THE CATALYST

Q2 2022

JOIFF The International Organisation For Industrial Emergency Services Management

JOIFF Website Update

JOIFF Members will be pleased to learn that the upgrade of the JOIFF website has been completed.

JOIFF Role of Honour

A list of JOIFF qualifications that have been awarded to specific persons during January, February and March 2022.

News from Accredited Training Providers

With the lifting of more COVID travel restrictions during Q1 2022, it was possible for more overdue JOIFF accreditation audits to be carried out.

CRISIS MANAGEMENT

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What makes the difference for corporate Crisis Management Teams – Three criteria for success.
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Hydrogen, the safety challenges of a cleaner future
Putting in place fire protection measures for lithium-ion battery energy storage systems

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ABOUT JOIFF

JOIFF, the International Organisation for Industrial Emergency Services Management is a not-for-profi t 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 Affi liation - 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.

ABOUT THE CATALYST

The Catalyst is the Official magazine of JOIFF, The International Organisation for Industrial Emergency Services Management. The Catalyst is published Quarterly – in January, April, July & October each year. The JOIFF Catalyst magazine is distributed to all JOIFF members and member organistions worldwide. The Catalyst magazine is published by ENM Media on Behalf of JOIFF.

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Message from the Chairman

Dear JOIFF Members and Catalyst readers,

As if Covid is not bad enough, we are faced with economic challenges caused by the war in Ukraine and the theme for this edition of the Catalyst "Crisis Management" is very fitting for the current times we face as emergency responders.

"Crisis Management": – It is the strategy of applying formal risk assessments to .....
•Anticipate unexpected and disruptive events that will have adverse consequences happening;
•Determine measures to limit the seriousness of the consequences when these events occur;
•Define response actions to mitigate the impact of the consequences and keep business interruption as short as possible;
•Define and implement preventative measures to counter re-occurrence of similar incidents.

The saying "Fail to plan is plan to fail" comes to mind whenever I hear the term "crisis management" and so often we find that the comparison of probability versus consequence just does not happen – process safety specialists will hammer on the fact that plants are designed and engineered to ensure that the probability of an incident happening is low on any risk matrix, but then the process stops there and no time is spent on looking at the consequence side of the risk matrix. This is where we, as emergency responders must stand our ground and make sure that the consequence side of the risk matrix gets full attention also.

Sometimes when we talk "crisis management" the main direction will actually be "Incident Command Management" and in my mind, incident command management is one part of overall crisis management.

I trust that this edition will open up much more discussion on this very important topic, so please enjoy and if you want to respond, please do so by sending me an email and I shall make sure the message is spread to our members for discussion.

Unfortunately we had to postpone the JOIFF Conference and Exhibition that were planned to take place in March 2022, but we are working on making it happen during this year still, so look out for the communication in this regard.

I would like to end by again quoting our CEO, Alec Feldman: -

" JOIFF is an independent not-for-profit organisation representing many emergency services Worldwide, with the one aim of working to improve the quality of emergency services management in Industry, in particular to work for safety of the emergency response personnel who respond to incidents and protect the persons, property and the environment of their communities."

In light of this I would like to extend my deepest sympathy for all who suffer in the unnecessary war in the Ukraine and especially all the emergency responders who must render a service during these very difficult times. May God bless and protect you!

Regards,

Pine Pienaar
FIFireE; FJOIFF; FSAESI
Chairman & Director: JOIFF
Email: pine.pienaar2@outlook.com
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Please visit: www.joiff.com for more information.

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The Catalyst

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CRISIS MANAGEMENT EDITION

* Crisis management feature

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JOIFF NEWS

JOIFF WEBSITE COMPLETED

JOIFF Members will be pleased to learn that the upgrade of the JOIFF website has been completed.

The Directors express their sincere thanks to Paul Budgen and the ENM Team for a marathon effort over many months to implement all the changes that were necessary.

The Members' Area of the new website is now an easily accessible treasure trove of information and Shared Learning.

The JOIFF Membership Directory, which serves as the JOIFF Members' mailing list has been fully absorbed into the new Members Area. Members are asked to please check their Directory entries to ensure that the details are accurate including that each member organisation can have up to 4 nominees and please check that the list of nominees for their organisation is current.

The Shared Learning Archive is an excellent and very important tool and members' benefit and provides access to a wide range of past incidents under the headings of General, Onshore and Offshore, FEHM, Guidelines and Training and Competence.

All presentations of JOIFF Shared Learning webinars held since 2020 are available to members including the presentations on Firefighter Health and Wellbeing, Turbine Extinguishing Technology, CAF Fixed Pipe Systems, Non-Technical Skills and the most recent webinar Lastfire Update.

Papers presented at past JOIFF Conference and Summits are also available in the Members Area papers including the papers presented at the JOIFF 2020 Foam Summit.

JOIFF Guidelines are an important part of increasing JOIFF's Shared Learning knowledge base in line with new developments requiring different approaches to emergency response and they are developed by JOIFF Working Groups of Subject Matter Experts from JOIFF Member Organisations Worldwide.

A number of JOIFF Guidelines are available for download from the Members Area including JOIFF Guideline on Confined Space Entry, JOIFF Guideline on inserting vertical storage tanks, JOIFF Guideline on Foam Concentrate, JOIFF Guideline on Emergency Response to incidents involving vehicles powered by Alternative Fuels (including Hybrid vehicles) and JOIFF Guideline on Emergency Services Management of Airports.

WWW.JOIFF.COM

Accredited Training Providers

With the lifting of more COVID travel restrictions during Q1 2022, it was possible for more overdue JOIFF accreditation audits to be carried out.

INTERNATIONAL TRAINING CENTRE (ITC)
Tunisia
ITC Team presented with JOIFF certificate of accreditation.

Back row from left to right.
Nahed Dahmen, Emma Jammoussi, Hamdi Amri, Mohamed Daoud, Mondher Louati.

Front row from left to right
Ezzedine Kacem and Yosri Ben Amar, ITC, Gerry Johnson and Craig Kelsall, JOIFF auditors

YASSINE MARINE SERVICES
Tunisia
Yassine Marine Team presented with JOIFF certificate of accreditation.

Back row from left to right.
Amar Yousfi , Craig Kelsall JOIFF auditor, Wassim Megdiche, Don Sheens, Jmaiel Mansour

Front Row left to right:
Gerry Johnson JOIFF auditor, Omazine Jerbi.

TECHMA
Dubai
Presentation of JOIFF certificate of accreditation to Techma

Left to right:
John Lowe, Group Training Director Techma, Alec Feldman, JOIFF auditor, Thierry Cusin, CEO Techma.

JAHEZIYA
Dubai
Presentation of JOIFF certificate of accreditation to JAHEZIYA

Left to right:
Malcolm Barrett, Training Manager Jaheziya, Bodor Al Nimer and Alec Feldman, JOIFF auditors, Chris Lawson, Training Manager Jaheziya.

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ROLL OF HONOUR

During January, February and March 2022, the following persons were awarded JOIFF qualifications:

JOIFF DIPLOMA

ADNOC Onshore,
Abu Dhabi
United Arab Emirates

Brain Chigaro Dip.JOIFF
Firefighter

Miguel Latasa Banados Jr. Dip. JOIFF
Firefighter

JOIFF DIPLOMA

Essex County Fire and Rescue Services,
Essex
United Kingdom

Marc Diggory Dip.JOIFF
Group Manager

Peter Neal Dip.JOIFF
Station Manager

LEADERSHIP 1 - TEAM LEADER

ADNOC Onshore
Abu Dhabi
United Arab Emirates

Salem rashed Al Nuaimi
Officer, Fire Services

JOIFF DIPLOMA

Unity Fire and Safety LLC
Sultanate of Oman.

Kevan Whitehead, Manging Director of Unity Fire and Safety LLC, reports that in December last year, Unity Fire and Safety LLC concluded a 16-Week intensive recruit course. The course ran from 1st Aug 2021 until 9th December 2021, in 4 x 4 week blocks (with a week off duty after each 4-week block). The training took place at the OQ LPG Fire Station in Salalah.

On successful conclusion of the course , the following firefighters were awarded the JOIFF Diploma:

Abdullah Masoud Amur Sulaiman Al Maskari

Ali Hamed Al Jardani

Haitham Nasser Saif Al-Mamari

Mohammed Ali Salim Ba Makhalif

Hassan Said Saad Al Manhali

Yasir Said Saad Al Manhali

Haitm Salim Awadh Majudah Bait Said
Mashal Abdullah Ba Shaib

Salim Said Ali Bazanbour

Ahmed Rashid Al Badi

Gerry Johnson JOIFF Director (right) presenting Kevan Whitehead (left) with the JOIFF Diploma certificates for the successful students.

