THE CATALYST

Q2 2021

JOIFF

THE INTERNATIONAL ORGANISATION FOR INDUSTRIAL EMERGENCY SERVICES MANAGEMENT

1. New JOIFF Members
2. LNG Safety & Awareness Training
3. Welcome To The Grid: Industrial Firefighting Train

ALSO:

JOIFF Roll Of Honour

Titanic Safety & The Fire Service

Persistent Liabilities - Navigating PFAS Risks

Industrial Disasters - Can They Be Prevented

A Bold Proposal To Simplify PPE For Firefighters

WWW.JOIFF.COM

ABOUT JOIFF

JOIFF, the International Organisation for Industrial Emergency Services Management is a not-for-profit organisation dedicated to developing the knowledge, skills and understanding of personnel who work in and/or who are required to provide emergency response to incidents in Industry, primarily High Hazard Industry, with the aim of ensuring that risks in Industry are mitigated and managed safely.

The 4 pillars of JOIFF aiming to support its Membership in preventing and/or mitigating hazardous incidents in Industry are: Shared Learning – improving risk awareness amongst JOIFF Members; Accredited Training – enhancing operational preparedness in emergency response and crisis management; Technical Advisory Group – raising the quality of safety standards in the working environment of High Hazard Industry and Professional Affiliation - networking and access to professionals who have similar challenges in their work through Conferences and other events and the prestige of being a member of a globally recognised organisation of emergency response.

Full Members of JOIFF are organisations which are high hazard industries and/or have nominated personnel as emergency responders/hazard management team members who provide cover to such organisations. Commercial Members of JOIFF are organisations that provide goods and services to organisations in the High Hazard Industry.

JOIFF welcomes enquiries for Membership - please contact the JOIFF Secretariat for more information.

JOIFF CLG is registered in Ireland. Registration number 362542. Address as secretariat.

JOIFF is the registered Business Name of JOIFF CLG

ABOUT THE CATALYST

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MESSAGE FROM THE CHAIRMAN

Dear JOIFF Members and Catalyst readers,

As I write this message to you the whole of the Fire Industry is still in the grip of the Pandemic COVID 19, restricting our daily lives as never before.

Despite this, the recent JOIFF Virtual Conference and Exhibition was a huge success with thousands attending the two days, checking in to the exhibition hall and the speakers who had a wide array of subject matter to present.

The presentations have now been uploaded onto the Members' Area of the JOIFF website for future reference by our members, and I urge members to please use the valuable knowledge and information about so many subjects relative to Emergency Services Management in these presentations to assist you in your decision making.

We continue to hold on-line Seminars during 2021 and have decided to follow these up with podcasts of the subject matter some weeks after the Seminar. The podcasts will be available for download from the JOIFF website.

We intend to hold a re-run of the successful Foam Summit which this year will be on-line and will be held on the 19th and 20th May. We once again have a wide range of speakers to give you up to date information. As always JOIFF will take a neutral stance on this. Please book in on-line.

JOIFF Working Groups continue to develop JOIFF Guidelines and I remind members that the recently published Guideline on 'Emergency Response to incidents involving vehicles powered by Alternative Fuels" is available to members for download from the Members Area of the JOIFF website.

I trust that you will again enjoy this edition of the Catalyst where there are some really interesting articles.

I would like to take this opportunity to wish you good health and fortitude facing the continuing challenges of COVID 19.

JOIFF greetings to all of you until next time.

Regards,

Pine Pienaar FIFireE; FJOIFF; FSAESI
Director: JOIFF
Email: pine.pienaar2@outlook.com

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JOIFF NEWS

Throughout its formal establishment 21 years ago, JOIFF has had a close relationship with the Aviation Industry and is proud to have welcomed a number of Airports as JOIFF member organisations. To strengthen the links between JOIFF and the Aviation Industry, the Directors of JOIFF have appointed Mark Buckingham Grad.JOIFF as JOIFF's liaison with the United Kingdom Airport Owners Association (AOA) and Airport Fire Officers Association (AFOA).

Mark is Head of Fire and Emergency Planning at Birmingham Airport. As a Fire, Crisis Management and Business Continuity professional he has implemented systems and processes in his workplace that have been embedded across the whole airport operation, enabling it to respond not only to the acute site based issues caused by COVID, but also the broader higher level impacts. He is joint Chair of the UK Airport Operators Association RFFS (ARFF) working group, and he also frequently speaks at various Aviation conferences, seminars and summits. In 2018, Mark was awarded Graduate of JOIFF.'

THE JOIFF VIRTUAL FOAM SUMMIT 2021 LIVE - 19TH & 20TH MAY 2021

The Global Covid 19 Pandemic has resulted in all of the important Fire Industry Events to be cancelled or postponed. Due to the risks that Covid 19 represents, organisational travel restrictions & quarantine periods, In house budget restrictions, reluctance to allow Senior Safety Staff to travel to attend physical events due to volume of people & the social distancing challenges plus the probable impact of quarantine periods & self isolation to protect co workers upon return means that... ATTENDING A PHYSICAL EVENT IS NO LONGER A PRIORITY AND OFTEN NO LONGER A POSSIBILITY.

To overcome these issues, we are pleased to announce that the annual JOIFF Foam Summit will this year be a virtual event. The JOIFF Virtual Foam Summit 2021 will be available as a live event on the 19th & 20th May 2021 Plus a Further 30 Day On Demand Event. The JOIFF Virtual Foam Summit 2021 is a Virtual Online Conference & Exhibition platform that will allow all JOIFF Members and the Global High Hazard Fire Community the opportunity to view Key Note conference presentations to learn, share and participate in the discussion of the most important issue currently facing our Industry – Fire Fighting Foam. The JOIFF Foam Summit is "Live" for 2 days when you can interact with live video meetings, chat, network in the lounge and then On Demand for a further 30 Days, with continued access to all booths, documents & videos and Subject Matter Expert Presentations without having to leave the office.

Visitors can meet with each other online and also chat directly over video with equipment and technology suppliers who are exhibiting, collate all that product information electronically and communicate it directly via email with colleagues from around the world without having to leave their desk or laptop or tablet or phone.

Go to https://joiff.com/events/ or call the events team on + 44 (0) 1305 831 768 to register to join this event

NEW JOIFF MEMBERS

During January, February and March 2021, the JOIFF Board of Directors were pleased to welcome the following new Members.

Antea Group Netherlands BV, Rotterdam, The Netherlands, represented by René Sloof, Project manager/ Senior consultant, Govert Jongsma, Senior consultant, Henk-Jan Schuurman, Department manager and Martijn van Nieuwenhuijze, Senior consultant. Antea Group is an international engineering and environmental consulting firm specialising in many full-service solutions including industrial and process safety, crisis management and prevention, fire safety, incident management and oversight, occupational health and safety/ industrial hygiene, environment, risk assessments, gap analyses etc.

Delft University of Technology, The Netherlands, represented by TU Delft, Safety & Security Science. It is the mission of Delft University of Technology to contribute and excel with scientific methods and techniques in developing evidence-based theories and innovative practices, in order to quantify, predict, visualise and optimise risk and hazard levels of loss of human life and multi-variate damage, to acceptable levels. It is their ambition to take up a leading role in scientific research and education regarding safety and security. They study entities such as socio-technical systems, their decision-making processes on technical, human and organisational issues and their conflicts with safety and security. This should result in proactive and reactive measures to improve safety and security levels while respecting other conflicting values and uncertainties.

Dynamic Well Control Inc., Alberta, Canada, represented by Wayne Stennes, CEO. Dynamic Well Control provides emergency response and emergency management services to both the upstream and downstream oil and gas industries on a global basis. They deal with preventative, risk management, response and recovery activities and have a wide experience responding to a broad scope of Industrial emergencies across the globe.

PRONOIA, Athens, Greece, represented by Timos Vossos, General Manager, Ms. Yulie Kyriazopoulou, Administrative Manager, Giannis Draziotis, Sales Engineer and Alexandros Kiragkas, Account Manager. With more than 80 years' tradition in the fire protection sector, PRONOIA are active in the following sectors: Oil & Gas, Industrial, Maritime, Food & Beverage, Mining, Transportation, Construction, Fire Service, Civil Protection and Armed Forces. PRONOIA advise, research and implement fire protection projects in all sizes of business and represent the top manufacturers in the world in firefighting equipment and rescue gear.

We look forward to the involvement of our new and existing Members in the continuing development of JOIFF.

JOIFF ROLL OF HONOUR

During January, February and March 2021, the following persons were awarded JOIFF qualifications:

JOIFF TECHNICIAN

Greater Manchester Fire and Rescue Service (GMFRS)

Martin Foran Tech.JOIFF
Station Manager

Martin is an operational Station Manager in Greater Manchester Fire and Rescue Service (GMFRS). Having successfully completing and been awarded the JOIFF Diploma, Martin began work on the JOIFF Technician programme which he recently successfully completed. On receiving the JOIFF Technician award Martin said "I found this course really interesting, particularly the petrochemical processing, this has increased my depth of knowledge in many areas including the hazards associated with plastics and rubbers when they ignite."
"I intend to use my new knowledge to assist in responding to incidents as one of GMFRS's Petrochemical Officers and also in helping to design and deliver training courses and packages to the Operational Crews".

Manchesterm, United Kingdom
Mike Branney Tech.JOIFF
Station Manager

Mike joined the Fire and Rescue Service in January 2002 and is currently a Station Manager for Greater Manchester Fire and Rescue Service. He is currently the Incident Command Training Lead for the Organisation and holds several operational qualifications. As well as being a petrochemical Officer he is a Hazardous Material advisor and he says "the skills complement each other. The qualifications support me in resolving operational incidents but also allow me to cascade training to individuals."
Having successfully completing and been awarded the JOIFF Diploma, Mike began work on the JOIFF Technician programme which he recently successfully completed.

Paul Richardson Tech.JOIFF
INEOS Chemicals Grangemouth Ltd.
Scotland

Paul was a fire fighter with Humberside Fire & Rescue service for eight years' working both the whole time and retained duty systems. His current role is an Emergency Response technician within the INEOS Group. During his time in the petrochemical industry, he has gained excellent knowledge and understanding of all health and safety procedures that accompany top tier COMAH (Seveso) sites as well as the different fire and explosion hazards within the industry. He has a good knowledge of firefighting foams, systems and equipment that are in use today.
Paul successfully completed the JOIFF Technician programme and was awarded the Post Nominal Tech JOIFF.

