree nozzles were added to afford effective agent distribution in any position.

Both Janus' design suite software and the data from the survey showed that the existing piping could be used with Janus Fire Systems' 500psi Novec 1230 hardware. The flexibility of the software coupled with cylinder configurations and nozzles allowed the systems to perform in accordance with NFPA 2001 and Underwriters Laboratories Approval. An improvement was made by upgrading the system actuator to NFPA 2015 sections 4.3.4.1, which states that 'removal of an electric actuator from the agent storage container which it controls shall result in an audible and visual indication of system impairment at the system releasing control panel.'

Once the mechanical portion of the system was in hand, the control panel and accessory devices were tackled. These systems were conventional mirror images of each other and appeared to have been installed at the same time as the Halon 1301 equipment. While the team had several replacement possibilities available to them, the end user required minimum complexity, therefore, the solution selected for each of the hazards consisted of the Janus C-1 conventional control panel, whose footprint closely matched the size of the existing panels. Working closely with the client's schedulers as test cells became available, local staff disabled the Halon 1301 cylinders, actuated the systems in an effort to confirm the sequence of operation, actuation of alarms, shutdown signals and interface with fire alarm and evacuation systems.

Existing panels were then carefully removed, the external wiring tested for suitability, and detectors, manual fire alarm stations and audible visual devices were replaced with modern equipment. Each system was then tested to ensure it performed as well as its predecessor.

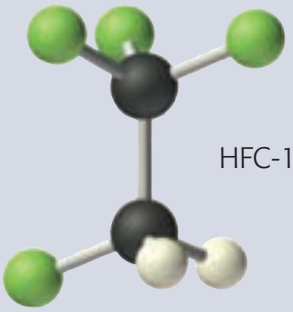
The Janus Fire Systems 500psi Novec 1230 equipment was then sequenced for installation – typically a 48-hour period is allocated for the mechanical installation and test.

Finally, the Halon 1301 was removed from the site and sent to an authorised recycling company in accordance with US regulations. In total, the project took around 14 months to complete. The end result of the successful collaboration was a better-protected site as well as environmental peace of mind for the owner.

Left to right: Janus C-1 conventional control panel for the Novec 1230 cylinders. Piping layout plans for the installation.

PHASE DOWN

What does the Kigali Amendment mean for HFC-based clean agents? The key, writes Al Thornton of The Chemours Company, is that HFCs are being phased down, not phased out.



HFC-134a, CH_2FCF_3

1,1,1,2-Tetra fluoroethane is a non-flammable gas used primarily as a refrigerant for domestic refrigeration and automobile air conditioners.

Since their introduction 25 years ago, it is estimated that HFC-based clean agents have protected over 141 million cubic meters of critical space around the globe. Most of the agent remains in the original system cylinders, available to provide rapid protection in the event of a fire. When no longer needed the agent is removed, recycled, and reused to service existing systems or new facilities. Over the course of HFC fire protection history, only a small percentage of the agent has been released to extinguish a fire – but the value of those extinguishments, in time and material saved from fire, has been enormous.

The Kigali Amendment was adopted in October 2016, adding hydrofluorocarbons to the list of substances managed by the Montreal Protocol. It provides for a phase-down schedule – not a phase-out – of HFC products. The Amendment creates four groups of countries, each with different baseline volumes and reduction schedules.

The Kigali Amendment does not call for a complete phase-out of HFCs, but a phase-down: a reduction to 15% to 20% of the baseline in 2036 or 2047, depending on the countries involved. This remaining production extends out indefinitely, recognising the importance of HFCs for many critical and non-emissive applications, such as fire protection. The small red line at the bottom reflects the global requirements for HFCs in fire protection; a small fraction of the baseline and allocation.

The Kigali Amendment does not limit the sale or use of HFCs in fire protection in any region. It provides for a 'cap and reduction' of HFCs on a GWP-weighted basis over a specific time period – a 'phase-down', not a 'phase-out'. An important aspect of this allocation scheme is that it does not restrict the amount of any particular HFC placed on the market or the amount of HFCs used in any particular application; it simply restricts the total CO_2 equivalents of all HFCs that can be placed on the market in a given year.