GRADUATE OF JOIFF

Salem rashed Al Nuaimi Grad.JOIFF
Officer, Fire Services
ADNOC Onshore
Abu Dhabi
United Arab Emirates

Having successfully completed the JOIFF Diploma programme in 2019, Salem Rashed Al Nuaimi moved on to take the JOIFF Technician programme. On successfully completing the Technician programme in 2020, Salem said "I made sure to obtain a JOIFF Technician certificate because I know it will help me in developing my abilities and my skills as fire Officer in the oil industry".

Salem then began to work on the Leadership 1 Team Leader programme, which he successfully completed in February 2022 and as a holder of the Technician and Leadership Team Leader qualifications, he was awarded the Post Nominal Grad.JOIFF – Graduate of JOIFF.

GRADUATE OF JOIFF

Ewen Duncan Grad.JOIFF
Training & Operations Manager
Emergency Preparedness Solutions (EPS) Ltd
Dumbartonshire
Scotland

Ewen Duncan has been involved in the fire protection industry for the past 35 years, starting his career at ICI Grangemouth, Scotland, as an apprentice fireman. Ewen quickly progressed to leading fireman in charge of a duty shift. After sixteen years at ICI Grangemouth, Ewen "headed south of the border" to Sembcorp Utilities as a site protection Officer, and then he was promoted to Crew Commander serving at Wilton, Billingham and North Tees fire stations.

An opportunity arose for Ewen to further extend his knowledge and experience when he was recruited by Das Island Fire & Rescue Service, United Arab Emirates., as Lead Fire Training Officer (DO) in charge of the training centre and by natural progression he was successful in being promoted to Section Leader (Deputy Chief) upon the retirement of John Nimmo FJOIFF.

For ten years he was a conference and seminar speaker representing Williams Fire & Hazard Control in 36 countries and he was awarded with Russian Fire Academy award for contributions and best fire paper to Russian flammable liquid firefighting. He is currently working with three oil refineries, instructing on tank fire management including tank design and construction, hydrocarbon fire scenarios and intervention requirements, tactics, water/foam calculations, foam performance, and emergency response.

Ewen has extensive experience conducting technical rescue standbys on chemical and petrochemical sites and in tank firefighting including attendance at major incidents in the UK, Nigeria, USA, Spain and UAE.

Ewen has been a valued member and strong supporter of JOIFF throughout his career, and was successful in encouraging a number of organisations to become JOIFF members organisations. Over a number of years, he successfully completed the JOIFF Diploma and the JOIFF Technician programme and wherever he goes, he promotes the ideals of JOIFF to Industry in particular how JOIFF accredited training sets the benchmark for the Industry.

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

Industrial Disasters
Can they be prevented?

CRISIS MANAGEMENT FEATURE

Image Source: The Environmental Justice Atlas

"The major problem with the chemical industry and indeed other agencies is the way accidents are investigated, reports written, read and filed away and then forgotten and then ten years later, even in the same Company, the accident happens again. Organisations have no memory only people have memory and once they leave the plant, the accident that occurred there is forgotten about."

Statement by
Trevor Kletz
OBE, FREng, FRSC, FIChemE, a prolific author on the topic of chemical engineering safety.

The primary aim of JOIFF since it was established, continues to be Shared Learning. An important aspect of JOIFF's Shared Learning policy is to ensure that in learning about incidents that have taken place, JOIFF Members can benefit from the misfortunes of some to educate against the same mistakes being repeated by themselves i.e. if such Shared Learning is acted upon, this could prevent many future incidents/accidents and subsequent losses. Does this happen?

Incidents that took place in the first quarter of the year - A fatal chemical incident, fatalities due to a natural gas explosion and a refinery explosion

17th January 2010 DuPont Bell West Virginia

DuPont was founded in 1802 as a gunpowder manufacturer, and by the early 20th century the Company had developed into a major chemical company with the stated focus on accident prevention with a goal to reach zero incidents. Through the years DuPont became recognised as a safety innovator and leader with a highly regarded safety culture. But their reputation was shaken in January 2010, when 3 separate incidents occurred within 33 hours in their Bell West facility in West Virginia.

The 1st incident occurred on 17th January 2010 when a production unit was started up after extended maintenance. Methyl chloride, produced in a reaction vessel, flowed through an open rupture disc and escaped from an improperly located drain hole. The hazardous gas vented indoors in an area not frequented by operators and the on-going release of methyl chloride from process equipment went unnoticed for 5 days when an air monitor alarm alerted personnel of the release. Approximately 2,000 pounds of methyl chloride had escaped.

The 2nd incident occurred the following morning, when plant operators discovered another release, this time, of highly corrosive oleum, a concentrated form of sulphuric acid, which over time had corroded piping in the plant's spent-acid recovery unit. Steam from an attached copper tube mixed with the oleum and created a large hole in the pipe. The escaping oleum formed a vapour cloud which was discovered by workers on 23rd January. Approximately 22 pounds of oleum had been released.

The 3rd incident on at the Belle West plant came just 6 hours after the oleum release was discovered and this would prove fatal. A transfer hose ruptured, releasing highly toxic phosgene, an industrial chemical used as a chemical weapon in World War 1. The phosgene, used for their production of pesticides, was stored in a one-story partially walled structure which was open to the atmosphere. The cylinders were connected to other equipment by flexible braided stainless-steel hoses with an inside lining of Teflon (PTFE). The hoses were used to pressurise the cylinders pushing the liquid to the manufacturing process and as each cylinder was emptied, an alarm was sounded, and an operator closed the valves of the empty cylinder and opened valves to a second full cylinder. The stainless-steel hoses to the empty cylinder were then purged of phosgene with nitrogen.

On the day prior to the fatal phosgene release, operators were experiencing flow problems with one of the hoses and they began switching between cylinders to avoid disruption to the chemical process. In the course of switching

cylinders, the valve was closed on a partially full cylinder, however the hose was not purged, allowing pressure to build up as the liquid phosgene inside warmed up. In the early afternoon, an operator was inspecting one of the cylinders when the pressurised hose suddenly burst and he was sprayed across his chest and face with a lethal dose of phosgene. A total of 2 pounds of phosgene was released to the atmosphere. The operator who had been sprayed with phosgene called for help and was transported to a local hospital and despite medical treatment, he died a day later.

The US Chemical Safety Board (CSB) carried out an investigation and found that each of the 3 serious incidents at the DuPont plant was preceded by another event or series of events, but these early warnings and near misses did not result in action preventing them from occurring.

1st incident: The CSB found that due to a history of false alarms, this alarm was viewed as a nuisance that could safely be ignored.

2nd incident: The CSB found that DuPont had a previous oleum leak resulting in a company recommendation to conduct regular maintenance inspections of the oleum piping but this was not done due to ineffective communications between DuPont and its inspection contractors

3rd incident: The CSB found that the PTFE lined stainless steel hoses are particularly susceptible to failure when using phosgene because the phosgene can seep through the permeable PTFE lining and corrode the stainless steel. They also learned that another phosgene hose nearly failed in the same manner and was discovered just hours before the fatal phosgene release, but this near failure was not subject to an investigation. DuPont's standard operating procedure requires replacement of hoses in phosgene service every 30 days, however by the day of the accident, the phosgene hoses had not been changed for more than 7 months.

The CSB also found that as far back as 1987, DuPont officials were aware of the hazards of using the braided stainless-steel hoses lined with Teflon and an alternative lining had been recommended but this recommendation was not followed by management. Documents from 1988 showed that DuPont considered building an enclosure that would be much safer but again this proposal was not followed. The danger was raised again in a 2004 process hazard analysis and it was agreed to proceed with the changes to be completed by December 2005, but the deadline was extended had still had not been met by the date of the accident.

Image Source: NBCconnecticut

7th February 2010: Kleen Energy Natural Gas fuelled Power Plant, Connecticut, USA.

On 7th February, construction was almost finished on the new plant which was scheduled to start supplying energy in June 2010. New piping had been installed from the natural gas supply line to massive, precisely constructed turbines that generate electricity. Because debris such as rust or welding slag can remain within the pipes after construction, the pipes must be cleaned to ensure that the debris does not damage the turbine blades. At Kleen Energy this was accomplished by a procedure called "gas-blows" i.e. forcing large volumes of high-pressure natural gas through piping to blow out debris directly into the atmosphere. Despite there having been at least 2 other fires and explosions at gas power plants since 2001 this was a common practice in the industry at the time.