JOIFF DIPLOMA

Greater Manchester Fire and Rescue Service (GMFRS)
Manchester, United Kingdom
Bob Birtles Dip.JOIFF
Station Manager

Bob started his career as a firefighter at Stockport Fire Station serving in a number of positions including operating special appliances as a qualified responder and driver. He joined Greater Manchester Fire and Rescue Service (GMFRS) in January 1997 as an operational firefighter and has since been promoted as Leading Firefighter, Crew

Commander and Watch Manager. In 2011 he transferred to the fire protection department as an inspection and enforcement officer and in April 2013 he was seconded to the fire engineering department where he is currently in post as the team's manager primarily responding to complex consultations as part of the U.K. building regulations process.
Bob represents the National Fire Chiefs Council on the British Standards Institution (BSI) fire extinguishers technical committee and on behalf of GMFRS he attends other industry platforms including the British Automatic Fire Sprinkler Association, the National Fire Sprinkler Network and the Institution of Fire Engineers special Interest Group, Fixed Firefighting Systems. He is a qualified Level 2 Incident Commander, a Waste Site Fire Tactical Advisor serving the National Resilience programme and a specialist Petrochemical Officer.
On successfully completing and being awarded the JOIFF Diploma, Bob said "Completing the JOIFF Diploma has helped me to better understand the underpinning chemistry as well as the practicalities of tackling incidents involving these types of hazard. Online research and collaboration during practical drills has improved my ability and confidence to safely respond and subsequently to effectively tackle a large petrochemical incident, should it ever become necessary. Additionally, the knowledge gained from the course supports my other roles, particularly the fire safety enforcement activity and my representation at the BSI."

Greater Manchester Fire and Rescue Service (GMFRS)
Manchester, United Kingdom
Mat Rooney Dip.JOIFF
Station Manager

Mat was Station manager of GMFRS fire stations at Stockport and Whitehill, with 20 years' service. On successfully completing and being awarded the JOIFF Diploma, Mat said "I found the course very interesting and useful in increasing my knowledge of the risk presented by petrochemical incidents, with several high risk sites in the geographical area covered by GMFRS."
Also successfully completing and being awarded the JOIFF Diploma are Station Managers Owen Jones Dip.JOIFF, and Jon Nolan Dip.JOIFF of Greater Manchester Fire and Rescue Service and Sharon Cowie Dip.JOIFF of INEOS Chemicals Grangemouth Ltd., Scotland

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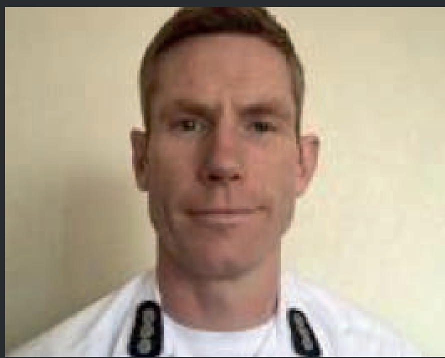


Also successfully completing and being awarded the JOIFF Diploma are Station Managers Owen Jones Dip.JOIFF, and Jon Nolan Dip.JOIFF of Greater Manchester Fire and Rescue Service and Sharon Cowie Dip.JOIFF of INEOS Chemicals Grangemouth Ltd., Scotland

JOIFF MEMBER

Greater Manchester Fire and Rescue Service
Manchester, United Kingdom
Ian Redfern MJOIFF Group Manager, Built Environment Project

Ian Redfern has worked in Municipal Fire and Rescue Services in the United Kingdom for 21 years. He was with Derbyshire Fire and Rescue Service for 15 years before transferring to Greater Manchester Fire and Rescue Service (GMFRS) six years ago. He is currently a Group Manager working on the service improvements with cognisance to the recommendations from the Grenfell Tower Inquiry. He has attended many large-scale incidents throughout his service and undertaken many roles, often in the Incident Command structure as either Incident Commander or Sector Commander.
Ian is the Lead Petrochemical Officer and as such is leading on the procurement of largescale foam making equipment to bridge current gaps in the GMFRS's response provision. In parallel to this he has co-ordinated a North West (UK) Regional response and procuring and working collaboratively with Merseyside and Cheshire Fire and Rescue Services in a form of mutual aid.
He has completed the High Hazard Facility Tank Storage Fire Management course with Essex Fire and Rescue Service and successfully completed both the JOIFF Diploma and Technician programmes as well as attended the Xtreme Fire Training course at TEEX.
Ian has introduced JOIFF accredited training to GMFRS and a number of students have either achieved or will be working towards the Diploma and Technician awards. Ian is currently a member of a JOIFF Working Group specifically looking at logistics and designing Tabletop Exercises.
On being awarded the honour of MJOIFF, Ian said "I am proud to become a Member of JOIFF and although I am conscious that I have much more to learn, I am looking forward to contributing to the principles of shared learning and my continued involvement with JOIFF."

GRADUATE OF JOIFF

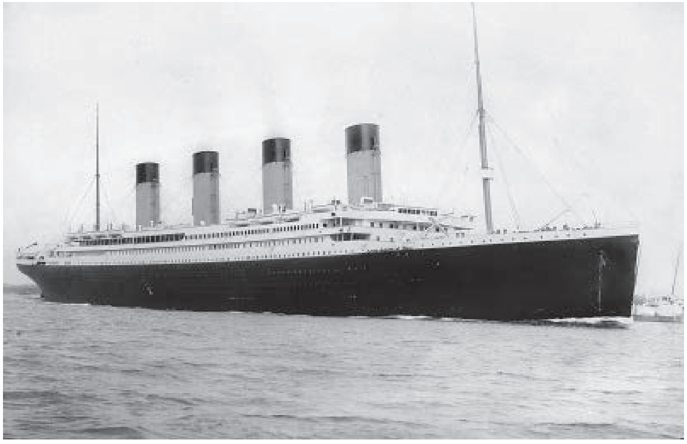
Paul Richardson Grad.JOIFF
Emergency Response Team
INEOS Chemicals Grangemouth Ltd.
Scotland

On successfully completing the JOIFF Technician programme, Paul applied for and was awarded Graduate of JOIFF. Paul has been a firefighting professional with over 15 years' in both the petrochemical and domestic sector. He is a guest instructor at the annual Williams Fire and Hazard Control Industrial Fire School which takes place on the training ground of JOIFF member organisation TEEX, Texas.

The Catalyst and the Directors of JOIFF extend congratulations to all those mentioned above.

TITANIC SAFETY AND THE FIRE SERVICE

By: Chief Charles Brush MS EFO



The Royal Mail Ship Titanic sailed into infamy as one of the all time tragedies on the night of April 14, 1912. On that fateful night, the Titanic struck an iceberg and sank in less than 3 hours with the loss of over 1500 passengers and crew.

While the incident and the stories surrounding it are both inspiring and frightening, there are underlying safety issues that contributed to her demise. Those same issues are with us today in Fire Service operations ! How can the safety issues of almost 100 years ago be pertinent today and especially to the fire service?

The issues or findings contributory to firefighter injury discovered during investigations consistently involve:

- Complacency
- Situational Awareness
- Communications
- Conditioned Response
- Unexpected Condition
- Unusual Circumstance

Compare these to the causes that contributed to the sinking of the Titanic.

COMPLACENCY:

From the very beginning, the Titanic was touted as being "practically unsinkable". As time went on, hype became fact at all levels. As she was "unsinkable", changes such as lower quality rivets for the hull (rivets were used to connect hull plating together) and reducing the height of the watertight bulkheads or walls that divided the ship into watertight compartments were made. These changes greatly reduced Titanic's ability to survive the incident.

Firefighters wearing their PPE improperly, or not at all, on repetitive type calls comes to mind!

SITUATIONAL AWARENESS:

At the time of Titanic's demise, the Atlantic icebergs had travelled further south than ever before. The icebergs were so numerous in the area that the nearest vessel to the Titanic, the Steamship Californian, had stopped for the night and drifted with the icebergs.

The Captain of the Titanic had knowledge of an unusually high number of reported iceberg sightings and this caused him to alter course further south, however the course change was not substantial enough to prevent the disaster. The main goal of Titanic's Captain was to arrive at New York as soon as possible and any additional course change to the south would have delayed that arrival.

How many times do Firefighters aggressively fight fires in structures, placing manpower and equipment in harm's way for the goal of reducing property loss when there is nothing to save!

COMMUNICATIONS:

Communications issues weighed heavily on the incident and consisted of both internal and external issues.

External – The Titanic radio operator's focus was the transmission and reception of passenger communications. The action of Titanic's radio operator when the Steamship Californian tried to transmit an iceberg alert to Titanic just before the incident was deadly. The Californian's loud radio transmission (due to its close proximity) and the interruption of Titanic's passenger requested transmissions caused the Titanic radio operator to strongly admonish the radio operator of the Californian. In response, the Californian shut down her radio system for the evening and therefore the Californian, which was the closest vessel to the Titanic, could not hear Titanic's distress calls. Had Californian heard them, help would have arrived before the Titanic sank and many of those who lost their lives would have been saved.

Internal – When The Titanic's captain gave the orders to prepare the life boats, he gave the now famous order "Women and children first". This however was interpreted by ship's officers as "Women and children only" and with this interpretation, life boats were launched with as few as 7 people when they could have held as many as 58. With full life boats, an additional 477 lives would have been saved!

Internal – The last iceberg report received by Titanic was not given to the captain because he was dining with the passengers. Not informing the captain removed the opportunity to perhaps order a change of course and avoid the impending collision.

Basic communications problems,

created by humans, not technology, are the most consistent finding in investigative reports and the most ignored. Instead of reviewing the human problems, we focus on how to engineer a solution.

CONDITIONED RESPONSE:

When the iceberg was sighted and reported by the lookouts, the officer of the watch took the action that he was conditioned to take - turn to avoid and hit the brakes (reverse engines). The problem with this conditioned response was twofold:

- In trying to turn away, the Titanic exposed her vulnerable side. The bow of the Titanic was designed to collapse in a head on collision. There probably would have been lives lost from the impact of the crash, but Titanic would have remained afloat longer or perhaps would not have sunk at all.

- In reversing the engines, design differences between Titanic and other vessels of her day, actually reduced the ability of Titanic to turn away.

When firefighters hear an explosion or loud noise, they tend to look toward it instead of going for cover!

UNEXPECTED CONDITION:

The Titanic was divided into 15 watertight sections and was designed to remain afloat with as many as four of these flooded. The damage to her side resulted in five sections flooding. Even with this knowledge, the inevitability of the Titanic sinking was not readily accepted and the preparations for organizing passengers and crew to abandon ship were delayed so as not to alarm anyone..

Firefighters respond to and deal with many incidents based upon past experience. When the unexpected occurs, they continue operating as if nothing has changed - with potentially deadly results!

UNUSUAL CIRCUMSTANCE:

The two lookouts atop the Titanic's forward mast, did not have the binoculars they normally would have had because the binoculars were locked up and the keys were not on board. This greatly reduced the lookouts ability to identify hazards in time for Titanic to take avoidance action. Instead of forcing the locker open or adjusting speed based upon the reduced visibility, the 882 ft long, 46,000 ton Titanic continued at 22 knots (about 25 miles per hour).

Consider the number of times fire companies have conducted operations with reduced resources without changing tactics or strategies! There are many more examples that I leave you to discover or perhaps you already know.

Are you proactively addressing these safety issues or just rearranging the deck chairs?

EDITOR'S NOTE:

This article, first published in The Catalyst edition of October 2011 was written by the late Chief Charles (Charlie) Brush MS EFO who at the time was Safety Programs Manager, Bureau Fire Standards and Training, Florida State Fire Marshal. In February 2013 Charlie passed away following years of a brave fight against cancer that he contracted as a result of exposures to carcinogens whilst leading a team in tackling a severe fire. He used to say that he was "last man standing" of his team, all of whom succumbed to cancer suspected to have been contracted at that incident.