Fire protection represents only 1% of the global HFC market on a mass basis and about 2% of the total global HFC market on a GWP-weighted basis and the Amendment is not likely to affect the supply of HFCs available for fire protection. HFCs in refrigeration, foam blowing and aerosol propellant applications account for the majority of the global HFC market and the majority of the environmental emissions. With active replacement programs in these much more emissive applications, the volume of HFCs required in these markets will be a fraction of today's use. Conversion programs are already successfully underway in mobile and fixed refrigeration, propellants and foam expansion.

For example, the mobile (automotive) air conditioning industry is migrating from HFC-134a to HFO-1234yf technologies. By the end of last year, more than 24 million cars have switched to HFO-1234yf, and 2017 will see an estimated 50 million cars with HFO-1234yf systems. Additional regulatory constraints on specific HFCs in refrigeration and other non-fire protection applications, combined with other reductions in the HFC refrigeration market, will release GWP allowances and provide for the continued use of HFCs in fire protection.

The EU F-Gas regulations and MAC Initiative have provided us with a trial run of a similar cap and allocation scheme for HFCs. While there have been some minor adjustments and lessons from managing the allocation process in Europe, the overall effect has been an engaged shift to alternatives in air conditioning, refrigeration and some foam-expansion applications; with sufficient allocation quotas to meet the needs for key fire products.

Sufficient GWP allocations will be available throughout the course of the Montreal Protocol to support the requirements of key applications such as fire protection, confirming the viability and availability of HFCs like FM-200 to protect the world's infrastructures and crucial facilities for decades to come.

In December 2016 the US EPA published Final Rule 21, revising the SNAP listing status for certain HFCs in specific applications. SNAP Rule 21 modified products in refrigeration, foam expansion, and aerosol propellants. The Rule provided no change for the use of HFCs in fire protection. EPA has indicated they believe the changes enacted through Final Rule 21 will allow the US to meet its Kigali Amendment targets through 2029.

While the industry remains committed to research and developing new techniques and products to protect critical facilities from fire, the regulatory authorities are likewise committed to supporting the safe, tested, and proven HFC products supplied to the market today. We fully support the goals of Kigali and the transition to low GWP-alternatives in applications that have an environmental impact. The Kigali framework, along with supporting regional regulation, secures the future for non-emissive applications such as FM-200 fire suppression. As long as there are critical hazards requiring clean, safe, effective fire protection, HFC-based clean agent fire protection will be available to protect them.

The Kigali Amendment does not limit the use of HFCs in fire protection.

Problem

Reports of fires in recycling centres are still appearing on an almost daily basis but there are signs that things may be changing – and fire detection is at the heart of the trend.

In February this year 53 firefighters and six appliances were tackling a huge fire at Hanbury Plastics Recycling where a thick plume of toxic smoke was seen rising 300m into the sky. This fire in Milton, Staffordshire, around 70km north of Birmingham, was found to have been caused by arson.

In January, 70 firefighters and 10 fire engines attended a fire at a recycling plant in Brentford, London where around 75 tonnes of recyclable waste were on fire.

Considering the frequency of such events, it is not surprising that the UK's Environment Agency has placed fire detection at the heart of its fire strategy for recycling centres.

Since last year, the EA requires a fire prevention plan as a prerequisite for the issuance of an Environmental Permit. The guidance says operators must have procedures in place to detect a fire in its early stages so that its impact can be reduced, with detection systems being proportionate to the nature and scale of waste management activities carried out. Among the appropriate automated systems suggested are smoke and heat detectors, including temperature probes; CCTV visual flame detection systems; and spark, infrared and ultraviolet detection.

In waste handling facilities, flame detectors are usually installed as part of a complete fire detection and suppression system. If a shredder, for example, catches fire, as soon as the flame detector recognises that there is a fire, it passes a signal that automatically stops the machinery and initiates a fire suppression system.

While it is nigh-on impossible to ascertain how quickly fire detection is being taken up by the recycling industry, the signs appear to be positive with a number of reports describing such installations becoming available.

To protect its waste recycling facility from fire hazards, some months ago Winters Recycling installed eight optical flame detectors at its Hitchin site, 100km north of London.

These detectors were chosen because they have the ability to detect almost all types of flickering flames, no matter the source, whether it be paper, plastic or metals. The infrared technology within the Talentum Dual IR sensors works irrespective of the presence of dust, steam or smoke – and is not affected by wind or draughts. A processor analyses the optical sensor signal waveforms and determines if they represent flames and, if so, accepts them. If the signals do not match the internal algorithms for flames then they are considered to be false sources and rejected.