Prior to starting the gas blows, workers made efforts to control potential ignition sources outside of the power generation building, but such sources are difficult to completely eliminate as the metal debris expelled from the piping can strike other objects causing sparks that can ignite the gas.

Over a 4 hour period that day, nearly 2 million standard cubic feet of gas and debris were released from a number of open pipes just outside the power generation building. At around 11.15 a.m. gas blowing through an open pipe to a congested outdoor area next to the power generation building contacted an ignition source and exploded Six people died in the explosion and at least 50 were injured.

Following this explosion, regulatory changes were introduced to prohibit natural gas blows and to use alternative inherently safer methods such as air blows or blows with non-flammable nitrogen etc.

March 23, 2005: Texas City Refinery SA, explosion.

The massive explosion and fire that erupted at the BP refinery in Texas City, Texas on 23rd March 2005 was the worst industrial accident in the United States in nearly 15 years. Several units at the Texas City Refinery had been shut down for lengthy maintenance projects which required nearly 1,000 contractors to be on site along with BP employees. Portable trailers for

the use of contractors and other maintenance workers had been brought onto site and positioned close to process units. Though some of these trailers were located beside the isomerisation unit (ISOM) the occupants were not warned that this unit was about the undergo the potentially hazardous operation of starting up.

At 02.15 hrs March 23rd overnight operators began introducing flammable liquid hydrocarbons, known as raffinate, into a raffinate splitter tower used to distil and separate gasoline components. Near the base of the tower there was a single instrument that measured how much liquid was inside and this information was transferred to a central control room located away from the ISOM unit. During normal operations, the tower was only supposed to contain about 6 ½ feet of liquid, and the level indicator was not designed to measure liquid above the 9 foot mark. During operations, operators routinely deviated from written procedures and filled the tower above the 9 foot mark.

At 03.09 hrs. as the liquid neared the 8 foot mark an alarm activated and sounded in the control room but a 2nd alarm slightly further up the tower failed to go off. At 03.30 hrs the level indicator showed that liquid had filled the bottom 9 feet of the tower and the feed was stopped.

In their investigation that followed, the US Chemical Safety Board (CSB) estimated that the liquid was in fact at a height of 13 feet but operators could not know the actual level because the indicator only measured up to 9 feet. At 13.25 hrs. the 3 emergency valves opened sending nearly 52,000 gallons of flammable liquid to the blow-down drum at the other end of the ISOM unit. Liquid rose inside the blow-down drum and overflowed into a process sewer. As flammable hydrocarbons overfilled the blow-down drum, vapour erupted from the top of the stack. The equivalent of nearly a tanker truck full of hot gasoline fell to the ground and began forming a huge flammable vapour cloud engulfing the Unit in the nearby trailers full of workers in just 90 seconds.

Below the base of the blow-down drum, 2 workers were sitting in a pickup truck with the engine idling. As flammable vapour entered the air intake, the diesel engine began to race. The 2 workers fled unable to shut off the engine and moments later the truck backfired and ignited the vapour cloud. Powerful explosions swept through the area.

The USA Chemical Safety Board (CSB) carried out what at the time was the largest and most comprehensive investigation in its history. The report concluded that it was the result of organisational and safety deficiencies at all levels of the Company. They found that BP management has for many years, overlooked warning signs of a possible catastrophic accident. They noted multiple safety system deficiencies at the plant and a history of fatalities – 23 people died of accidents at the refinery over a 30 year period. Budget cuts were made over the years without assessing the impact on process safety. All this left the refinery vulnerable to catastrophe.

The March 23rd explosion killed 15 workers and injured 180 others, many of them seriously. It shattered windows in homes and businesses up to three quarters of a mile away and 50 large chemical storage tanks were damaged. The accident cost BP billions of dollars in victims' compensation, property damage and lost production.

Could any these disasters have been prevented?
What do you think?

Image Source: Houston Chronicle

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What makes the difference for corporate Crisis Management Teams – Three criteria for success.

CRISIS MANAGEMENT FEATURE

Everyone in business is a crisis manager now. Or so it seems, after two years of survival through pandemic, economic downturn and war in Europe. However, there is a risk that business leaders use recent experience to avoid engaging with crisis readiness for this very reason. Understandably, crisis management fatigue has set in. Focus is (and should be) on restarting or reinvigorating business. We would obviously argue that avoiding crisis readiness is the last decision businesses should be making right now, as they navigate an uncertain few months and years ahead.

Every few years, a potentially high-impact event appears on the radar. Remember Y2K? London terror attacks? Flooding? Snow? Cyber-attacks? As each of these events faded away, thousands of crisis teams congratulated themselves on being masters of the (last) crisis. It's the fault of Recency Bias - the tendency to place too much emphasis on experiences that are freshest in our memory, even if they are not the most relevant or reliable. So, for a moment, we take our foot off the pedal, assured we are in good shape. But there's a problem. Maslow's Hammer states: if all you have is a hammer, everything looks like a nail.

There's a risk that management teams round the world are currently satisfied they have pretty good crisis management capability. The problem is that they have a capability designed for tackling a slow-burning, mainly reactive, government-led response to a very specific set of circumstances. Not everything is a nail.

This brings us to the first of three success criteria we offer: Interpreting high-impact

risks. One of the perennial problems in corporate risk management is how high-impact risks feature on the risk radar. Recently we spent two days with an enlightened Swedish company, who wanted to break through this problem and really understand the potential crises facing them.

We started with a typical risk register item: War in Europe. Then we asked: 'so what?'. The conversation went something like:

War in Europe. So what?

Contagion to Finland. So what?

Asymmetric or New Generation Warfare. So what?

Sabotage of datacentres and other critical infrastructure. So what?

Unavailability of XX business process. So what?

Business interruption to XX value chain, to the value of around SEK 50m.

OK. Noted. What else?

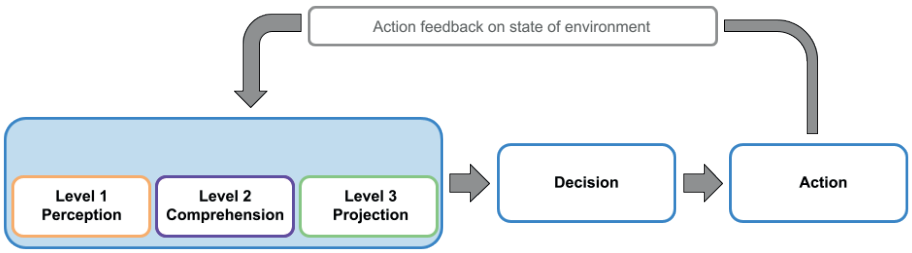
Of course, the conversation was not linear and did not stop there. A complex map of potential consequences emerged, which provided a rich understanding of potential impacts and requirements for further research. The most important outcome was capturing potential, plausible high impacts to the business, instead of meaningless statements, which dramatically improved corporate risk management and focus for the crisis team.

Our second success criteria: Knowing what to do when you get in the room. Assuming the mechanics for crisis identification, notification, assessment, escalation and team activation are in place, what else? For us, the focus is on what the crisis management team does when it gets in the room (or on the conference call, Zoom, Teams, etc.). Much work has been done on the Common Operating Picture (COP) and this has enhanced situation awareness. Much work has also been done on the Common Recognised Information Picture (CRIP) but, arguably this is just a standardised briefing tool. These tools support decision-makers, but they are not game-changers in their own right.

JESSIP has championed the Joint Decision Model (JDM), but that is often difficult for business crisis teams to translate into an actionable process. We believe the key lies in the three-part process often printed just

below the JDM on JESIP posters: Situation – Direction – Action.

Another take on the three part process, as defined in the UK concept of operations for emergency management, is a model that breaks situational awareness into three levels https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/192425/CONOPs_incl_revised_chapter_24_Apr-13.pdf but the model still doesn't tell crisis



teams what they will do when they get in the room.

The biggest difference we see is where crisis teams have a format for sessions that enables them to do their three core functions:
1. Creating and maintaining situational awareness.
2.Making decisions in a structured way, including strategy formation.
3. Generating actions that are based on 1 and 2.