LNG SAFETY AND AWARENESS TRAINING

LNG is a mixture consisting mainly of methane with possible residual gases such as nitrogen, propane and ethane. Methane becomes liquid at normal pressure at cryogenic temperatures of about -162° C. Due to the lack of infrastructure for the transport of this natural gas, it is converted into LNG, making it approximately 600 times smaller in volume.

Liquefied Natural Gas (LNG), once a niche market, is nowadays increasingly used as a cleaner fuel for trucks and ships instead of oil or diesel. Power plants have switched from coal to natural gas. As a result, the number of LNG terminals, filling and bunkering stations is also growing and the transport of LNG by water and road is increasing sharply.

The increased demand for LNG has led to an increase in production, transport and storage, which also raised the question on how to act in the event of an accident involving LNG. What are the characteristics? Is the personal protective equipment adequate? Can you measure the cold gas? How can you control an LNG gas cloud that is released (Boil-off)? What is the Boil-off rate of an LNG pool? What to do if it burns? What about water and foam on LNG? Can an explosion (BLEVE) occur? In order to get answers, the first LNG training facility was built at the former Falck Rotterdam training centre in 2014. After the relocation of the training centre in 2018 and the rebranding to RelyOn Nutec, there were opportunities to realize a renewed LNG training facility.

LNG TRAINING FACILITY

Someone who stays calm, can work unThe new facility consists of a 10m³ LNG storage tank, which feeds the various training simulators. The installation has a number of safety provisions that meet the latest safety requirements. During the exercises boil-off gas (BOG) is released that create relatively large clouds of flammable gas. The LNG fire ground alone already covers 400 m2 and has a round fire pit of 3.8 m2 in the middle. Water screens have been set up at the edges of the training ground to reduce the concentration of combustible gas when the LNG fire pit is being filled. This is also one of the Vapor Cloud mitigation techniques that can be employed during an emergency. The training facility is located at a considerable distance from the LNG storage and other installations and buildings. Furthermore, it is equipped with three hydrants connected to the RelyOn Nutec's central extinguishing water system and their own water purification installation.

In the re-engineering of the LNG installation, RelyOn Nutec took into account the wishes of customers and a focus on practical objectives for; the emergency response teams and people who work with LNG in their installation, such as those on board of LNG driven ships. At the first LNG facility developed in 2014, it was only possible to simulate an LNG pool evaporation. With the new facility it is also possible to connect an LNG hose with fittings to simulate an LNG flange leak with a possible 2-phase Jet Fire and the operation and releases of a Pressure Relieve Valves (PRV) and Thermal Expansion Relieve Valve (TRV) but also sealing a flange leak is possible. The options for filling an LNG fuel tank for a truck and flaring off of an LNG fuel tank will become possible at the new facility as well.

LNG AWARENESS TRAINING AND CRYOLAB

Training with LNG at RelyOn Nutec largely consists of visualizing and experiencing theoretical knowledge about the behaviour of LNG. This usually starts with a workshop in the CryoLab where the cryogenic hazards and properties are explained and demonstrated with liquid nitrogen. After going through and following the safety protocols, the real work follows. The ice-cold metal LNG pipes, the condensation of the BOG from a 50 mm pipe with a huge white cloud, an evaporating LNG puddle, the whistling of a flute leak, the radiant heat from the fire pit, a Rapid Phase Transition (RPT) all give indelible impressions. But training goes further, such as correctly setting up monitors and/or water screens, using foam to reduce the evaporation of an LNG pool, controlling an LNG fire, distinguishing between water vapour and BOG and measuring the explosion limits. Delegates who work with LNG can experience what happens when LNG is blocked in a pipe system, what to do in the event of a small leak, to recognize the different types of pipe insulation, increase tank pressure with a Pressure Build Up unit and experience how the various safety systems such as leak sensors and gas monitors work.

Thanks to the variety of training options and scenarios, RelyOn Nutec is able to offer a tailor made programme based on the risks of the customer.

Authors: Gert-Jan Langerak and Steve Watkins

WELCOME TO THE GRID: INDUSTRIAL FIREFIGHTING TRAIN

Throughout the service area of Port of Rotterdam, rail emplacement yards are keystones in the tight-fitting distribution web for (dangerous) goods to the European hinterland. Due to the high-risk nature of shunting goods back and forth, these yards must naturally meet all required safety standards. For one of the shunting yards in the Rotterdam harbour area, an unusual solution has been found by rail infrastructure and asset manager ProRail to re-open one of their prime industrial shunting sites after more than 18 months of restrictions....

September 2019, dark clouds gather above Waalhaven port in Rotterdam. Local authorities have halted the shunting of hazardous substances on one of in total six industrial emplacement yards. Research has shown that fire water facilities do not meet the authorities' requirements. And because of that, the fire brigade cannot perform an effective intervention in case of an emergency. As shunting yards have an increased spill and spill fire risk, they must demonstrate readiness to intervene in these situations. Direct consequences: all shunting of dangerous good must be relocated to other sites, meaning extreme additional costs, disgruntled stakeholders, liability, indemnity, and more. Above all: no direct solution for the problem within sight.

As of April 1 (that is no joke), rail yard Waalhaven Zuid restarted to shunt goods. A brand-new firefighting train stationed at the emplacement yard has convinced authorities that emergency preparedness is now adequate enough for re-opening. A temporary solution that is, as ProRail continues to work on a structural solution.

EMERGENCY RESPONSE TRAIN

The firefighting train measures 67 meters long, divided in 3 container carriers and 1 locomotive in the middle. The carriers hold five tanktainers with a total fire water storage capacity of 150,000 litres. Inside a 40 ft container the extinguishing pump system and 8,000 litres of foam concentrate are situated together with all control systems.
At both ends of the train small platforms house foam monitors with a capacity of 4,000 litres per minute and over 80 meters in throwing distance. Handlines can be attached near the platforms for manual foam application.

The purpose of the train is to perform a cooling and/or extinguishing intervention of up to 30 minutes at the most difficult-to-reach areas of the emplacement yard. It is that explicit purpose for which the authorities halted the shunting processes mid-2019. In the middle of the rail yard an emergency road is situated to be used by the ProRail incident crew and Unified Fire Brigade Rotterdam during emergency situations. With water supply not being optimal from the emergency road, the most southern rail tracks are not within reach. With the train situated on a service track at the south side of the yard and manned 24-7, this problem is now temporarily resolved.

PRESSURE COOKING

Due to the enormous stakes at game, the lead time for this project was extremely short. H2K and Kappetijn Safety Specialists were asked by ProRail to investigate concepts to improve firefighting possibilities from the south end of the yard. Though an emergency response train seemed an incredibly bold idea at the beginning, in the end it proved to be the only effective measure to achieve the demanding requirements within the set timeframe.

Next, an intensive period of conceptualising, designing and engineering started. Only few organizations have the means in-house to fully engineer and manufacture a new concept like this within 5 months' time. Sounds like plenty of time, is not. The project team partnered with Kenbri Fire Fighting and rail workshop Shunter to construct and assemble the firefighting systems and mount these on rail-driven carriers.

In the meantime, H2K and KSS prepared commissioning of the train in consultation with the local authorities. Operating procedures were written, an intervention crew assembled, education and training organised, preparing of site acceptance tests, writing of ITPM-policies, application for temporary permits and exemptions, guaranteeing occupational safety, the list goes on.

In March 2021 a series of acceptance tests have been performed together with the Unified Fire Department Rotterdam to demonstrate operational readiness of the train. Upon receiving the 'OK' by the authorities, the train has been on active duty since April 1.

Fire and rescue trains

The idea of a firefighting train derives from methods for emergency response in mountainous countries such as Norway, Austria and Switzerland. In these countries 'fire and rescue trains' have proven useful over decades. These trains are mainly used for safely delivering emergency crews on-site in tunnels and evacuating passengers. Additionally, equipment for technical rescue and small-scale firefighting are onboard.

With the commissioning of this firefighting train in Rotterdam, a new application can be added to the list of uses. The train is deployable for purely industrial scenarios: coverage of unignited spills, extinguishment of spill fires up to 160 m2 and cooling of irradiated surrounding objects. Because industrial emergency response is based on lengthy intervention approaches, the throwing distance of 80 meters allows for the train to keep its distance. To further guarantee safety of operating personnel both the train and its water/foam monitors can be remotely controlled. Maybe the train can be enlisted in the Guinness Book of Records for being the longest, most water carrying, remote controlled firefighting robot?

POWERHOUSE TROUBLESHOOTING

Why did the H2K-KSS combination work so well for this project? From the very start, the project was to be settled on the boundary of theory and practice. Theory, because the sought-after solution needed to be integrated in an existing framework of regulations and enforcement. Practice, because more than ever it was desirable to present a practically workable solution, where there would be no doubt about the proven effect.

Remote controlled 4,000 L/min monitors are mounted on platforms at both ends of the train, handlines can be attached for manual foam application

To thrive in this high-pressure environment, it helped that both H2K and KSS are 'network organizations', capable of mobilizing people and resources together with relevant partners in an extremely short timeframe. From day 1 onwards, all effort has been to work towards a robust, safe and proven system as a solution. And in the end, all parties delivered.

ProRail continues to work on a structural solution for improvement of water supply and accessibility, but until then the train and its crew will remain on duty.

Interested to see the firefighting train in action? Watch the mini documentary at www.h2k.nl or www.kappetijn.eu.
Want to know more about this project? Get in touch with H2K or KSS.

For further Information please email:

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By: Jochem van de Graaff (H2K) and Dick van Roosmalen (KSS)

STATS	
TYPE	Emergency response train
PURPOSE	Spill coverage, firefighting, cooling
IN USE SINCE	April 2021, manned 24-7
LENGTH	67 meters (3 container carriers and 1 locomotive)
WEIGHT	Over 330 tons (when filled)
STORAGE CAPACITY	150,000 L water 8,000 L foam concentrate
FOAM SYSTEM	Diesel powered pump with FireDos proportioner
MONITORS	2x 4,000 L/min Akron StreamMaster
DEPLOYMENT TIME	Max 20 minutes after alarm
CREW	1 train driver and 2 operators
SPECIALTY	Both train and monitors are fully remote controllable

TIMELINE	
	2019
SEPTEMBER	Authorities halt shunting of dangerous goods at shunting yard Waalhaven Zuid
	2020
NOVEMBER	First brainstorm on technical solutions and project planning
DECEMBER	Conceptualisation firefighting train
DECEMBER	ProRail management roadmaps April 2021 for 'resumption of all shunting'
	2021
JANUARY	Design, engineering, construction
FEBRUARY	Construction, delivery of train to ProRail
MARCH	Commissioning and testing
APRIL	Train operational and on duty

PERSISTENT LIABILITIES - NAVIGATING PFAS RISKS

By: Ian Ross Ph.D. Tetra Tech, UK

INTRODUCTION

There are a growing number of lawsuits are being filed against polluters by communities and businesses impacted by PFAS contamination [1]. Some $212M was recently paid to a PFAS-impacted community in Australia, located along a 9-mile PFAS groundwater plume, caused by use of firefighting foams, which impacted the drinking water supply to the town of Katherine [2, 3].

The recent settlement from a district court in Sweden where compensation was awarded to plaintiffs who had been exposed to PFAS in drinking water, on the basis that elevated levels of PFAS in the blood being classified as a personal injury, may indicate the direction of future litigation[4].