The same technology was installed last year in a relatively new biomass handling facility operated by E.ON at Gladstone Docks, Liverpool, UK.

The Liverpool depot consists of three conveyors taking the biomass direct from ship to train or from ship to a large storage building. Up to 10 trains per day transport the biomass to Ironbridge power station in Shropshire.

Due to the highly flammable nature of the biomass, the fire and safety plan required an extensive fire detection and suppression system on all three main conveyors. Here, the flame detectors work in tandem with a water-mist system to protect over 700 metres of conveyors.

Each conveyor is divided into fire zones, with each zone having a dedicated Talentum flame detector, zone valve, fire control panel and set of water pipes and spray nozzles. The flame detectors and nozzles were installed inside the conveyor covers to provide optimum protection of the biomass. The water-mist system operates from a central high-pressure pump set with 100% redundancy.

identified

The entire system is linked to a side-wide addressable fire panel which allows further automatic controls to be programmed, ensuring the desired number of zones will automatically operate when required and that the conveyors will stop as soon as the fire system operates.

Another cutting-edge fire system has been installed in a high-profile waste-to-energy plant that opened in Stourbridge, Worcestershire last May.

The US$1.3-million fire contract was awarded to fire detection and prevention equipment supplier Argus Fire. The plant was financed by Worcestershire County Council and Herefordshire District Council, with Swiss waste to technology provider Hitachi Zosen Inova acting as the main EPC contractor.

The admininstration building, weighbridge, turbine hall, air cooled condenser area, pipe bridge, tipping hall, waste bunker, boiler hall and flue gas treatment area at Envirecover are monitored by an addressable fire detection and alarm system. This is connected to five fully networked open-protocol fire alarm panels and a disabled refuge panel.

The devices include smoke and heat detectors, break-glass units and sounder beacons, a very early smoke detector (VESDA) air sampling system, triple IR flame detectors and thermal imaging cameras.

The water-based fire protection systems include a 1,000m^3 tank and a pump house with pumping systems approved to the NFPA 20 standard that are capable of delivering 10,000 litres of water a minute.

The waste bunker roof, tipping hall roof, shredder motor room, ammonia storage area and emergency diesel generator are protected by sprinklers; the waste bunker is protected by remote-controlled fire water monitors.

The control room windows, waste hopper openings, steam turbine bearings and steam turbine lube oil skis are protected by a deluge water spray system; the boiler burners have enhanced protection with a foam sprinkler system.

Six inert gas fire suppression systems using the clean agent IG541 are also protecting the plant's distribution control system and motor control centre for the plant crane, as well as for the main equipment room and server rooms, uninterruptible power supply room, low voltage switch room and turbine control room.

To top it all off, the fire prevention systems have been integrated with other systems including door access controls, entry and exit barriers, lifts, roller shutters doors and the building management system.

If all recycling centres were similarly well protected, their environment-friendly reputations would be truly deserved.

This biomass handling facility UK was recently opened at Gladstone Docks, Liverpool, and is operated by E.ON.

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Aspirating in the cold

A food processing company in the county of Norfolk, UK has installed aspirating smoke detectors with heated sampling points in its cold rooms.

Gressingham Foods' new facility in Diss, Norfolk (east of the UK), employs 550 people and has over 20 different farm sites across Suffolk and Norfolk.

Ten early warning systems with filter boxes and dirt trap boxes have been installed in the pallet racking warehouse, several cold rooms and a packing area.

The cold rooms, where temperatures range between -4C° and -22C°, are fitted with heated sampling points to prevent the build-up of ice affecting the system. Should a sampling pipe be affected by low ambient temperatures to the point where accumulating ice crystals might impact adversely upon its performance, the heating automatically comes on to immediately eliminate the problem.

The seven ASD 535-1 single sensor detectors and three 535-2 dual sensor detectors manufactured by Securitron were installed by local engineering company E Rand & Sons.

The ASD 535 is the flagship model of the ASD detector range and it can monitor an area of up to 5,760m^2 square metres. The detector analyses the airflow from one or two sampling pipes independently, reliably identifying any deviation in the airflow while detecting any breakages or blockages in the sampling pipes. Up to 400m of sampling pipe with a maximum of 120 sampling holes can be connected to each smoke sensor. Its ambient temperature range reaches as low as –30°C, making it perfect for cold storage warehouses.

Racking system at Gressingham Foods' new facility.