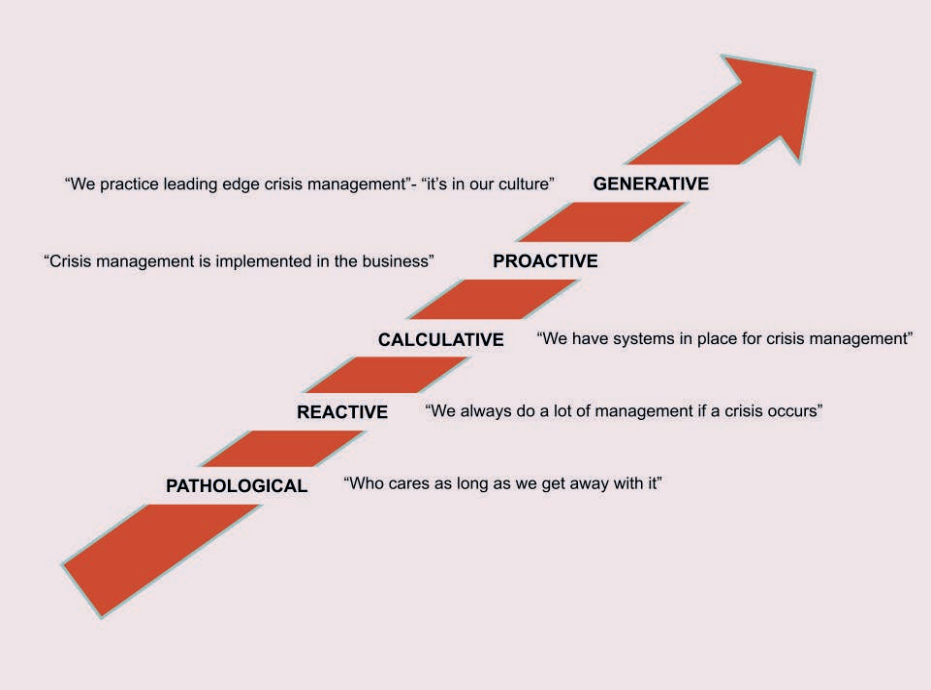
Date/time	**Situation** So far? Now? Future?	**Direction** Ends? Ways? Means?	**Action** To do? To find out? To communicate?
People			
Environment			
Assets			
Reputation			

We've included an example here. Rather like an iPad, it should not need instructions; it should just make sense. We'd suggest that something like the following model achieves this, if the team leader knows he or she must complete the first column, then the second, then the third, then take a break, then repeat.

Our third and last success criteria is: Knowing where you are on a maturity model. It is probably fair to say that all companies exercise for crisis in some way. We see examples right across the crisis management maturity spectrum.

For example, leaving long intervals between exercises, often with minimal training in between, produces a saw-tooth effect on the organisation's capability. We see large-scale, complex exercises being run, but higher levels of realism often come at the expense of learning: an incident manager is overwhelmed for three hours, while fire crews wait patiently to be involved. And too often we see organisations run just the first few hours of their response, which is a bit like Mo Farah only training over 100m. Low maturity.

This discrete problem is easy to solve: Do



more frequent, smaller-scale exercises and skills fade is reduced. Exercise the whole cycle of an emergency, using artificial time more creatively, which gets corporate minds flexing from the onset of a crisis, through response to recovery phases. An organisation doing that would be further up the maturity scale.

Leaders with accountability for risk management want to know the organisation has appropriate measures in place and, if not, that they can demonstrate progress towards appropriate measures. At the very least, the organisation needs a defensible position – that it has a reasonable, proportionate approach to crisis readiness. Managers with responsibility for implementing crisis management say they have difficulty knowing whether their organisation is genuinely crisis ready. BS and ISO standards (and now the new European Standard for Crisis Management) give us some high-level principles, but they don't tell each organisation the appropriate level of readiness for them.

Instead of developing yet another standard or benchmark, we acknowledge that all organisations are somewhere on a journey towards appropriate crisis readiness. So, rather than auditing against a fixed standard, we would suggest helping the organisation understand where it is on that journey, and where they want to get to, over time. This approach is consistent with approaches to safety culture used by many High Reliability Organisations, where risk management is closely scrutinized. Using this maturity model approach can be a step change for organisations because it moves away from the binary compliant / non-compliant discussion, towards a more relevant discussion about capability. Like the safety maturity model, our preferred version crisis maturity model uses five indicators for each element of crisis readiness, corresponding to five stages of maturity: Pathological, Reactive, Calculative, Proactive and Generative. Subject matter is based on relevant sections of the Crisis Management Standards (BS11200 and PD CEN/TS 17091), Major Business Continuity Standard (BS/ISO 22301, 2012); and Resilience Standard (BS 65000, 2014). It covers forty elements under ten headings, including: Leadership & Accountability; Structure; Process; Planning; Facilities; Stakeholder engagement; Training, exercising and learning.

Crucially, this framework helps organisations self-assess internally, so they can negotiate and agree their position on the maturity model. The output enables them to plan a way forward without having to 'fail'.

Implementing one or more of these three suggested interventions may just reinvigorate a crisis team suffering from relentless crisis management fatigue. It is a hard sell to executives who have spent over two years running disrupted businesses, but there's no option: organisations somehow need to maintain readiness for the next one . . . whatever that will be.

AUTHOR:
Tim Bird
MD
Eddistone Consulting

I lead Eddistone Consulting. We help organisations prepare for, respond to and recover from emergency and crisis events. We deliver consultancy, exercises and accredited training globally and offer support in all aspects of Risk, Emergency and Crisis Management, and Business Continuity. We are well equipped to serve our clients remotely if required, and seamlessly continue to provide training and support throughout the current pandemic.

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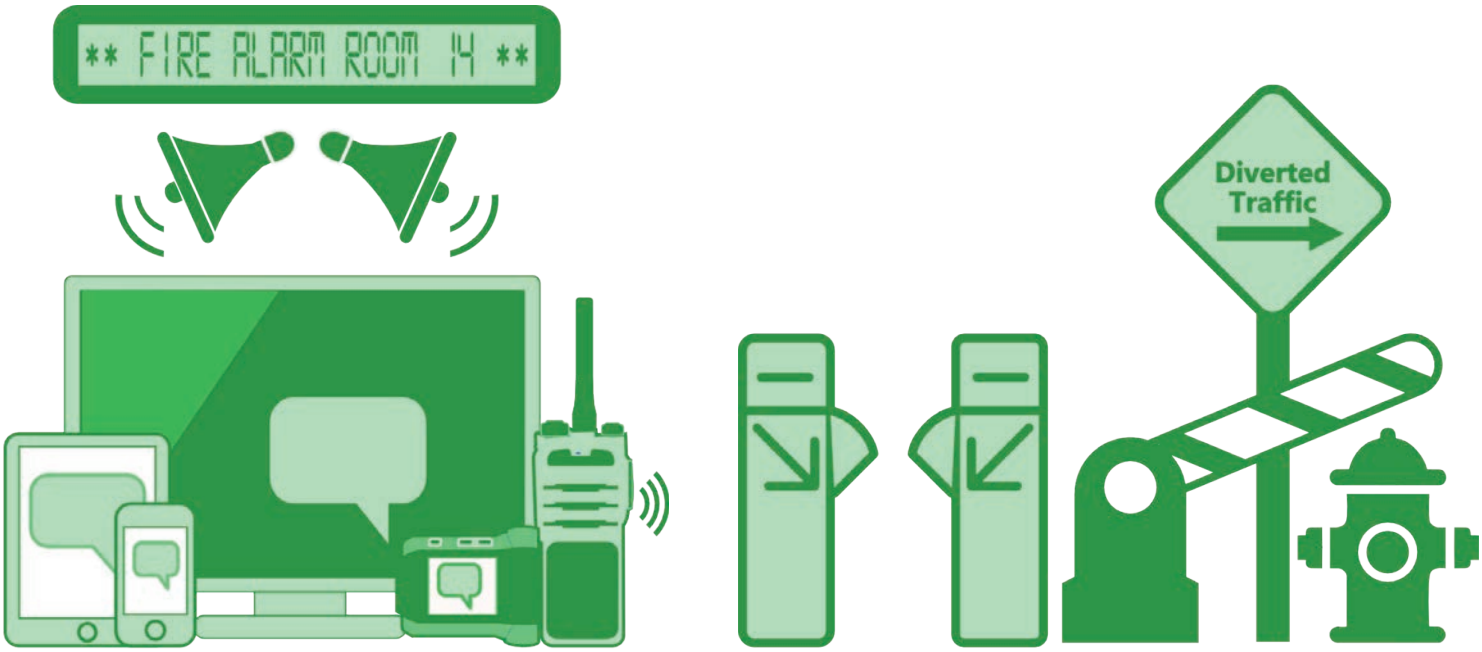
Get your Crisis Response to work SMARTER not harder

CRISIS MANAGEMENT FEATURE

The dynamic nature of human judgement and critical evaluation is undoubtedly a powerful tool in your emergency response process, however unnecessary human touch-points can often impact the accuracy of information communicated, increase risk, and significantly impact turn-out times. In this article, we'll guide you through how to evaluate if some aspects of your process could benefit from automation.

to human error, personal risk, the potential for incorrect information to be relayed and the overall time each manual action takes. Consider whether any of these points require the input of human judgement or evaluation and if so, record what these judgments are and why they're important. Once you have this exercise complete, you can review your list under two basic questions:

Others include email notification to stakeholders, TV or LED scrolling text displays and Public Announcements to inform staff during an evacuation. By no means should you be looking at automation purely as a means to reduce the number operators in your process, but rather you should look at it as a means of bolstering all the active players in your emergency response. For example, if your Security team expresses



How much of your crisis response process hinges on unnecessary human input and actions?