There are multiple potential liabilities to consider when managing PFAS use in firefighting foams, from the perspective of legacy usage and moving forward to ongoing use and containment of foams.

Liabilities may be perceived to primarily result from the need to manage environmental impacts of PFAS to soil and groundwater as a result of using PFAS-containing firefighting foams (C6 and C8). However, there are potentially further liabilities associated with PFAS impacts to pipework and infrastructure, disposal routes applied for foam and equipment, land transactions and methods used for treatment of PFAS and site remediation. The properties that PFAS possess need to be understood to manage the environmental liabilities they potentially pose.

As regulations continue to be promulgated addressing and increasing number of PFAS in multiple parts of the world this article helps to assist with identification and management of environmental liabilities and risks associated with use of PFAS in firefighting foams.

STAYING AHEAD OF THE REGULATIONS

As per- and polyfluoroalkyl substances (PFAS) are increasing discovered in drinking water, concerns over potential liabilities associated with ongoing use of Class B firefighting foams containing this whole class of chemicals are increasing.

In some geographies the regulatory focus targets only perfluorooctane sulphonate (PFOS) and perfluorooctanoic acid (PFOA), which with their precursors are termed C8 PFAS. However, an increasing number of locations have regulations addressing many more PFASs including C6 varieties, with restriction on future use of C6 PFAS proposed in Europe. It is inevitable that C6 PFAS will be subject to environmental regulations across the developed world over the forthcoming years.

Regulations are also being enacted to prevent the use of C8 PFAS foams for testing and training in Europe and many US States. Stockpile regulations in the UK and Europe mean that if more than 50L of a PFAS foam is held, it needs to be tested using the total oxidizable precursor assay to determine whether it represents a notifiable stockpile of persistent organic pollutants, meaning it's volume needs to be reported to regulators annually.

DUE DILIGENCE CONSIDER ACQUISITIONS AND DIVESTMENTS

When considering the purchase or sale of many types of businesses, the prior use of PFAS in firefighting foams and many other products can factor into determining whether the site can represent a potential future environmental liability. For example, if a fire suppression system was present on the site and accidental discharges occurred or if testing involving partial deluge events were done, this could have released foam to ground. As PFAS can form multiple layers on surfaces, there is potential that residual PFAS remain on the site as a source of contamination. Considering advancing regulations to address multiple PFAS, use of a comprehensive tool to chemically analyse the presence of a wide range of differing PFAS at sites where investments or divestments are planned is a wise approach. The use of the total oxidizable precursor (TOP) assay to assess for the presence of PFAS can provide a more robust approach to determining whether there are potential future liabilities. This analytical technique can detect and quantify a much larger range of PFAS than the conventional analytical methods that are commonly used to examine environmental matrices.

Many of the proprietary PFASs present within firefighting foams that are not detected using conventional analysis can be visualised using this tool, which then provides more confidence regarding whether a site is or is not impacted by PFAS.

SOIL AND GROUNDWATER IMPACTS

The loss firefighting foams containing C6 or C8 PFAS to ground or disposal to a sewer network can create potential future liabilities. From a land contamination perspective, local regulations considering how land is determined to be contaminated can vary significantly depending on the country or state where a site is located. Land contamination regulations

generally use a process which aims to determine whether harm is being caused by chemicals detected on a site. This is usually done by the development of a conceptual site model (CSM) which identifies if the source of the impacts (e.g. detections of PFAS in soils or concrete surfaces) are migrating via a pathway (e.g. groundwater) to a receptor (e.g. drinking water supply). As many PFAS form films on surfaces, this means they can remain present at fire training areas for decades slowly releasing dissolved PFAS which can then travel some miles in water to impact receptors. At many sites there may be no pathway to sensitive receptor, so the site may not be classed as contaminated. A portfolio review of the geology, hydrogeology and location of receptors at multiple sites, can determine if some sites are more likely than not to be posing a risk of harm.

MAKING WISE FOAM CHOICES

To avoid future environmental liabilities, the wise choice is moving to a non-persistent foam such as some of the fluorine free foams currently available that don't contain PFAS or persistent chemicals such as siloxanes. The extinguishment performance of these biodegradable F3 foams being proven in multiple sized tests since 2002, with large scale tests performed by LASTFIRE demonstrating that these F3 foams can extinguish real world scale fires [5, 6] [7-9]. Finding a foam that has Green Screen or HOCNF certification will be essential to mitigate future potential environmental liabilities. Replacing foams containing PFAS with those containing any type of non-biodegradable organic will inevitably lead to liabilities as the persistent molecules remain in the ground, which can potentially impact the property value of a site.

Given the continued use of PFAS-containing foams will likely incur significant environmental liabilities for the end user, switching to non-persistent F3 foams is a wise decision with use of foams containing persistent siloxanes inevitably creating future potential environmental liabilities. As many fluorine free foams do not contain any persistent compounds, the potential future environmental liabilities associated with their use are significantly lower.

WASTE DISPOSAL

With incineration of liquids wastes containing PFAS not proven to be effective for treatment of liquid wastes, there are potential future liabilities associated with use of this disposal route. Incinerator ash pits have been determined to be sources of PFAS to groundwater. Alternative technologies are becoming commercially available using cement kilns, sonolysis, plasma, electrochemical oxidation, and supercritical water, but thorough examination of their efficacy is required.

Waste pipework from fire suppression systems can be coated with layers of PFAS, these can contaminate F3 foams to g/L levels when the foam changeouts occur. Alternatively significant PFOS can appear in C6 foams within fire suppression systems as a result of using water to attempt decontamination of pipework which previously held other firefighting foams. The use of effective decontamination agents and procedures helps to mitigate this liability.

Gifting or selling waste foams and other fire suppression infrastructure, such as hoses and emergency rescue vehicles (e.g. ARFF vehicles), can also incur future liabilities and these are likely heavily contaminated with PFAS. Effective decontamination would be required before the sale or transfer of ownership occurs.

Treatment Technologies

Certain treatment technologies, such as injection of activated carbon to aquifers, just concentrate PFAS in the ground and do not eliminate it, so do not alleviate potential future environmental liabilities. Treatment technologies such as ozofractionation converts PFAS into shorter chain varieties which can evade detection and be discharged. This can also lead to potential future liabilities as an increasing range of PFAS are regulated. Careful consideration should be given to remediation of all PFAS that have the potential to pose harm to receptors on individual sites, bearing in mind that a toxicological understanding of many PFAS is still in its infancy.

SUMMARY

There are a wide range of differing PFAS that are being subject to regulations and litigation focussed on members this class of contaminants is increasing. The properties PFAS possess can lead to a wide range of potential liabilities, so expertise in understanding their environmental behaviour, chemical analysis and status of regulations can be key to managing the potential environmental liabilities they pose.

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ARE WE IGNORING CRISIS MANAGEMENT CONSEQUENCES OF LOWER FIRE PERFORMANCE OUTCOMES?

In these days of just concern over legacy long-chain C8 foams (C8s), many foam users are considering changing existing firefighting foam systems and reserve stocks of C8s to either Fluorine Free Foams (F3s) or high purity short-chain C6 foam (C6) alternatives. Whilst F3s are widely endorsed for firefighter training and smaller Municipal fires, what about suggestions of F3s handling larger industrial fires? Are we reflecting on the crisis management implications?

Some foam users assume that if their new foam has been tested to show equivalent approval ratings to existing foams in use, all will be good and existing systems will still function equally effectively during major incidents. ...If only it were that simple. Sadly, that is often not the case, as many F3 fire test approvals seem to be misleading us. Are our crisis management teams prepared for potential major incident consequences?

ARE FIRE TEST APPROVALS MISLEADING US?

Leading foam approval test standards including EN1568-3, UL162, FM5130, ISO7203-1, Lastfire, and IMO all use heptane as their test fuel. For good reason, because its tight specification does not change with seasons or locations, like gasoline. Fluorinated foams behave similarly effectively on heptane and gasoline, but recent rigorous research has confirmed this is generally not the case with F3s. This has worrying implications for firefighters and fixed foam system designs. Most foam systems protect uses and storage of volatile fuels like gasoline and E10 (gasoline with 10% ethanol added) crude oil, aviation fuels and polar solvents, not heptane. Such approval testing is often conducted using UNI86 test branchpipes delivering more uniform higher expansions, which are not particularly representative of most proprietary lower expansion foam delivery devices widely in use. UL162 and Lastfire are notable exceptions where test nozzles are specifically modified to deliver representative foam quality of delivery devices, as a critical part of their protocols, but they still use heptane as representative of all hydrocarbon fuels. Is that justifiable? Despite a built-in safety factor for recommended design application rates, typically around double test rates, this may be insufficient to guarantee safety in all situations and all foam types. Particularly where foams may have no fuel shedding or poor vapour sealing capabilities. Favourably low ambient temperatures around 15°C (59°F) are also usually specified in these approval tests, facilitating positive results which may be misleading us. Summer temperatures often reach 35°C (95°F). Higher operating temperatures are known to undermine any foam's firefighting performance. Will these approvals still provide adequate reliability in major fire emergencies, all year round?

Footscray Chemical Factory Fire –Aug.2018

COMPREHENSIVE RESEARCH HIGHLIGHTS DIVERGENT FIRE PERFORMANCE

Recent comprehensive fire testing programs by the US National Fire Protection Association Research Foundation (NFPA) and US Naval Research Laboratory (NRL) confirm substantially divergent results on gasoline versus heptane when comparing F3s and C6AFFFs. This raises major implications for crisis management. NFPA found 3-4 times higher application rates were required using leading F3s on gasoline, 6-7 times higher with F3 on E10, compared to benchmark C6AR-AFFF agent performances. Surprisingly leading F3s also required 25-50% higher application rates on gasoline when using lower

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3-4:1 expansion ratios plus slower extinguishment times, than when F3 was used at 7-8:1 on gasoline. This has implications for delivery devices. All F3s tested failed burnback testing on E10. Only one of five F3s passed burnback testing on gasoline at 3-4:1 and two at 7-8:1. Yet all five F3s passed burnbacks on heptane at 7-8:1 and all but one at 3-4:1 expansion. Still it seems little rigorous realistic large scale F3 testing has yet been completed.

2019 NRL testing similarly found that four leading F3s extinguishing the same gasoline pool fire in 60 seconds required 2.5 times more; 3.75 times more; 5 times more; and 6.25 times more F3 agent respectively, than the benchmark C6AFFF. These differences became even greater when faster extinguishment times were demanded. Could this make a crisis much worse than necessary, not better as many anticipate? C6 foams did not suffer these vulnerabilities due to their fuel repellency and vapour sealing, performing similarly closely on both heptane and gasoline pool fires, providing strong assurances of continued reliability and effectiveness in future major incidents.

NRL established the cause of these F3 failings. Four aromatic components of gasoline and E10 namely TriMethylBenzene (TMB), Xylene, Toluene, and Benzene preferentially attack F3 foam blankets, but not C6AFFFs. NFPA results showed F3s failing burnback tests even at elevated application rates on gasoline, supporting NRL's conclusions. These aromatics are not present in heptane, which explains similar F3 approval test ratings to C6AFFF. Should we be relying on such approvals using heptane which seems unrepresentative, when our most commonly used and stored hydrocarbon fuels are gasoline, E10, crude oil, Jet A/A1 etc?