Safety alert: fire alarm may fail

The affected detectors are FM-approved and comprise two wireless photoelectric smoke detectors branded Notifier and Fire-Lite and one Fire-Lite- branded wireless photoelectric smoke/thermal detector.

The fire alarm from these wireless smoke and smoke/thermal detectors may fail to be communicated.

The alert was originally issued by Notifier by Honeywell on 30 December and disseminated by FM Approvals in January.

According to FM these detectors may not communicate a fire alarm condition if certain environmental factors are present at an installation site. To resolve the issue a firmware update is required on the FWSG (Notifier) or W-Gate (Fire-Lite) wireless gateway modules, which are part of the SWIFT wireless system.

SWIFT, or Smart Wireless Integrated Fire Technology, is a commercial wireless system that uses robust mesh network that integrates with intelligent fire systems.

The update is required on all gateways manufactured between October 13, 2014 and December 15, 2016.

Affected organisations should contact their local Notifier or Fire-Lite distributor for a downloadable firmware upgrade.

According to Notifier by Honeywell, it was aiming to have FWSG gateway SLC micro firmware version 2.1 available for download in mid January, but this has not been confirmed.

Notifier is not new to safety bulletins. In 2008 it recalled 2,000 fire alarm control panels. It was found that the software in the fire alarm system could fail to process an alarm condition which could result in the system failing to respond in the event of a fire.

Pan-European certification

A pan-European certification scheme for fire and security products now offers certification to ISO 7240 *Fire & life safety alarm systems* as well as some EN standards not yet harmonised.

The Certalarm certification scheme, which is managed by a non-profit association based in Brussels, is valid throughout Europe and has been endorsed by the European Co-operation for Accreditation. It is designed to improve efficiencies and increase the speed to introduce new fire products and technologies across Europe, by providing a one-stop-shop for certification that dispels uncertainty regarding the standards against which products should be developed, tested and certified

The Certalarm scheme now covers a number of EN 54 standards that are not yet harmonized under the Construction Products Regulation, namely EN 54-22:2015, *Resettable line-type heat detectors*; and EN 54-27:2008, *Duct smoke detectors*.

Marc Chenevoy, chair of the Certalarm's technical advisory group, commented: "It is important that newly published EN 54 standards are made available through Certalarm. Due to current backlogs in the standards organisations, some documents have been on hold for over a year to be listed in the Official Journal for compliance with the CPR. Until this listing is released notified bodies cannot issue CPR certificates for the corresponding products, whereas Certalarm can list EN54 and now the relevant ISO standards."

Anti-ligature fire detector base

A fire detector base that cannot be used to hide contraband or assist in self-harm has been re-designed and launched by Gent by Honeywell.

The S-Quad Anti-Ligature Base is made for buildings that accommodate individuals who are considered to be at risk, such as hospitals, prisons, mental health units and other secure facilities.

It features no points where a cord, rope, or bed sheet could be looped or tied. Additionally, the device does not afford any spaces to hide drugs, knives, razor blades or any other items that could be used for self-inflicted damage; it also incorporates an anti-tamper lip.

A built-in magnetic switch provides loop continuity even when multiple devices are removed; this ensures full loop integrity without the need for a separate T-breaker. As well as being easy to install, it is certified to 6.4kg release load and it is easy to reinstate the device if removed.

Simon Foulkes, Product Marketing Manager at Gent, commented: "The protection of vulnerable people is taken incredibly seriously, so when our customers offered suggestions about how the previous S-Quad Anti-Ligature Base could be improved, we instantly set about redesigning it. The result is the ALD302 and I am confident that it will make a valuable contribution to the way that the pioneering S-Quad fire detection portfolio can be used within specific environments that accommodate those who are potentially at risk."

The base has been verified by the National Offender Management Service, the body responsible for correctional services in England and Wales.

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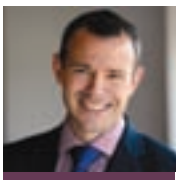
Fire goes BIM

As the construction industry embraces the digital age, where is the fire detection industry? Charles Smith of Apollo provides an overview of BIM's introduction and fire detection's progress within the new world.



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

Building Information Modelling (BIM) is the perfect illustration of how digital advances within the construction and building management sector can give even the most experienced of architects, builders, specifiers and fire detection system designers a helping hand to achieve higher levels of accuracy and efficiency.