Some common examples of manual inputs in crisis response would be: alarm initiation or escalation, phone or radio communications, public-address announcements, man-on-the-ground investigations and crowd management and direction. It would be a good exercise to map your response process in detail; highlighting each manual input in relation to its vulnerability

"Is there an action I can automate?" and "Is there communication I can automate?". Some examples of actions that can be automated could be gate or turn-style control, traffic management or fire-pump activation, while some examples of how information can be automated can include detailed SMS, radio or page notification to specific groups (e.g. sending specific location details of a triggered sensor to ERT).

they are usually under significant pressure to notify multiple stakeholders or teams after an initial alarm is triggered, it is worth looking at alleviating some of this pressure through automated notification such as SMS or public announcements. From our experience designing bespoke automated processes for clients in all levels of crisis response, we have found that systems that support the human element of emergency response rather than replace it are resoundingly the most successful.

User buy-in is a huge part of the successful rollout of change and due to this, user feedback is also essential. Take the time to sit down and talk to each member of your crisis response team. Ask them their thoughts on the current process, whether they have any suggestions or feedback, or if there are any aspects of the process that they feel could be improved and then use this feedback to inform you on areas that could significantly benefit from automated support.

Which level of automation works best?

Some industries (particularly remote or large scale sites) automate a large portion of their emergency response to better cope with limited resources or extended travel distances. Examples of this could be automated off-site notification via SMS for man-down incidents or the presentation of specific alarm location details on a scrolling text screen in the security office.

Which level of automation works best?

Some industries (particularly remote or large scale sites) automate a large portion of their emergency response to better cope with limited resources or extended travel distances. Examples of this could be automated off-site notification via SMS for man-down incidents or the presentation of specific alarm location details on a scrolling text screen in the security office.

Sites that employ significant levels of human evaluation in their incident response or have large volumes of staff to manage often tend to integrate a mixed approach; using human judgement on a per-incident basis to dictate which automated processes to trigger and when. For example: an alarm is triggered and responders are notified to investigate the scene. Once the incident is fully identified and an operator makes a judgement on who needs to be notified and what actions need to be taken. They could then manually trigger a scenario which they deem to best fit their understanding of the incident. Examples include opening the gates, notifying the local fire department, triggering a public address, alerting the ERT team and more. This mixed approach allows for a fully locally controlled response and is commonly orchestrated via a custom-built button dashboard or console.

In summary, automation is not intended to remove the human aspect of an emergency response, but rather to be a powerful tool for efficient and safe communication. Human judgement is one of the best tools of evaluation, but when it comes to actions, there are numerous ways to streamline your response with automation.

A little about us:

At Sigteq, we have proudly designed and built intelligent automated solutions for use in a large variety of industries including Oil & Gas, Tunnels & Ports, Hospitals, Universities, Manufacturing, the Armed Forces and more for over 20 years. We are passionate about what we do, and we really view ourselves as 'nerds' for technology and innovation. We're looking forward to sharing more of these key tips with you in the next edition, but if you want to learn a little more about us in the meantime feel free to drop us a message or check us out online!

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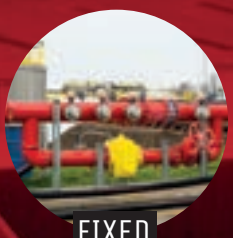
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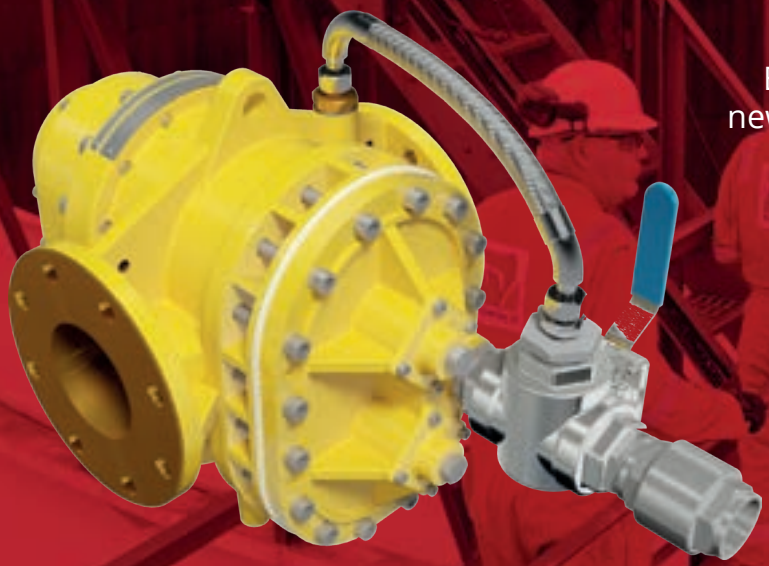

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CRISIS MANAGEMENT FEATURE

Hydrogen
The safety challenges of a cleaner future

As the world moves away from fossil fuels, hydrogen has become attractive as a clean alternative. It is already a vital component in our economies and has been used for centuries in many industrial applications, such as power station cooling and semiconductor processes. However, its use as a fuel has its challenges from a production, storage and safety point of view. This article explores these challenges related to emergency response and discusses what can be done to overcome them.

The fuel of the future?

Global production of hydrogen is currently around 70 million tonnes each year. The need to limit global average temperature rise to 1.5 degrees Celsius is forcing more aggressive decarbonisation. This is having big impacts on sectors such as marine and aviation – sectors that are hard to decarbonise through electrification. Hydrogen fuel cells and electrolysers offer an excellent alternative to the well-publicised lithium-ion battery transportation and energy storage systems. The main benefit of using hydrogen is that the only by-product is water meaning much cleaner vehicles, better air quality and an improved environment.

The global sustainability strategies put forward by many governments have made it very clear that hydrogen is a fundamental part of the future and are investing in research and deployment by the 2030s. For example, Ricardo has joined a group of leading UK businesses – which have together committed to investing £3bn into hydrogen projects.

The technology behind electrolysers has been available since the 1800s so is well developed. However, it is a challenge to produce what is termed "green" hydrogen, formed from renewable energies such as wind and solar, at a cost-effective price. Most of the hydrogen produced today is comparatively cheap, but 95% of it is currently made from fossil fuels.

Since most uses of hydrogen today are industrial, the regulations and safety standards have helped to limit workplace incidents. Staff involved with its production, storage, transportation and use are trained in the properties and hazards of hydrogen, so they are aware of the safety implications, as well as how to safely respond when an incident does occur.

However, if hydrogen is going to be used more widely as fuel for mass transit and shipping, all potential users need to be aware of the safety standards and associated hazards. Emergency responders also need to be cprepared for the increase in hydrogen production and use and train for any related incidents as the likelihood of emergency incidents, will increase over the next decade.