NRL showed heptane with 25% TMB added, became an effective gasoline alternative for both F3 and C6AFFF fire performances, confirming current F3 approvals are seemingly misleading us into a false sense of security. Interestingly Jet A/A1 aviation fuels also contain these four aromatics, but at lower quantities, perhaps explaining why F3s similarly often seem to struggle on Jet A/A1 compared to C6AFFFs. Irrespective of approval certification, Society's realistic expectations still need to be delivered during major incidents whichever foams are chosen – because people's lives, including firefighters, are usually in the firing line. Crisis Management and Regulatory Authorities surely need to effectively address these disturbing issues which could expose lives and communities to unnecessarily increased danger?

F3S BRING SERIOUS IMPLICATIONS AND CONSEQUENCES FOR FIXED FOAM SYSTEMS

Efficient, effective, reliable and fast-acting firefighting foam systems are usually designed to ensure all these considerations are addressed in an integrated system, protecting lives and critical infrastructure in our major hazard facilities (MHFs - including airports), when fire strikes. Any changes to an individual system component like foam, could significantly affect fire performance, reducing effective system operation, potentially compromising the original system design objectives. It may also compromise crisis management objectives. We cannot simply make unilateral foam changes on the 'assumption' the whole system will still function correctly, without adopting a rigorous verification process to ensure that is reliably the case on the specific fuels and delivery equipment being used to protect these major facilities.

Ensuring concentrates are fully mixed at intended concentrations usually occurs before testing commences, but does this adequately reflect reality? Most foams need immediate mixing during emergencies, often under hot summer conditions and worst case scenarios. It works for flexible, forgiving, fluorinated foams, ...but seemingly not always for more viscous F3s where greater vulnerabilities are becoming apparent. Unpredictable effects during crisis management could result, increasing danger beyond expectations.
The problem being that existing systems are generally designed around well proven, highly effective fluorinated foams, which have been the mainstay of flammable

liquid fire protection for around 60 years. Modern alternative C6AFFFs typically contain only 2% short-chain PFAS content of which ≥ 98.5% is C6, meeting stringent EU residual PFOA requirements, but retaining critical fuel shedding and vapour sealing abilities, often delivering performances close to, or better than, legacy C8AFFFs which are being phased out. Adapting existing systems for very different F3 use (rather than C6AFFF) to provide equally effective crisis outcomes without fuel repellency and reduced vapour sealing, is problematic. NFPA confirmed F3s are NOT 'Drop-in' replacements for fluorinated foams in existing systems, and their fire capabilities vary significantly, ...making it difficult to develop any 'generic F3 design standards' which could reliably support major incident control. This common inability to use F3s in existing system designs without significant re-engineering, modification, or replacement with new equipment, adds complexity and consequences, of which many seem unaware, including some crisis management teams and Regulatory authorities. Are we planning alternative fire protection while existing systems are out of action, for F3 modification and system cleaning?

Are we allowing for increased F3 application rates demanding higher flows, different hydraulics , potentially larger pipe diameters? Gentler delivery of better quality higher expanded foams as the research suggests, is also likley to require more and different delivery devices, higher pressures, shorter reach, probably larger pumping capacities. Slower fire control and extinguishment can result. Greater risk of escalation or flashbacks, potentially compromising life safety, while also risking overflowing of existing containment areas is more likely to result. Combined, these factors could make an incident crisis far worse than expected – we've already seen it happen at Footscray (discussed below). Congested process areas may not physically be able to accommodate all these necessary changes. Is creating polluted adjacent waterways, or problems for neighbouring sites now acceptble?

Can we extend our containment areas, particularly since increasing application rates by 2-4 times seems likely with F3s on common fuels like gasoline, possibly 6-7 times on E10. Rapidly expanding volumes are created with every minute's operation, exacerbated when higher expansions of 7-10:1 are also required. A major headache for Crisis Management teams. Many such fixed foam systems are designed for 55 minutes duration, which may be too short when F3s are often slower acting, probably with longer extinguishment times required on volatile fuels, increasing risks to firefighters, critical infrastructure, escalation risk to adjacent sites and nearby communities. What happens if fixed systems run-out of foam - before extinguishment occurs?

OTHER FOAM CHARACTERISTICS ALSO PRESENT CRISIS CHALLENGES

Checking storage stability effects, corrosion, proportioning accuracy, potential viscosity differences, mixing ability and clean out procedures are important pre-requisites to major incident control. Conducting your own rigorous review, with representative fire tests using existing application rates, fuels, delivery and proportioning equipment under likely operating conditions, should help verify suitability. ...It also identifies preparatory changes necessary, to prevent current levels of fire and life safety being compromised – before any transition. Recording this process, as a documented trail of actions, demonstrates adequate duty of care, with final washwater lab analysis, to verify acceptably low residual C8 levels, before filling systems with new foam – whether F3 or C6.

Clean-out procedures to remove traces of PFAS down to acceptable residual levels can be time consuming and costly before F3s can be used, particularly if later 're-bound' of residual PFAS release is to be avoided. Binding onto system surfaces like storage tank linings, proportioning devices, and internal pipework over time can continue PFAS release after cleaning, prolonging residual contamination. Foam is such a critical system component, it requires all aspects of the system to work together in harmony, in order to deliver reliable, effective and successful outcomes. How can we be certain existing design safety objectives will not be compromised after transition during emergency operations?

Commissioning foam devices with functional testing using temporary dams, or discharging into 20ft containers avoids spilling foam, allows capture with windows to video and sample expansion ratios, helping provide assurances to crisis management teams of future effectiveness when system changes are planned. Pipework allows drainage of foam residues into mobile tankers or IBCs for remediation and safe disposal, whichever replacement foam type is being used. Ensuring new foams are appropriate, act swiftly, effectively, reliably - without endangering lives, without over-flowing containments, goes a long way to ensuring your duties of care are adequately discharged -were any major incident to susbsequently occur.

Following any incident it is important to remember that all foams and all firewater runoff can pollute, can contain PFAS from fire breakdown products, so needs collecting, containing, testing for undesirable chemicals, prior to remedial treatment and safe disposal, irrespective of whether F3 or C6 foams are used. Two contrasting major incidents without the added complexities of fixed foam system activation may

help crisis management teams to appreciate the criticality of these issues.

MAJOR FOOTSCRAY (MELBOURNE) CHEMICAL FIRE BURNED FOR SEVERAL DAYS

August 2018 saw a 1.4 ha chemical factory site in Footscray's residential suburb, become the largest fire Melbourne had seen in decades, involving an estimated 100,000 chemical drums. It reportedly took 17 hours to bring this large fire under control and 5 days to fully extinguish (some areas were heavily shielded causing extra delays). EPA Victoria confirmed "the foam used by Melbourne's Fire Brigade did not contain PFAS". Thick black smoke billowed for days, causing 50 school closures, forcing residents to remain indoors due to smoke hazards across 19 suburbs - a serious crisis.
A wide range of industrial chemicals, detergents and firewater runoff were quickly washed into nearby Stony Creek, poisoning its waters. 55million litres of contaminated runoff was pumped from this creek by day 3, to try and save it. 170million cubic metres of contaminated sediment had been removed in 3 weeks. Creek remediation was still on-going in January 2020.

PFOS and PFOA were also detected in the creek, up to 16 times above the permitted recreational water quality guidelines for 2 weeks following the fire, immediately downstream of the fire site. Presumably emanating from fluorinated materials used and incinerated on site, as the foam was PFAS-free (F3).

EPA Victoria's Chief Environmental Scientist confirmed this Footscray incident was "...probably as bad as it could be. The chemicals from the fire have had a 'massive impact' on the creek system - We've had more than 2,000 fish killed." It was widely reported as a major environmental disaster. Are crisis management teams and Regulators learning from such damaging outcomes?

Disturbingly, October 2019 saw 30 firefighters reportedly still experiencing severe illnesses following attendance at this Footscray fire ...with symptoms of fainting, headaches, nose-bleeds, fatigue, dizzyness, nausea etc., possibly from toxins and excess smoke exposure over several days. Did slower fire control deliver worse outcomes? ...might a faster fire control have significantly reduced resulting runoff volumes, environmental harm and these adverse health issues? Surely this is not what Society needs or expects from modern firefighting?

MAJOR UK & US CHEMICAL FIRES - OUT IN FOUR HOURS

Contrast Footscray with a similar major 1996 chemical factory fire near Avonmouth port in Bristol, UK. This was a 6.8ha site - congested by another chemical complex, fuel storage depots, major docks, industrial units, 2 significant residential areas, all within a 2.5km radius.

Total petrochemical inventory was estimated at 220,000Litres. A 20 tonne road tanker was delivering, when an explosion caused this major fire. Surprisingly there were no fatalities. The truck driver and seven plant operatives ran to safety, while sounding alarms and starting plant shut-down. 6 firefighters were briefly hospitalised with smoke inhalation, but soon fully recovered. This 2,400 m2 fire area was quickly extinguished in 4 hours, using AR fluorinated foam.

The recent major K-Solv chemical storage facility fire in Channelview Houston, Texas required nearby residential neighborhoods to shelter-in-place. This chemical fire involving Toluene and Xylene chemicals, hazardous to human health, was reportedly extinguished in just 4 hours with fire control achieved in 2 hours. 95 employees were working on site but no deaths or life threatening injuries resulted. Pollution levels did not appear to be a concern, although firefighters were mindful of potential re-ignition. The cause is still being investigated.

Houston is home to an estimated 2,500 chemical facilities. A Houston Chronicle investigation in 2015 found there's a major chemical incident in the greater Houston area every six weeks. A local resident reported concerns over what she felt was an increase in hazardous facilities built near neighborhoods. Can such exceptional crisis management efforts be maintained in future?

Both these incidents could have been so much worse - without fast, reliable, efficient fire control and extinguishment of these large complex escalating fires. Crisis management teams were supported by fast acting foam assisting the saving of lives, homes and community protections, critical infrastructure, and escalation was prevented. No schools were closed, minimal site damage and spread, no ongoing resident or firefighter illnesses reported. No reported environmental damage. All Society's realistic expectations were fully and safely met, without resulting in disaster. Which would you prefer?

Do we have to accept more facility closures from fire destruction, community trauma, health issues and environmental harm if major incidents are to be restricted to F3 use in future? Where would liabilities and consequences rest ? With Regulators, Standards agencies, manufacturers, system designers, foam users or crisis management teams? Who 'carries the can' for misleadingly allowing such unnecessary disasters to perpetuate? Or is it a shared responsibility. Are we missing a key learning opportunity for important crisis management teams and regulators from recent comprehensive comparative fire testing and major incident outcomes? It's not too late for a serious re-think.

WHEN WILL THEY EVER LEARN ?

JOIFF

The primary aim of JOIFF since it was established has been and continues to be Shared Learning. This is to assist in the development the knowledge, skills, understanding and competence of Emergency Services Management primarily in High Hazard Industry to help them improve standards of safety and of the working environment in those sectors in which its members operate. A further important aspect of JOIFF's Shared Learning policy is to ensure that in learning about incidents that have taken place, JOIFF Members may benefit from the misfortunes of some to educate against the same mistakes being repeated.