It was back in 2011 that BIM became something of a buzz word within the sector as the UK Government announced, through the Government Construction Strategy, its intention to require collaborative 3D BIM on all public projects. The strategy had the main aim of modernising the industry and driving a 20% reduction in both capital cost and the carbon footprint from building projects.

When it first announced this strategy in 2011, the Government initially aimed for implementation within two to three years, but it soon became clear that the construction industry wasn't ready for such a big step. This led to the implementation date being repeatedly pushed back, eventually to a target of 2016 for all project and asset information, documentation and data being handled electronically via BIM level 2.

As we've now seen, the final 2016 deadline has come and gone and we're beginning to see the impact of BIM construction strategy, with many companies' plans now totally digitalised and paper versions fast becoming a thing of the past. For early adopters such as Apollo (our BIM library was completed in June 2016), BIM compliance is a truly unique selling point although it's a fair observation that the fire industry in general still has some way to go before its use is a given.

A BIM object can combine product defining information, product properties, geometry data and functional data.

A BIM object is a combination of many things, product defining information, product properties, geometry data and functional data. Our BIM models include properties that derived from COBie-UK-2012 and requirements called for by the NBS BIM Object Standards. They are available in both Revit and IFC formats, and provide an accurate digital representation of an Apollo product.

The demand we've seen for our BIM information has been very encouraging. To date, we've seen our BIM objects – both through the NBS national BIM library and our own website – achieve nearly 200,000 views and tens of thousands of downloads. While there is a heavy UK focus, it's worth highlighting that these figures include users from over 130 different countries. These statistics pay testament to the potential positive impact of the platform to drive innovation within the fire industry on a truly global scale.

The benefits of BIM are clear, with much of the anecdotal feedback we receive being hugely positive. One of the main advantages of its use in fire detection systems is the role it plays in managing integrated systems which often involve different partners, for example one contractor for a fire suppression system, one for the evacuation strategy and another for the detection design. Independently, the three may not always come together, but BIM offers the flexibility for architects and system designers to be able to digitally visualise the product and system models for a range of contractors and how these fit into a plan. This is especially beneficial in circumstances where modifications and adaptions are required.

Another benefit is the ability of BIM to help the customer understand the life cycle of a building. This is particularly pertinent in circumstances where a building may have

been taken over and the new occupier hadn't been involved in its original design and construction, or for the owners of multiple properties who may currently have numerous paper plan details. BIM offers the opportunity for these groups to achieve a better understanding of what has been installed and where, helping to advise them on which products are reaching the end of their life cycle, and when. This is obviously a huge advantage for ensuring the reliability of fire detection systems.

The same approach can also be applied to system maintenance. Knowing when a device or system was installed, and its location – particularly on large-scale projects which see hundreds of detectors in place – is a valuable tool. This helps to ensure that detection systems are regularly maintained, preserving their effectiveness and allowing customers to schedule a cost-efficient programme of maintenance for all of their devices.

Finally, as one of the key driving factors for its inclusion in the UK Government's Construction Strategy, it's no surprise that BIM offers considerable cost savings for industry. As outlined, BIM is a helpful tool in ensuring timely maintenance and a significant factor in ensuring the effective operation of a detection system. Cost savings can also be seen at the design stages, with architects and system designers able to see exactly how many devices are needed for a successful system, thereby minimising the wastage of over-ordering often seen in projects.

BIM also plays a fundamental role in helping to deal with the complex intricacies often seen on building projects. An example might be where problems, such as a structural beam in an awkward position, might previously only have been found once detectors had been delivered and installed. These troublesome factors can now be digitally visualised, and solutions to them implemented.

So, what can we expect to see in the future for BIM? It's clear that its uptake will continue to flourish as its adoption moves increasingly into the private arena as a natural progression from its mandated status for public projects.

In general, as our digital age continues, it will undoubtedly open up a raft of opportunities for the industry. One of these will certainly be the widespread creation of virtual reality environments, which will give all of us within the fire protection sector the opportunity to fully visualise a project at the initial architect design stages. We also fully expect a move towards greater interconnectivity between more systems than at present, as the increased use of digital technologies leads to higher levels of systems integration. The digital age, and its focus on innovative solutions which will improve safety and efficiencies, is something that we fully embrace and we're excited about the future developments we anticipate within the sector.

Integrity on high

Passive fire-protection solutions play a vital role in high-rise buildings such as the Al Fattan Crystal Towers recently completed in Dubai, writes Chris Hall of Siderise.