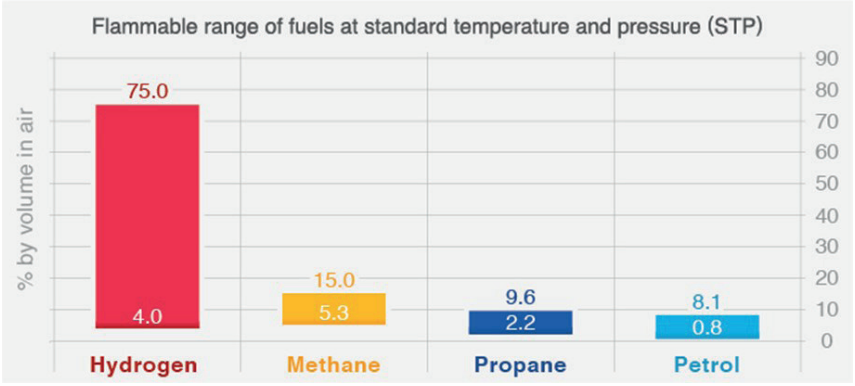
'I wanted to express how impressed I was by the hydrogen and lithium-ion battery emergency training days delivered by the National Chemical Emergency Centre's (NCEC) training platform, Hazmat Academy, to the Shoreham Technical Centre Emergency Response Team last week.

'The courses were excellent and were tailored precisely to our training needs. The instructors were incredibly knowledgeable, and their different teaching styles complemented each other well. We have a diverse team with very different learning requirements, and yet the course suited everybody. All delegates were engaged throughout, learned a great deal, and have had nothing but praise for the whole experience.' — **Johnnie Walker, Health, Safety and Environmental Advisor, Quality Manager, Ricardo Automotive**

Hydrogen safety and incident response

NCEC's emergency response experts have been considering the safety and incident management of a world where hydrogen is widely utilised. Working alongside partner organisations they have been developing training material to assist anyone involved with hydrogen, from awareness to more specific emergency response training to help the global community prepare for the emerging technology. Below they highlight some of the main challenges to be addressed when it comes to hydrogen safety, namely, its flammability and compatibility with existing infrastructure.

Hydrogen is extremely flammable with a very broad flammability range of 4% to 75%. In confined spaces such as tunnels or bus depots, it can form an explosive atmosphere when mixed with air. It is very light and will disperse rapidly into the atmosphere if allowed to do so, meaning that venting can be an extremely useful tactic if a hydrogen leak or flame is found. But care needs to be taken when venting a confined space as this could



risking a potential explosion. Incidents such as fires involving hydrogen-fuelled buses have already occurred, mostly the safety systems worked well to prevent loss of life although in one case the bus depot was burned out.

A hydrogen flame radiates very little heat when compared to common fuels like propane or butane and is almost invisible in daylight, so you must be extremely close to feel it. This is why hydrogen detection equipment or thermal imaging is so important to visualise a hydrogen leak or fire. This equipment is required for industrial use but is not likely to be available everywhere hydrogen could be used in the future, for example in vehicles, service stations and homes. This is a challenge that will need to be addressed alongside the deployment of hydrogen.

Hydrogen blends are already being supplied through gas networks to households. All five UK gas grid companies have stated they will be able to deliver up to 20% hydrogen gas blends throughout the country by the government's target date of 2023. Testing for this has been carried out by the UK government body responsible for health, safety and welfare and trials are already underway. The biggest concern here is the compatibility of hydrogen with various materials such as metals and plastic pipelines already used for natural gas. Hydrogen can cause defects to certain materials through processes such as hydrogen embrittlement at low temperatures (below 150°C), and hydrogen attack at higher operating temperatures (above 200°C). Therefore, regular maintenance checks are necessary to spot any material weakness or damage to prevent leaks. Hydrogen easily leaks because of its nature and making sure that these leaks can be detected and resolved easily is a big challenge for the future of the hydrogen industry and emergency responders.

As vast quantities of hydrogen will be needed in the future, there will also be a need for contemporary solutions to store it. One option is to use ammonia (NH_3) as a source of hydrogen as it is easy to store in comparison to similar quantities of liquid hydrogen. Ammonia's molecular structure is formed of three hydrogens and one nitrogen, so it has high amounts of hydrogen available. It is however toxic, corrosive and flammable. Additionally, decomposition is the method used to release the hydrogen from the ammonia, but it is not usually possible to decompose the ammonia fully. It is then difficult to remove the residual

ammonia that hasn't decomposed from any hydrogen produced. For use in hydrogen fuel cells, the hydrogen needs to be clean of contaminants, which limits the potential uses of ammonia storage. Using ammonia as a source for hydrogen storage also presents its own safety and incident response challenges. These are important for emergency services to understand.

Hydrogen also provides much less energy by volume in comparison to current fuels. This can be addressed by using increased pressure to achieve a greater volume in the same space. With further research into hydrogen storage, it is hoped that higher pressures can be achieved, which will allow for smaller tanks or longer ranges. In worst-case scenarios, these increased pressures could result in catastrophic failures compared to the emergencies that current fossil fuels present. Preparedness is essential for all emergencies, training and awareness are required for these new hazards.

Hydrogen's physical properties and its use bring advantages and challenges. As the need to manage hydrogen incidents increases, so does the need for awareness and training of users and responders.

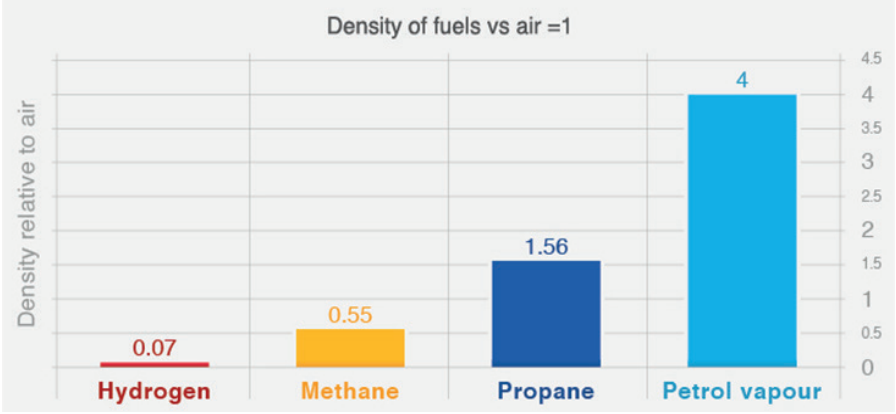
Overcoming the emergency response challenge
Hydrogen could revolutionise the world in terms of transportation, power and technology, the shift to this cleaner fuel has already begun but it comes with safety issues that will present emergency services with significant challenges. These can be mitigated by immediate collaboration with industry, safety organisations and quality training.

If you would like to find out more about, hydrogen awareness, safety training or a potential training collaboration get in touch with the NCEC at www.the-ncec.com.

Find us at Interschutz 2022 – Hall 12 Stand B62.
If you're attending Interschutz, look for the Hazmat Academy, the NCEC's training platform. Our team of experts in hydrogen, hazardous materials training and chemical incident support will be on hand to talk to you and support you and your organisation with all your hydrogen, hazmat and emergency response needs.

Ed Sullivan
NCEC Hazmat Academy Manager

Dr Nigel Blumire
NCEC Training Product Manager



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Putting in place fire protection measures for lithium-ion battery energy storage systems

Incidents involving lithium-ion batteries have hit the headlines in recent years; think spontaneously exploding mobile phones and laptops on planes and electric vehicle fires after an impact or crash have damaged batteries. Adding to this volatile mix are a relatively new technology, Battery Energy Storage Systems ('BESS'), an asset key to the Renewable Energy transition with all forecasts pointing to exponential growth. BESS fires have already been reported worldwide, from South Korea to the US to the UK, with fire regulations and standards seeing numerous revisions to keep pace with a rapidly evolving industry.

Introduction

Although an energy asset, Battery Energy Storage Systems are not the preserve of traditional power and utility companies accustomed to dealing with the specialised operational demands. BESS developers and end use customers are as likely to be financial investors, property developers, industrial parks, factories or councils with limited understanding of the inherent risks and dangers.

Furthermore, as BESS is a relatively nascent industry, many firefighters and other emergency services have little or no experience of this type of hazard, which presents risk of fire, explosion, high voltage and fume toxicity, with the use of water potentially perpetuating the battery fire by additional cell shorting. It also goes without saying that water damage and fire water run off could result in the total loss of asset, which at scale have a capital cost in the millions with attendant insurance issues. As such, it is critical to work with BESS owners, contractors, integrators and other stakeholders at the initial design stage to fully understand all aspects of fire risk and associated hazards specific to the site.

Regulations and Standards

UL is the underlying standard on which many international and national organisations base their regulations and fire codes. In addition, UL 9540A was drawn up in November 2017 to specifically address 'Thermal Runaway Fire Propagation in Battery Energy Storage Systems'. Three further iterations of the standard have been published in the intervening period and the regulatory environment is unlikely to stand still. Furthermore, more recently the National Fire Protection Association of the US published its own standard for the 'Installation of Stationary Energy Storage Systems', NFPA 855, which specifically references UL 9540A. The International Fire Code (IFC) has also published more robust ESS safety requirements in its most recent 2021 edition.