The feedback from JOIFF members is that the Shared Learning is well received and most useful, but in the wider spectrum of High Hazard Industry around the World, the same mistakes continue to be repeated and disasters regularly happen, people are injured and killed, property is damaged and destroyed and the environment gets destroyed.

A very famous anti-war song written in 1955 by Pete Seeger called "Where have all the flowers gone" asks the question "When will they ever learn". The message of the song is a clever circle of destruction and rebirth caused by war. Flowers are taken by the young girls, the young girls marry young men, the young men become soldiers, go to war, get killed and end up in graveyards, the graveyards are covered in flowers and the circle starts again……..

How similar is this type of message when it is related to incidents in High Hazard Industry? The list of disasters that have taken place in Industry since Industry commenced is endless and so many of them are caused by a similar series of events that start with a small error or omission that is ignored and not rectified, following which another error or omission is made that is ignored and not rectified, followed by another and another and so on until all these small errors or omissions that could so easily have been rectified at the time they occurred have compounded to become the catalyst of a disaster. When it happens, the public are outraged with the injuries, loss of life and property and environmental damage. Then the protracted insurance and legal procedures begin, one or more tribunals of investigation are established, time passes and the details fade away from the media and from the public mind, with the exception of those who have been impacted by the disaster and will not forget it.

> A very famous anti-war song written in 1955 by Pete Seeger called "Where have all the flowers gone" asks the question "When will they ever learn".

In the meantime, somewhere else in another location no notice has been taken of the causes of the recent disaster and a small error or omission is ignored and not rectified, followed by another and another and the circle will keep on turning until another similar disaster occurs some time later with further injuries, injuries, loss of life and property and environmental damage.

Dr. Nigel Blumire of JOIFF member organisation National Chemical Emergency Centre, United Kingdom, presented a paper at the recent JOIFF Virtual Conference on the long history of incidents involving ammonium nitrate from when ammonium nitrate started to be used in agriculture in the early 1900s. His presentation emphasised the necessity to identify the hazards and properties of all hazardous materials in use in High Hazard Industry, assess the risks and implement safety procedures that will ensure that the products are stored and used correctly and this will prevent the repeat of an earlier incident. He asks the question "Why are we still seeing indents involving ammonium nitrate causing a major loss of life and property and damage to the environment when we know the hazards?"

Hopefully, by continually promoting the message given by Dr. Blumire in his presentation, we will eventually get a positive answer to the question "When will they ever learn?" and these continuing tragedies and wasteful losses will stop happening.

To maintain the message that disasters can be prevented if early remedial action is taken when small errors and omissions occur, we are introducing a new feature in this edition of The Catalyst taken from the words of the Spanish-American philosopher, poet, and humanist George Santayana "Those who fail to learn from history are condemned to repeat it".

RESPONDING TO CORROSIVE CHEMICAL ASSAULTS

NCEC's 24/7 chemical emergency response helpline has been receiving an increased number of calls from the UK's emergency services relating to assaults involving corrosive substances. These terrible and disfiguring attacks not only present risks to the victim, but also to the emergency services attending the incident. This article will help you and your teams understand what risks may be present in this sort of chemical incident, and how best to protect yourselves and the victim(s).

Corrosive chemical assaults (often incorrectly called acid attacks, as not all involve acids) usually involve the chemical being thrown or sprayed into the victim's face. Typically, the corrosive is highly concentrated causing immediate effects. Exposure can lead to chemical burns, scabs, ulcers, blanching, alopecia and scarring. Corrosive substances can cause severe and long-lasting effects when they come into contact with eyes and may lead to sight loss.

While all corrosives have the same hazard classification, treatment should be determined by the nature of the corrosive. Alkali caustic agents may cause deep tissue damage, which continues even after pain has stopped as they can quickly destroy nerves and continue to react for longer on the skin. Acids are usually self-limiting as they form a coagulum, which limits the depth of injury. Some acids have additional hazards associated with them. For example, strong mineral acids, such as nitric acid and chloric acid, are oxidising agents. These can increase the risk of fire and cause combustible materials to smoulder and burn. Highly concentrated sulfuric acid is viscous and will not run off the skin quickly. It is also dehydrating, so it will dry out the skin as well as causing burns.

In one horrific incident, nitric acid was poured onto the victim as they slept on a sofa. Fumes and heat were produced leading to concerns from on-scene responders regarding the respirable atmosphere and whether there was a fire risk from the contaminated sofa. Responders were right to be cautious as nitric acid can decompose and produce fumes that are a mixture of hazardous nitrogen oxides. Fire and rescue service (FRS) teams made the area safe and the victim was evacuated to hospital for treatment.

ACTIONS TO CONSIDER WHEN ATTENDING A CORROSIVE CHEMICAL ASSAULT

• Evacuate any casualties and perform initial decontamination. Speed is essential in corrosive chemical attacks as it may only take a few minutes for serious damage to occur. Wounds should be irrigated with copious amounts of water to dilute the material as much as possible and eventually remove it from the skin. Try to ensure any runoff does not come into contact with other uncontaminated parts of the body. Keeping people away from the agent is also essential as it will still be hazardous following the initial attack.

• Hand over casualties to the ambulance service as quickly as possible. Once again, due to the speed with which corrosives act, it is likely that victims of corrosive chemical attacks will require medical attention or, at the very least, monitoring. Handing over casualties to the ambulance service should be a priority for FRS crew members so they can then focus on dealing with other aspects of the situation.

• Make the scene safe – reduce the risk of fire and structural damage. Risks presented by some corrosive materials may not be immediately apparent. For example, soft furnishings soaked in nitric acid may not appear hazardous at the time of the incident. However, as the nitric acid dries and becomes more concentrated, the soft furnishings could begin to smoulder and eventually burst into flames hours after contamination due to the oxidising properties of nitric acid.

• Preserve the scene as far as is reasonably practicable. While safety is the top priority, reasonable steps should be taken to ensure that evidence is not tampered with or removed. In this way, evidence is preserved, which can be used to bring offenders to justice, which may act as a deterrent to others.

• Sample the scene. This will almost certainly be carried out by forensic teams, but simple field tests may help others in performing their job. Knowing if a liquid used in an attack is an acid or an alkali will help inform medical personnel to decide on a course of treatment. Likewise, knowing if the substance is oxidising will help FRS teams decide what they should remove and what can remain undisturbed.

• ALWAYS follow your

operational guidance and training. This list in no way overrides any previous training or operational guidance you may have received. Your response to an incident should be based on a dynamic risk assessment and best practice. In the UK, this is represented by the 'Remove, Remove, Remove' campaign1, which aims to educate emergency services personnel and commercial businesses in preparing for a corrosive chemical incident at their premises.

Disfiguring assaults have been commonplace in South Asia and the Indian subcontinent for a long time. In the west, the number of assaults involving corrosive materials has steadily increased over the last few years. In London, between 2011 and 2016, there were 1,500 attacks reported that involved a corrosive substance and, allegedly, many attacks go unreported due to gang violence. Typically, this type of crime is associated with female victims – women are often attacked by jealous former partners, love rivals, rejected suitors or even angry family members. Globally, women make up 80% of corrosive substance attack victims. However, in the UK, 71% of victims are male. This is likely to be due to the increased prevalence of the use of corrosive materials within gang violence.

A major risk with assaults involving corrosive materials is the potential for others to be affected. Often, attackers do not consider, or even care about, the risk of other people being affected. An assault can easily turn into a mass casualty situation, which puts an increased strain on responders. A recent, high-profile case in London left 20 people injured when an argument broke out and ended in acid being thrown in a busy nightclub. As previously mentioned, essential rapid decontamination is already a challenge due to the fast-acting nature of corrosives, this will be even harder with numerous casualties and limited resources.

Many household items can be used in these assaults making it difficult to tell if something is innocuous or is intended to be used as a weapon. As with most clandestine chemistry incidents, it is worth noting if a normal household substance is present in large quantities or is in a strange place. For example, a bottle of bleach under the sink is fairly common. However, while 10 bottles in someone's vehicle, bedroom or lounge is not a sign of wrongdoing, it may need further investigation.

NCEC is experienced in providing advice following assaults involving corrosive materials. One call we received related to an incident where a man answered his door and had sulfuric acid thrown in his face. The effects were quickly noticeable – vision impairment and extreme pain – and the person was taken to hospital. The emergency services thought the substance was sulfuric acid, but were unsure because of its colour. We provided advice on protecting the crew about to enter the property, how to sample the substance and how to identify the substance. We later advised the scenes of crime officer that forensic sampling should be carried out immediately to avoid loss of evidence. The investigation led to criminal proceedings and a guilty verdict, but unfortunately the victim suffered life-altering injuries.

As corrosive attacks are becoming more commonplace, emergency services need to train regularly to understand what they are dealing with and how they can respond rapidly to minimise the damaging effects of these attacks on themselves and the public. Through NCEC's close relationship with incident responders and hazmat leads, we know that training has been heavily impacted because of financial constraints placed upon response teams over the past decade and the consequent reduction in staff levels. This has the potential to cause issues where a team may not be fully prepared for the incidents it is faced with.

Therefore, NCEC has now launched the Hazmat Academy, which provides off-the-shelf and bespoke training that is delivered in person or via distance learning – or a combination of both. These focus on chemical hazards and incidents, including corrosive chemical assaults, so responders arriving at the scene know the steps to take to minimise risks and reduce negative impacts. Our next course is Hazardous Materials Instructor and it begins on 21 June. Our distance learning courses are available to book throughout the year. To book your place or to find out more about our hazmat and chemical training courses, please visit www.thehazmatacademy.co.uk.

NCEC's multilingual 24/7, emergency response helpline provides callers with direct access to our highly trained chemical experts. Our chemical experts have access to our comprehensive and reliable safety datasheet (SDS) database, alongside our own Chemdata® chemical hazard database. We also operate a 24/7 emergency phone line to assist the UK emergency services during incidents involving hazardous materials.

You can also join us for a free event – the Virtual Hazmat 2021 on 18 and 19 May, which will focus on providing informative, practical and actionable advice about hazmat incidents. Register here www.the-ncec.com/virtualhazmat

For more information about dealing with the risks of corrosive chemical assaults or to find out how our training programmes can benefit your teams, please email ncec@ricardo.com.

AUTHOR

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1.https://naru.org.uk/wp-content/uploads/2018/03/IOR-REMOVE-AIDE-MEMOIRE.pdf Contains public sector information licensed under the Open Government Licence v3.0

Public attacks can lead to multiple casualties from the corrosive material

Join NCEC for practical hazmat advice from industry experts and the chance to win a free hazmat training session

NCEC's Virtual Hazmat 2021, which is supported by JOIFF, is a free virtual event for anyone who has to deal with incidents involving hazardous materials. It will comprise two different 2-hour sessions on consecutive days (18 and 19 May). The event will draw on the knowledge and experience of NCEC's hazmat experts – with a focus on providing informative, practical and actionable advice about hazmat incidents.