Fires in high-rise buildings generate large quantities of smoke that tend to spread vertically throughout the building even when the fire is contained to only one room. Smoke travels at up to 130m every minute and whilst most people can easily move at this rate in normal circumstances, the majority of survivors of fires state that smoke restricted their ability to see beyond 4m. It is not surprising then, perhaps, that asphyxiation from smoke and noxious gases accounts for more than 40% of fatalities and that most deaths happen to people who were not even in the room where the fire originated.

When the linear gap at perimeter edge between the floor and curtain wall is not properly sealed, flames and smoke spread vertically to higher floors. Addressing these linear gaps with firestops maintains the floors' fire compartmentation and delays vertical smoke-spread; the risk of smoke-related deaths in the upper floors of the building is thus reduced.

Chris Hall is commercial development officer at Siderise.

THE DANGERS OF NON-COMPLIANCE

The owners of Lacrosse Apartments in Melbourne's Docklands precint have been ordered to remove non-compliant cladding.
The Lacrosse Apartments made international news following a major fire in November 2014.
The blaze, which the Metropolitan Fire Brigade's investigation showed was started by a discarded cigarette, was dramatically exacerbated by the non-compliant use of an aluminium composite external wall cladding.
The MFB investigation confirmed that the existing Alucobest cladding did not meet the relevant performance requirements of the Building Code of Australia.
During an appeal that concluded in January, the Victorian Building Appeals Board upheld the orders of the Melbourne City Council Municipal Building Surveyor and ordered the owners to remove the cladding on the Lacrosse Apartments.
The decision means the 470 owners of the Lacrosse apartments could be left with an US$6.6 million (AU$8.6 million) cladding replacement bill, on top of AU$6.5 million already spent to fix damage from a fire that tore up the 21-storey building in 2014. Fire Protection Association Australia CEO Scott Williams commented: "Owners have a right to feel let down by the system that has failed to protect them from this situation. Recent changes to the Building Act are encouraging regarding industry reform at large, but these changes still don't treat the core issues of education and enforcement and clearly there is much more to be done." Although the Building Appeals Board is yet to set a date for the cladding to be removed, local reports suggest a Supreme Court appeal is also likely on the latest decision.

Perimeter barrier firestops effectively seal the linear gap between the edge of the compartment floor slab and external curtain wall. However, project designs and site tolerances mean that this linear gap can be variable, so a firestop system needs to have a degree of 'dynamic' movement in the form of compression and recovery – and do so not only while retaining its primary fire resistance functional requirement but also while matching the same level of fire resistance as the compartment floor.

All firestop systems need to be tested to two criteria – Integrity and Insulation (EI).

Integrity (E) refers to the ability of the system to prevent the passage of flame, smoke and combustible gases either through/around the material or through joints in an assembly; while Insulation (I) refers to a measure of the increase in conducted heat transferred from the exposed to unexposed surfaces of 180°C rise above ambient.

These two criteria are critical in the development of curtain wall perimeter firestop products. The most effective products combine a number of material features – density, thickness, resin content, fibre structure and controlled compression – which together determine the resistance properties.

When looking at the Integrity (E) criteria, the material chosen must be impervious to the transfer of flame and gases, easy to install with minimal site management and accommodate all real-world requirements at interfaces, joints and details.

At the US$135 million Al Fattan Crystal Towers recently completed at the Dubai Marina, UAE, fire safety was paramount in a development which houses hotel rooms, suites and residential apartments.

With both vertical and horizontal fire compartmentation requirements, the specification of Siderise CW-FS 120 firestops provided the contractor Cladtech with a single solution that could maintain a fire and smoke seal in one product while filling linear gaps in excess of 300mm at the podium levels.

For the two towers, Cladtech installed 12,000 linear meters of Siderise CW-FS 120 firestops including floor slab and vertical compartmentation. With the timeline on the project critical, the use of this dry fix system enabled the work to be completed quickly and efficiently, ready for handover to subcontractors.

Whilst specifying the correct product is vital, the quality of installation is equally as important. Contractors installing life saving measures such as perimeter barriers and firestops must have adequate training on the particular manufacturer's products and be qualified to install it in the first place. When it comes to saving lives and protecting businesses and property, a well designed and installed system can make the difference.