That being said, in the UK there are no laws or mandatory regulations governing BESS fire protection. For many BESS projects, the driving force behind implementation of fire protection measures that adhere to a recognised standard is likely to come from insurers, who on the whole prefer a 'belts-and-braces' approach.

Lithium-ion Batteries: The Risks

The most dominant battery type installed in a BESS is lithium-ion, which brings with it . particular fire risks including 'thermal runaway'

Thermal runaway is a self-perpetuating chain reaction in which excessive heat keeps creating more heat, potentially spreading from one battery cell to the next and causing widespread damage. During thermal runaway, oxygen is believed to be self-generated during cathode consumption, plus there are multiple internal sources of fuel in a lithium-ion battery (metals, plastic, electrical, flammable gases and liquids).

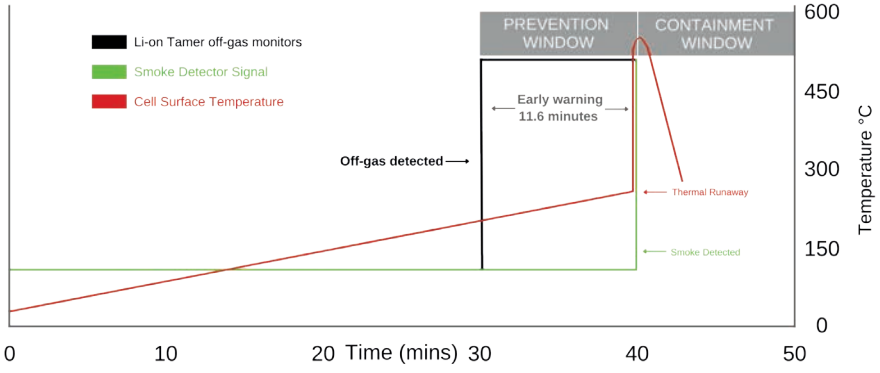
Also, lithium-ion battery fires are 'deep-seated' in nature, as the materials involved in the ignition and propagation of the fire are tightly integrated into a cell, making fire-fighting a challenge. To add to this equation, lithium-ion battery fires are at risk of 're-flash', hours or even days later having seemingly been controlled and extinguished. Lithium-ion batteries must be handled with care, in transport and during installation, as they are sensitive to mechanical damage (such as crush or puncture) and electrical surges, which can result in short circuits leading to internal battery heating, battery explosions and fires.

Furthermore, battery management control systems can be faulty or fail, leading to an inability to monitor the operating environment, such as temperature or cell voltage, with the potential for overcharging.

Understanding Lithium-ion Battery Failure

In terms of timeline there are four main phases of lithium-ion battery failure: initial battery 'abuse', the cause of cell damage being thermal, electrical or mechanical, followed by so-called 'off-gassing', in which minute quantities of gas (for example, hydrogen) and other cell vapours are generated, resulting in heat release. If battery temperature continues to increase, the next phase is a 'smoke' condition with the level of heat likely to result in ignition and thermal runaway. Catastrophic failure is imminent, ultimately resulting in a 'fire' with the potential for propagation and even an explosive event.

Given our understanding of lithium-ion battery failure, there are two main windows of opportunity to implement fire protection measures – a 'prevention' window and a 'containment' window. Off-gas generation in a lithium-ion battery should be considered as the trigger to take action to prevent thermal runaway. Results from independent testing suggest an average of 11-12 minutes between detection of off-gas and thermal runaway. However, if preventative measures are unsuccessful and a damaged lithium-ion battery ignites, measures must be put in place to contain the resulting fire and minimise the potential for propagation to other battery cells.



Fire Protection Measures

Prevention

A highly sensitive monitoring and detection system such as Li-on Tamer® is the ideal prevention solution. Li-on Tamer® is designed specifically to detect the very beginnings of off-gassing in a faulty lithium-ion battery of all chemistries, with an ultra-rapid response time to provide an early warning to BESS system controls.

Conventional gas detection devices are not sensitive enough or honed to this environment to create the speed of response needed in such a dynamic and critical location. The primary course of action is to send a signal to the battery management system to shut off power to batteries, with the aim of preventing any further increase in battery cell temperature; that is, lower than the point of thermal runaway. Also ventilation activation to remove flammable gas accumulation, if required.

UL 9540A recognizes and quantifies off-gas events as precursors to thermal runaway, while independent testing by DNV-GL has concluded that Li-on Tamer® can prevent thermal runaway after a two-year battery failure testing program.

Containment

In the event of off-gassing, there is no guarantee a BESS battery management system will shut down power to a battery in time or that a damaged battery cell will not continue to increase in temperature to the point of thermal runaway. If it does and you end up past prevention point, you're then in containment mode. This phase employs further automated systems which take the form of active fire suppression. These elements contain agents such as condensed aerosol or chemical gases. Nobel recommends Stat-X®, a condensed aerosol system, which is now the fire suppression system of choice of several lithium-ion battery OEMs and leading global BESS integrators, having undergone rigorous private and commercial testing in line with UL and NFPA standards.

DNV-GL testing has concluded that Stat-X® can put out a lithium-ion battery fire, that residual Stat-X® airborne aerosol in the hazard will provide additional extended protection against a re-flash of the fire, and that Stat-X® can reduce oxygen in an enclosed environment during a battery fire.

Cooling

Notwithstanding the implementation of best-in-class prevention and containment measures, the very nature of lithium-ion batteries means there is a certain element of randomness to how any given battery cell (or cells) reacts once damaged, be it the nature or extent of off-gassing, temperature increase, fire condition, or propagation from cell to cell. There is also the potential for explosion if left unchecked. As previously mentioned, lithium-ion battery fires are at risk of 're-flash', minutes, hours or even days later having seemingly been put out. As such, Nobel recommends a back-up Cooling option, specifically a Watermist system with deluge misting nozzles located internally within the BESS. The system can be linked directly to a water supply such as a dedicated tank, alternatively a fire brigade pumping-in breech can be installed externally on the BESS container.

Summary

BESS assets can be found at all scales, from in-cabinet to container to in-building. In addition to the principal prevention, containment and cooling measures outlined above, there is a suite of additional solutions to consider in monitoring, protecting and managing BESS fire risk, including control panel technology; other detection (heat, smoke, gas, etc); ventilation control; battery separation and containment; interface with customer house alarm and other systems; emergency procedures, including warning signs, sounders and manual release facility; communication with local fire brigades and other community stakeholders; maintenance, servicing and ongoing customer support; and installation protocol.

Addendum – other types of storage involving lithium-ion batteries

A powered-up BESS linked to a renewable energy asset (such as a wind turbine or solar array) or connected directly to the grid might represent the most challenging fire risk involving lithium-ion batteries; however, as part of the energy transition there is a general trend towards electrification, either directly or as back-up power. And this means lithium-ion batteries are being 'stored' in multiple industrial, commercial and even residential settings.

Examples include electric vehicle ('EV') manufacturing facilities, robotic assembly, mobile plant, and the manufacture of many portable appliances such as laptops, tablets, mobile phones, medical devices, power tools, vacuum cleaners, lawnmowers and many more. In such cases, lithium-ion batteries are stored in varying degrees of charge simply as stock, on the assembly line or as they are being transported. At any point, there is the potential for a lithium-ion battery to fail and begin to off-gas.

In residential settings an electric or hybrid vehicle represents a potential fire risk, particularly if there is charging infrastructure on the drive.

The cost of charge points has been driven down to the point of being very affordable, particularly with government subsidies. It is also worth mentioning there are now domestic BESS systems, typically linked to solar panels on a roof, such as Tesla's 'Powerwall'. This brings the threat of thermal runaway into the home and the use of such appliances is set for mass adoption over the coming years.

Nobel has installed fire suppression for a number of non-BESS projects involving lithium-ion batteries. For example, an EV manufacturing facility in the UK has a system in place to detect faulty lithium-ion batteries that have the potential for a fire condition, resulting in robots removing such batteries from the assembly line into a steel 'quarantine' bunker – rather than let the batteries burn out in the case of fire, the bunker is equipped with a Stat-X fire suppression system.