YOU ARE WELCOME TO ATTEND ONE OR BOTH DAYS. BOTH DAYS WILL INCLUDE:

• Discussion involving a practical hazmat-related scenario that will focus on a chemical spill at a commercial site. The scenario will explore incident scene management and how to implement a proportionate response to an incident involving hazardous materials.
• An interactive quiz during which delegates will be given the opportunity to test and challenge their knowledge on hazmat-related subjects such as hazmat history and incident scene management. The winning participant/team on each day will win a free, virtual, hazmat training session with our Hazmat Academy team*.

YOU SHOULD ATTEND THIS EVENT IF YOU ARE LOOKING TO:

- Gain knowledge and actionable advice from specialists in the chemical incident industries.
- Find out best practice for hazmat training.
- Learn more about effective hazmat response from practical hazmat-related scenarios.
- Put your hazmat knowledge to the test.
- Ask any hazmat-related questions to experts in the field.

This completely free event is the perfect opportunity to test whether you and your team are truly prepared should a hazmat incident occur.

Ed Sullivan
Hazmat Academy Manager NCEC
Ed's background is predominantly in the fire and rescue service as a responder, and he is a subject matter expert in hazmat and incident command.

Josh Allaway
Senior Emergency Responder and Hazmat Trainer NCEC
Josh is a subject matter expert for hazmat and fire science, and a trained firefighter.

Jon Gibbard
Director NCEC
Jon oversees the strategic direction of NCEC and has led significant change in NCEC to ensure we always stay at the cutting edge of chemical emergency response and compliance.

Dr. Nigel Blumire
Training Product Manager NCEC
Nigel is an expert in emergency response with several years of experience providing chemical advice to emergency services. He is also the secretary of the International Technical Committee for the Prevention and Extinction of Fire's (CTIF) Hazardous Materials Commission

SAVE YOUR SPOT AT THE EVENT TODAY

The National Chemical Emergency Centre (NCEC)
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NCEC’s Virtual Hazmat 2021

18 May (14:30 – 16:30 BST) and 19 May (08:00 – 10:00 BST)

NCEC’s Virtual Hazmat 2021, supported by JOIFF, is a **free online summit** for anyone who has to deal with incidents involving hazardous materials. It will draw on the knowledge and experience of NCEC's hazmat experts – with a focus on providing informative, practical and actionable advice about hazmat incidents.

Both days will include two sessions:

- **Discussion involving a practical hazmat-related scenario** that will focus on a chemical spill at a commercial site. The scenario will explore incident scene management and how to implement a proportionate response to an incident involving hazardous materials.
- **An interactive quiz** during which delegates will be given the opportunity to test and challenge their knowledge on hazmat-related subjects such as incident scene management. The **winning participant/team on each day will win a free, virtual, hazmat training session** with our Hazmat Academy team*.

Attend one or both days of this informative event to test whether you and your team are truly prepared should a hazmat incident occur.

To learn more about the event and to register, please visit

www.the-ncec.com/virtual-hazmat-2021

About NCEC

Since 1973, NCEC has worked with organisations around the world that are facing a range of complex, chemicals-related response risks and challenges. Our emergency responders provide chemical incident advice 24/7 and 365 days of the year. This puts us in the best place to identify regional, national and international trends, and share that information with the hazmat community through our Hazmat Academy. NCEC's Hazmat Academy provides off-the-shelf and bespoke hazmat training, delivered in person or via distance learning – or a combination of both.

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INDUSTRIAL DISASTERS – CAN THEY BE PREVENTED ?

35 years ago this month, the Chernobyl disaster took place. A few miles from Chernobyl, a town in Ukraine near the borders with Russia and Belarus, a nuclear power site was developed that was intended to have six reactors when completed.

In 1986, four reactors had been completed and the last 2 were under construction. In the early morning hours of April 26, 1986 during maintenance checks and testing on reactor #4, it exploded creating what has been described as the worst nuclear disaster the world has ever seen.

Unlike most nuclear reactors, where water is used as a coolant to moderate the reactivity of the nuclear core, the reactor in Chernobyl used graphite to moderate the core's reactivity and to keep a continuous nuclear reaction occurring in the core. When extremely hot nuclear fuel rods were lowered into cooling water, an immense amount of steam was created, which, because of design flaws in the reactor created more, rather than the intended less reactivity in the nuclear core of the reactor. The resultant power surge caused an immense explosion that detached the 1,000-ton plate covering the reactor core, causing nuclear meltdown and releasing over 200 times the amount of radiation released at Hiroshima and Nagasaki into the atmosphere. Fallout could be detected as far away as Canada.

The explosion and fire killed up to 50 people with estimates that there may have been between 4,000 and several hundred thousand additional cancer deaths over time.
Hundreds of thousands firefighters and emergency workers came from all over the former Soviet Union to deal with the disaster and they toiled for over two years to extinguish the fire, to bury radioactive equipment, homes, storage facilities, etc. and to build a "sarcophagus"-tomb-around the plant to hem in the radioactive material that had collapsed into the reactor. Many of these people are now dead, disabled, or have committed suicide.

Over 7 million people were effected by this disaster and more than 63,000 square miles of land has been affected. To this day millions of people are still living and growing food on contaminated land and as a consequence the food they are eating is contaminated.

Because of the absence of widespread farming, hunting etc., there has been major growth in the animal life in the region and the region today is widely known as one of the world's most unique wildlife sanctuaries with populations of wolves, deer, lynx, beaver, eagles, boar, elk, bears and other animals thriving in the dense woodlands that now surround the silent plant. That is not to suggest that the area has returned to normal – it is estimated that the area with the long-lived radiation in the region surrounding the former Chernobyl Nuclear Power Plant won't be safe for human habitation for at least 20,000 years.

If anyone wishes to learn more about the Chernobyl disaster and how early effective remedial action could have prevented it, the recent TV mini-series of the disaster is well worth watching.

Other disasters that took place during the first quarter of years past, that could have been prevented with early effective remedial action include:

JANUARY 1979

The Whiddy Island disaster in Bantry Bay Ireland., The oil tanker Betelgeuse owned by Total S.A. exploded at the offshore jetty for the Gulf Oil Corporation oil terminal at Whiddy Island, Ireland. The explosion and resulting fire claimed the lives of 50 people. Only 27 bodies were recovered.

The Tribunal set up to investigate the incident spent a year hearing evidence and identified three main factors had contributed to the incident:

1. The poor condition of the Betelgeuse. Immediately before the incident, the vessel's hull and tanks were cracked, corroded, and leaking. The 11-year-old vessel was at the end of her service life.

2. Incorrect unloading sequences and ballasting which resulted in the buoyancy of the hull becoming uneven and the hull therefore strained: Lack of crew training or knowing malpractice were possible explanations.

3. Inadequate and poorly maintained fire-fighting and rescue systems both on the vessel and on the jetty: A combination of human failings and financial constraints was the immediate cause.

MARCH 2019

A major explosion occurred at the Tianjiayi Chemical plant in Chenjiagang Chemical Industry Park, Yancheng, Jiangsu, China. 78 people were killed and 617 injured. Tianjiayi Chemical had previously been penalised six times for infractions of pollution and waste management laws and had previous fires and deaths. There was no government program to keep chemical plants like this one up to standard to prevent future disasters.

MARCH 2005

The BP Texas City Refinery explosion occurred on March 23, 2005, when a vapour cloud was ignited and violently exploded killing 15 workers, injuring 180 others and severely damaging the refinery. BP's own accident investigation report stated that the direct cause of the accident was heavier–than-air hydrocarbon vapours combusting after coming into contact with an ignition source, probably a running vehicle engine. Both the BP and the U.S. Chemical Safety and Hazard Investigation Board reports identified numerous technical and organisational failings at the refinery and within corporate BP.

The refinery was built in 1934, and it was reported that it but had not been well maintained for several years. A Consultant's report in January 2005 found numerous safety issues, including broken alarms, thinned pipe, chunks of concrete falling, bolts dropping 60 feet (18 m) and staff being overcome with fumes.

Industrial disasters – can they be prevented ? Of course they can, if management learn from and act on the mistakes of previous disasters.

Those who fail to learn from history are condemned to repeat it.

A BOLD PROPOSAL
TO SIMPLIFY PPE FOR FIREFIGHTERS

Honored reader, the following comments are intended to be thought-provoking from a person who has been working voluntarily in national and international standardization for more than 25 years and who has been producing PPE against flames and heat for more than 65 years.

If you look at the table below of todays standardized PPE for firefighters, you may get dizzy. Even more so when you consider that European and American standards - although not always identical - are hidden behind or within ISO standards.

Thus, one can find parallels of EN 469 performance level 1 in ISO 11613 and performance level 2 in ISO 11999-3 performance level 1. NFPA 1971 is largely reflected in ISO 11999-3 performance level 2.
Less confusing is the fact that EN ISO 15384 for wildland firefighting PPE is identical to ISO 16073-3.
This is because ISO 16073 is an ensemble standard, with clothing described in Part 3, while EN ISO 15384 deals exclusively with clothing.

Not included in the table is aluminized PPE for specialized firefighting at high radiant heat, for which there are also two standards, EN 1486 and ISO 15538.

Even if these are not included in the consideration, firefighters still have to wear - depending on the mission - four different PPE.

- Station uniform
- PPE for wildland fire
- PPE for structural firefighting
- PPE for associated activities

This raises questions:
How to store all this PPE in vehicles?
Which authority is ready or able to finance all this PPE, especially in countries, where most of the firefighters are volunteers?

Without disregarding the protection of firefighters, it would be possible to carry out a simplification - admittedly "revolutionary" - that would be of both economic and organizational advantage.
And the more models available, the greater the risk of wearing PPE that is unsuitable for the mission.

CONSIDERATION 1:

- EN 469 level 1 could be withdrawn, and instead ISO 11613 should be revised under Vienna Agreement as EN ISO 11613
- ISO 11999-3 level 1 could be withdrawn
- Station uniform ISO 21942 level 1 could be withdrawn
- Station uniform level 2 would be combined with EN ISO 15384 and ISO 11613 (under EN ISO 11613)

Following this there would remain two different types of firefighting PPE

1. Station uniform / PPE for wildland / PPE for associated activities under EN ISO 11613

Thus could be titled "BASIC", and depending on risk assessment under consideration of geography, climate, environment, constructions etc. the performance requirements could be as shown in the table hereunder with green markings.

2. PPE for firefighting in structures (EN 469 former level 2 or ISO 11999-3 former level 2)

CONSIDERATION 2:

For those who find this too far, here is a less spectacular simplification where ISO 21942 remains unchanged:
- EN 469 level 1 could be withdrawn, and instead ISO 11613 should be revised under Vienna Agreement as EN ISO 11613
- ISO 11999-3 level 1 could be withdrawn

Following this there would remain three different types of firefighting PPE

1. Station uniform ISO 21942
2. PPE for wildland fire and for associated activities under EN ISO 11613

Thus could also be titled "BASIC", and depending on risk assessment under consideration of geography, climate, environment, constructions etc. the performance requirements could be as shown in the table hereunder with green markings.

3. PPE for firefighting in structures (EN 469 former level 2 or ISO 11999-3 former level 2)

Moreover as already envisaged in the Netherlands, Station uniform / PPE for wildland / PPE for associated activities as undergarment could be combined with a coat/jacket as over garment in order to reach the performance level of PPE for firefighting in structures.