Nicely wrapped up

In just one month three separator vessels on the Statoil Mariner offshore platform have been fitted with 963m^2 of thermal protection in the form of ultra-light fire insulation blanket.

The new vessel fire protection system is being used to maintain structural integrity of the separators against jet and hydrocarbon pool fires.

Fire protection is crucial because these separators contain hydrocarbon inventory, which can become additional fuel to a fire in the event of structural failure. Thermal weakening and failure would occur via the heating of the walls of the separator through the exposing fire case.

The design fire scenario stated that the separators should be able to withstand fire loads of five minutes of jet fire at 350w/m^2, followed by five minutes of jet fire at 250kw/m, and an additional 50 minutes of hydrocarbon pool fire. Morgan Advanced Material's Firemaster solution was considered the most effective

and easy-to-install option for the project, which had to be completed within the space of just one month.

The initial plan for the project was to use traditional cellular glass, alkaline earth silicate wool with stainless steel cladding. However, the project party agreed that it would be more beneficial to seek out a lighter, more immediate insulation solution. The Firemaster vessel-protection system was selected due to its proven resistance to fire; ability to provide a certified solution for vessels; and its low rate of water absorption. The approach entailed using stainless cladding over the blanket to provide the necessary protection against erosion from the jet fire.

Upon receiving the design information, Morgan used its database of jet-fire testing to validate finite-element modelling to calculate the specified insulation thickness required to satisfy the critical temperature requirements of the vessel shell. With the tight project timescale in mind, Morgan's engineers advised that the first stage separator would require an insulation thickness of 50mm, with the second stage separator and test separator requiring a thickness of 63mm*.

The penetrations, which were to be insulated after erection, would require a coatback of 150mm to reduce the heat input into the vessels. Consideration also had to be given to the nozzle welds, which are inspected after one year and subsequently every five years. To facilitate easy access, inspection hatches were installed according to Statoil's own insulation handbook.

Three installation teams worked in tandem, to complete the insulation on time. Having all separators in one hangar allowed the teams to rotate around each separator in turn, by discipline. One team carried out the mesh work before moving to the next separator, while the insulation team came in behind on the separator that was vacated, followed later by the cladding team.

The Firemaster vessel system uses stainless steel mesh to support the blanket; to minimise any damage to the vessel paint coating and the potential for corrosion under insulation, the fixing mesh was set off from the vessel surface using strips of Teflon.

Proven resistance to fire and a low rate of water absorption were among the reasons for Firemaster's selection.

The subsequent air gap between the vessel surface and the wire mesh provided ventilation and reduced the risk of trapped water building up underneath the insulation. This further minimised the potential for corrosion under the insulation, which is a typical issue experienced in applied offshore insulation projects. The blanket was then encapsulated to reduce the potential for water absorption into the insulation system, helped by a water repellent blanket.

A key contributing factor to the fast and successful insulation of the separator vessels was the close collaboration between all parties involved in the project; Statoil, Daewoo Shipbuilding and Marine Engineering, and Morgan Advanced Materials.

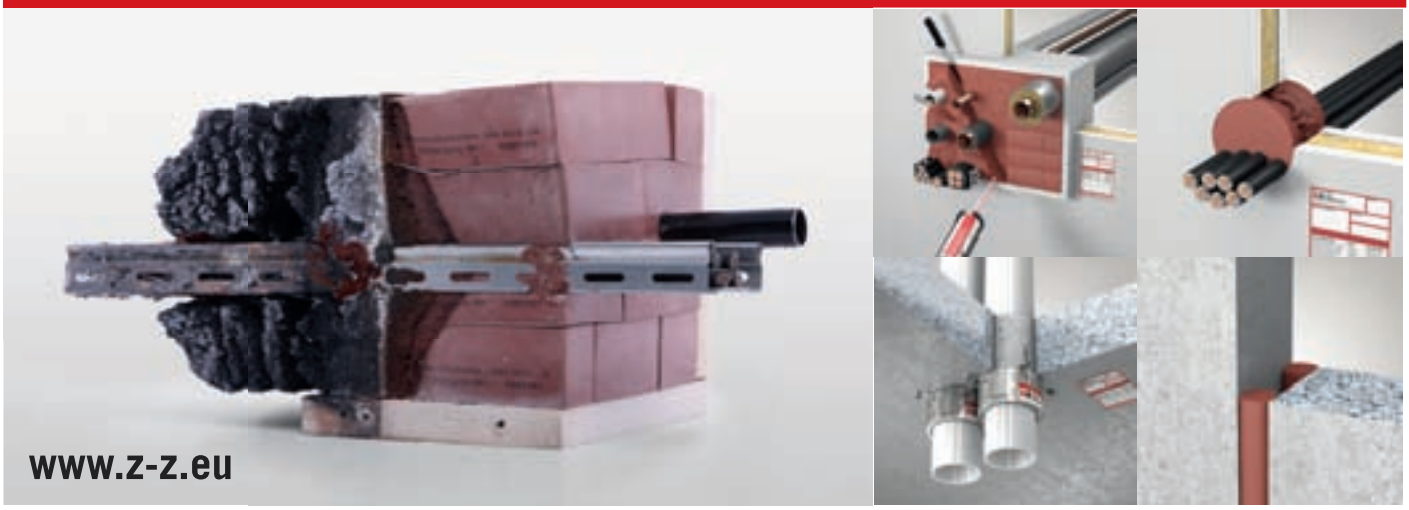
** DMSE and Statoil agreed to install the Lloyd's Registry certified system of 88mm thickness.*

INTUMESCENT FIRESTOP SYSTEMS

- Mixed-, cable- and pipe penetration sealings
- Joint seals with movement capability

References:

Medicine Management Transport Industry



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LEARNING ZONE Fire & smoke curtains

Mike Ward is sales director at Coopers Fire.

What are fire and smoke curtains?

Fire-resistant fabric barriers encased in a compact steel housing. The fire and smoke curtain barriers remain invisibly retracted until activated by an alarm or detector signal, at which time they descend safely to their operational position. Fire and smoke curtain barriers will stop and control the spread of fire and smoke in a building.

Where should they be used and why?

Fire and smoke curtains help designers of highly automated facilities to create large open plan premises, without compromising safety. Used in place of traditional compartmentation, smoke and fire curtains offer greater flexibility, allowing for larger open plan premises and greater freedom of movement.

In manufacturing premises, fire curtains can be used to protect plant areas and production facilities where multiple individual machines are operated by a limited number of operatives. They can protect production line fire break points, openings from one building to another where conveyor belts and tracks pass through, service and goods lift openings, roof lights and wells and offer building boundary protection.

CASE STUDY

In a recent application for the German Schütz Group, Coopers Fire was commissioned to manufacture and install fire curtains that, in the event of fire, would deploy and prevent the spread of fire from one factory building to another along a conveyor belt tunnel linking the multiple buildings together.

The UK factory based in Worksop, Nottinghamshire has more than 120 employees and is active in the fields of production and reconditioning of Schütz containers.

The factory comprises three main units that are interlinked by conveyor belt tunnels that assist in moving products from one building to another.

Coopers Fire installed a series of Firemaster vertical fire curtains along the conveyor belt tunnels specifically designed to compartmentalise the spread of fire from one building to the next. The fire curtains installed also offer boundary protection by creating a separating element within the interlinking conveyor belt tunnels.

What are the space requirements?

There is a whole range of different products available that are suited to a manufacturing environment. It is likely there will be large, expansive areas to be protected, so it is essential to specify a product that can allow a continuous run of fire or smoke curtains with minimal amounts of steel work or side guides. Most of the fire and smoke curtain products on the market can offer unlimited widths, but standard products may be limited to drops of up to 11m.

What are the considerations for specifying?

If the curtain is for compartmentation, then the integrity of the fire curtain needs to be taken into account. The integrity is determined by the letter 'E' and is rated in terms of minutes. The higher the E classification, the longer the compartmentation barrier will remain.

If the fire curtain is required to protect a means of escape, then an insulating zone may be necessary. Traditional fire doors can be removed to make free flowing corridors, but in the event of a fire, an insulating zone may be required as part of the escape route. An insulating zone is an area that allows occupants to pass by a fire curtain without the radiant heat temperature being too high. The radiation of a fabric is noted by the letters 'EW'.

A classification of E120 EW60 would mean the curtain has been tested and offers integrity (E) for 120 minutes and radiation (EW) for 60 minutes.

To comply with fire safety legislation, fire and smoke curtain barriers must be protected from a short circuit and or total power failure. In most systems this takes the form of an electromechanical fail-safe system.

And maintenance?

It is essential that they are regularly serviced and maintained. It is recommended fire and smoke curtains are serviced annually and tested with the fire alarm system once a week.

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