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Requirements	ISO 21942		EN ISO 15384	ISO 16073-3	ISO 11613	EN 469		ISO 11999-3	
	Station uniform		Wildland	Wildland	Structural	PPE for fire fighting		ff in structures (ensemble)	
	Level 1	Level 2		ensemble	associated	Level 1	Level 2	Level 1	Level 2
					activities				
Flame spread EN ISO 15025									
face ignition (A1)	Index 2	Index 3	Index 3	Index 3	Index 3	Index 3	Index 3	Index 3	
					acc. to EN ISO 14116				
edge ignition (A2)			Index 3	Index 3					Index 3
Heat resistance	180°C	260°C	260°C	260°C	180°C	180°C	180°C	180°C	260°C
ISO 17493	≤ 5% shrinkage	≤ 10% shrinkage	≤ 10% shrinkage	≤ 10% shrinkage	≤ 5% shrinkage	≤ 5% shrinkage	≤ 5% shrinkage	≤ 5% shrinkage	≤ 5% shrinkage
Thread heat resistance			260°C	260°C		260°C	260°C	260°C	260°C
Contact heat at 250°C									
Threshold time							≥10 s at 250°C	≥15 s at 180°C	≥15 s at 260°C
Heat transfer (flame)		HTI_{24} ≥ 4 s			HTI_{24} ≥ 9 s	HTI_{24} ≥ 9 s	HTI_{24} ≥ 13 s	HTI_{24} ≥ 13 s	HTI_{24} ≥ 17 s
	HTI_{24} (Heat Transfer Index) = time to raise temperature on the inside about 24°C								
Heat transfer (radiation)		$RHTI_{24}$ ≥ 7 s	$RHTI_{24}$ ≥ 11 s	$RHTI_{24}$ ≥ 11 s	$RHTI_{24}$ ≥ 10s	$RHTI_{24}$ ≥ 10s	$RHTI_{24}$ ≥ 18 s	$RHTI_{24}$ ≥ 18 s	$RHTI_{24}$ ≥ 26 s
	$RHTI_{24}$ (Radiant Heat Transfer Index) = time to raise temperature on the inside about 24°C								
Heat transfer (combined)								TTI ≥ 1 050	TTI ≥ 1 400
(flame and radiant heat)									
Dimensional change	≤ 5%		≤ 3%	≤ 3%	≤ 5%	≤ 3%	≤ 3%	≤ 5%	≤ 5%
Tensile strength (woven)	≥ 300 N		≥ 600 N	≥ 600 N	≥ 450 N	> 450 N	> 450 N	≥ 450 N	≥ 800 N
Residual strength					> 450 N	> 450 N	> 450 N	≥ 450 N	≥ 600 N
after heat exposure at 10 kW/m²									
Tear strength	≥ 10 N		≥ 25 N	≥ 25 N	≥ 25 N	≥ 30 N	≥ 30 N	≥ 25 N	≥ 40 N
Burst strength (knitted)	≥100 kPa alt. ≥200 kPa								
	depending on specimen size								
Seam strength	≥ 225 N	≥ 225 N	≥ 300 N	≥ 300 N		≥ 300 N	≥ 300 N	≥ 225 N	≥ 450 N
Abrasion resistance	optional		≥ 20000 rubs	≥ 20000 rubs					
	≥ 15000 rubs								
Thermal resistance	*< 0,010 m²K/W*		*≤ 0,055 m²K/W*	*≤ 0,055 m²K/W*					
ISO 11092									
Water vapour resistance	< 5 m²Pa/W		≤ 10 m²Pa/W	≤ 10 m²Pa/W		>30 ≤ 45 m²Pa/W	≤ 30 m²Pa/W	≤ 40 m²Pa/W	≤ 30 m²Pa/W
Total heat loss								≥ 200 W/m²	≥ 300 W/m²
Water absorption resist.					≤ 30%			≤ 30%	≤ 30%
Water penetration resist.					≥ 20 kPa	≥ 20 kPa	≥ 20 kPa	≥ 20 kPa	≥ 175 kPa
Surface wetting (spray rate)								≥ 4	≥ 4
Liquid chemical penetration					> 80 % run off			> 80 % run off	> 80 % run off
resistance for 4 chemicals					no penetration			no penetration	no penetration
						> 80 % run off	> 80 % run off		
resistance for 2 chemicals						no penetration	no penetration		

US Navy Info 2019

"We need to come up with fluorine-free foam. But what's available now can't meet (MIL-) specification."

– John Farley, Director of Fire Test Operations
US Naval Research Laboratory (NRL)
C&EN "The price of fire safety" January 14, 2019

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Evaluation of the fire protection effectiveness of fluorine free firefighting foams

FINAL REPORT BY:

Gerard G. Back
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Baltimore Maryland, USA

John P. Farley
NAVAL RESEARCH LABORATORY
Washington, DC, USA

January 2020

NFPA RF Report 2020

165 UL FIRE TESTS compare H-FFF and AR-FFF with C6 AR-AFFF (control)

Variables:

- **Hydrocarbon and polar fuels**
- **Fresh and salt water**
- **High and low foam expansion**
- **Gentle and forceful application**

Scan code for full NFPA RF Final Report

NFPA RF Report 2020 Executive Summary:

"The FFFs [F3 Agents] required between 2 – 4 times both the rates and the densities of the AR-AFFF to produce similar results against the IPA fires conducted with the Type II [Gentle application] test configuration.

During the Type III tests [Forceful application], the FFFs required between 3 – 4 times the extinguishment density [gpm/ft^2] of the AR-AFFF for the tests conducted with MIL SPEC gasoline and between 6 – 7 times the density of the AR-AFFF for the tests conducted with E10 gasoline."

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HIGH RISE FIRE TRAINING SESSIONS
AT BURY TRAINING AND SAFETY CENTRE
by Ian Redfern MJOIFF

Since the fire at Grenfell Tower, Greater Manchester Fire and Rescue Service (GMFRS) has continued to amend and develop operational procedures and training packages as part of a coordinated response to the recommendations of the Grenfell Tower Public Inquiry.

In addition, GMFRS is increasingly responding to larger, more protracted, more complex incidents such as *The Cube fire in Bolton*.

GMFRS' Built Environment Project has brought together a list of deliverables from the learning of both the Grenfell Tower Inquiry – Phase 1 report and The Cube Fire Incident Review. The project works with department heads ensuring that wherever possible activities are coordinated and cut across as many of the deliverables as possible, this training is a great example of this.

"It is now a reasonably foreseeable situation that our firefighters may be faced with a building that fails under fire conditions and therefore we have prioritised training for all our operational staff," said Area Manager Ben Levy, Head of the Built Environment Project at GMFRS.

"That's why developing this training has been essential to make sure we are all up to speed on the most effective techniques for tackling fires in blocks of flats and high-rise buildings.

"These buildings present complex challenges to firefighters, due to their structure, the potential for fire spread and therefore the need to ensure that we seize a window of opportunity as soon as possible upon arrival at an incident to assess whether the building is performing as we would expect."

The initial theory element of the training consisted of filmed presentations around topics including the Future of Greater Manchester's built environment and the particular challenges of tall buildings.

Once completed, participants attended a practical session at Bury Training Centre, which covered five elements of dealing with fires in tall buildings such as the use of lifts, use of smoke curtains and the gas detector to monitor conditions in stairwells.

SESSION 1:
Immediate Building Evacuation (IBE) and evacuation unit familiarisation.

A Station Manager delivered training on what happens when an Incident Commander declares an IBE, what the IC can expect in support including an additional Command Unit as an Evacuation Unit.

All crews were given familiarisation on Fire Survival Guidance arrangements, specifically how the information comes from Fire Control, is logged and sorted on the Evacuation Unit and then sent on to the operational sectors on the incident ground

SESSION 2:
Premises Information Boxes (PIBs) and Firefighting Lifts.

The Greater Manchester High Rise Task Force is developing the idea of PIBs and have agreed in principle a standard set of information that is to be contained within them. Also during this session we explored the functions of lifts, as depending on what standard they are maintained to, will determine the available functions that will be available for our firefighters to use. At our Operational Training and Safety Centre in Bury, there is a fully functioning lift with a 'Fireman's switch', we used this to highlight that such a switch is probably at least 20 years out of date and may not have the functions they would expect. The overriding message to the fire crews from this session was to get out into the built environment within theirs station areas and check the PIBs have the right information in them and to test the lift's functions.

SESSION 3:

Activities of Stairwell Protection Teams and the use of gas detectors.

A Hazardous Materials and Environmental Protection Officer (HMEPO) delivered training on the correct and effective use of gas detectors when crews are deployed as Stairwell protection Teams (SPTs). SPTs should not be a response to a building that is failing in fire, their deployment should be an early consideration by all ICs in order to seize the window of opportunity to ensure and maintain the tenability of the means of escape (stairwell). Their main tasks are to keep the stairwells as safe as possible, monitoring their Gas detectors and fitting smoke curtains on doors to stairwells to prevent smoke spread, keeping stairwells clear of firefighting equipment where possible and to guide and assist any residents that want to evacuate the building.

SESSION 4:

Rescue Intervention Containment Evacuation (RICE) Principles.

The RICE tool is new to GMFRS, in this session we discussed the priority of actions so that BA crews and initial Incident Commanders can decide where to deploy Smoke Curtains, whether to evacuate other flats on the fire floor, or to enter the flat that is on fire and intervene. In the instances where we know the occupants of the flat are safely outside, the crews may decide to evacuate the other residents on that floor before they make entry and fight the fire.

SESSION 5:

External fire attack and Cleveland Roll demonstration session.

Externally the fire crews observed the ground monitor in action and are introduced to the Cleveland roll, a method of stowing 52mm High rise Hose which enables quick deployment and reduces obstructions on stairwells.

This training was well received by crews, they recognised the value of this training and feel it was worthwhile even though there were concerns that, with the National lockdown due to COVID 19, the training might be postponed. However, the Operational Training Team overcame significant challenges and structured the sessions in such a way that crews stayed in their own "bubbles" and moved around the site from session to session safely.

We invited officers from across the North West Region of the United Kingdom to come and observe what we are doing, and we have created video recordings of each of the training sessions so that they can be used for eLearning packages for refresher training, but also so that we can share what we have done with other services.

Fires in tall buildings can be complex, especially when compartmentation fails and the problems this causes to our fire crews and residents are multi-faceted. It is our view that no single Fire and Rescue Service is going to be able to solve all of these problems, so it is vitally important that we all share our learning and work collaboratively."

EDITOR'S NOTE:

The July edition of The Catalyst will have an article on The Cube fire.

Ian Redfern MJOIFF is a Group Manager with Greater Manchester Fire and Rescue Service working on the Built Environment project and is also the service's Lead Petrochemical Officer. For further information on this project contact email: redferni@manchesterfire.gov.uk

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In person scenario week – 28th June to 2nd July
Phase 1 online training – 6th September
Phase 2 online training – 20th September
In person scenario week – 11th to 15th October
Hazardous Materials Adviser Revalidation
Online training – 4th May
In person training – 12th and 13th May
Online training – 13th September
In person training – 22nd and 23rd September
Online training – 29th November
In person training – 15th and 16th December
Hazardous Materials First Responder
In person training – 12th to 16th July
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