Nobel has also installed Stat-X units in charging pods for an electric scooter rental company, the pods being located at various strategic locations within an urban area. The pods contain lithium-ion batteries in the process of being charged. When the charge on a scooter gets low, tthe user is directed towards the nearest pod where they can swap out the battery. Again, this brings the threat of lithium-ion battery fires to the public at large.

The implications of a BESS fire and explosion are likely to be the most profound for firefighters. Significant reference cases include incidents in Liverpool in the UK and Arizona in the US, the latter involving catastrophic injuries to firefighters. Lessons learned from these incidents from a 'first responder' perspective will be the subject of a future article.

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Competence-based training at Shell

'Intrinsically motivated to improve together'

Chemical site Shell Moerdijk – Credit: Shell

Simon van Voorst | H2K

A few years ago, Shell Moerdijk introduced a new method for competence-based training within its company fire brigade. The first 3-year practice cycle has been completed and a new cycle has started in January 2022. In conversation with fire chief Arno van der Heijden, the best-practices of the past period are discussed.

Chemical site Shell Moerdijk mainly produces basic chemicals for consumer products from naphtha, hydrowax, LPG and gas oil. Around 1,300 people work here daily, of which 900 are Shell employees. With a total operating area of 325 hectares and production capacity of 4.5 million tonnes of product per year, this company knows its risks. To be well prepared for any incidents and accidents, Shell Moerdijk has its own emergency organisation.

With 138 firefighters, 6 industrial firefighting vehicles, gas suit teams, fully equipped fire station and extra outpost, Shell has one of the largest incompany fire brigades in the Netherlands. Even more reason to keep the firefighters with different job profiles in an excellent state of readiness. That means: training, training, training. To determine whether the people are not only trained, but also competent for their task performance, Shell Moerdijk uses Competence Registration software developed by H2K since 2019. For each position in the fire service, a competency profile is established with underlying tasks summarized in competency descriptions. These competences, each with its own refresher interval, are linked to the training calendar that is completed in a cycle of 3 years.

Last December, the first training cycle 2019-2021 with Competence Registration (CR) was completed. Meaning that all competencies have been practiced at least once and a new cycle has started as of 1 January 2022. Over the past 3 years, Shell and in-house training provider H2K have implemented this method and applied it frequently. During all internal and external exercise moments, predetermined competencies were measured. Instructors and observers consistently recorded the results in the mobile CR application.

Awareness, confidence, and performance

With completion of the first training cycle, the findings about competence-based training are clear. This method demands more from the people and the organization, but it also gives

back more in return. 'The most important result is awareness and with that comes confidence. Constantly we are aware of our own competence or incompetence, and this allows us to confide in a first responder organization that is well-prepared for its task', says fire chief Arno van der Heijden. Because of this approach, the urgency among instructors and participants to ensure that their organization and themselves are competent is increasing enormously. A non-committal attitude towards exercising, no longer exists and piggybacking on the qualities of team(members) is also no longer possible.

Competence-based training will keep the organization focused and on-topic, it the same time it requires the ability to swiftly respond to changing circumstances.

The effect of limited practicing due to the Coronavirus became visible in the Competence Registration system. 'During the pandemic, Shell Moerdijk has continued to train and exercise. This was made possible by hosting training moments in a different way such as smaller groups, e-learning, among other things ', Van der Heijden explains. Competence

daily on-site 2-hour training. And not only during large-scale realistic training at external facilities.' For this reason, the software system for CR has also been further adapted based upon the completed 3-year cycle at Shell. This stemmed from the desire to be more flexible in training planning. 'Previously, we needed H2K to prepare exercises, invite students, link instructors or observers, and prepare practice goals. That was not practical as training in practice always deviates from the plan on paper. In the renewed environment, this is now all dynamic.

Fire station with foam trucks – Credit: Shell

The pursuit to make exercises increasingly attractive and complex can be a pitfall. Organizing such complex system exercises can of course be useful, but also demands a lot of capacity. At the same time, experience shows that these training exercises are less effective for exercising skills at individual small-scale elementary exercises and
scenario training', explains Van der Heijden.

By planning and organizing training moments with competence-profiles in mind, the focus point in the organization is tilted away from attendance and towards performance. And very deliberate choices can be made based on up-to-date and relevant information.

decreases when practice is less frequent. 'That sounds self-evident, but by making this visually clear, the (fire) organization and its people become much more aware of it', says the fire chief. 'Our firefighters afterwards got intrinsically motivated to improve on this as a team.'

CR starts small

'Shell's main desire is to use a multi-applicable tool', says chief Van der Heijden. He continues: 'a tool for CR should not necessarily be large-scale or complicated. You must be able to integrate it within every exercise, including

Our in-house instructors can on-the-go prepare exercises using a tablet, which they can conduct as instructors themselves a few minutes later', says Van der Heijden. Thus, part of the competence-based training program are also short internal exercises and drills of ±120 minutes with 2 to 3 people. Personal guidance ensures that the performance can be properly monitored and, if necessary: adjusted and repeated. Practicing individual skill becomes extremely effective this way. Added benefit of this small set-up, is that a safe learning environment is achieved easily. Meaning more quickly will people ask questions, dare to make mistakes, and/or accept that certain individual skills still need attention.

Job profiles

Three years of competence-based training also taught to take a critical look at the existing job profiles within the company emergency response team. There are some questions to ask. Can all training goals within the job profile be successfully practiced within the training cycle? Does training frequency need increasing? Should emphasis be shifted towards certain tasks? Can the function profile be set up more efficiently, more task-oriented? Are some tasks now unjustly labelled 'basic', but should they be designated as specialisms?

By using the CR method, the tasks within the fire brigade job profiles are continuously being evaluated. Are we doing the right tasks to remain competent? And that is a much-desired situation as fire crews are in the front-line during incident response, and sometimes must perform their tasks under very critical circumstances. Quality and professionalism can then be highly demanded game-changers.

'The competence profiles of our basic tasks and specialties were critically examined this autumn', says Van der Heijden. He continues: 'Our competencies have been made even more site-specific and are more aligned with our local operating procedures. We have been able to make an improvement there, and these adjusted competences are used in our system since 1 January.'

Embedding

'In the next 3 years, we want to further embed the structure of competence-based training in our organisation and extend the applied method to other first responder profiles. It was new, we ran through a process of awareness, but now we need to routinize it, so this method becomes the standard. So that we're well prepared for the tasks that hopefully will never be needed in practice," concludes the fire chief.

Keeping people competent instead of trained must be part of an emergency response organization's DNA. All firefighters should have a sense of urgency to want to be and stay competent. It is the responsibility of the (emergency) organization to propagate this, to manage this, and to facilitate this process. Declaring someone incompetent is easy but ensuring that people remain or become competent again is a continuous process. This requires tailormade solutions, discipline, flexibility, and enthusiasm from the entire organization.

About Arno van der Heijden

Arno van der Heijden works at Shell for more than 20 years and has been fire chief at the Moerdijk site since 2017. Before that, he worked as operator and lead-operator in various petrochemical companies. In addition, Arno holds various advisory and board positions at industry associations, including the Royal Association of the Dutch Chemical Industry (VNCI), foundation for Calamity Management in Companies and Organizations (CaBo) and the Platform Industrial Incident Management (PII).

About Simon van Voorst

Simon van Voorst has been working at JOIFF-member H2K since 2018 as a specialist and consultant in competence registration. H2K Rotterdam specializes in industrial fire and safety training and conducts these courses globally. Customers are incompany fire crews and government services in the oil, gas, and chemical branch.

Competence registration during fire drill

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Evaluation of the fire protection effectiveness of fluorine free firefighting foams

FINAL REPORT BY:

Gerard G. Back
JENSEN HUGHES
Baltimore Maryland, USA

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

January 2020

NFPA RF Report 2020

165 UL Fire tests show Fluorine-Free Foams need higher rates:

- 2 – 4 times AR-AFFF rates for IPA Fires (Gentle Application)
- 3 – 4 times AR-AFFF rates for Mil Spec Gasoline (Forceful Application)
- 6 – 7 times AR-AFFF rates for E10 Gasoline (Forceful Application)

NFPA RF Final Report

FAA Part 139 Cert Alert No 21-05 2021

Safety concerns of Fluorine-Free Foams identified:

- Notable increase in extinguishment time;
- Issues with fire reigniting (failure to maintain fire suppression); and
- Possible incompatibility with other firefighting agents, existing firefighting equipment, and aircraft rescue training and firefighting strategy that exist today at Part 139 air carrier airports.

FAA Cert Alert

US FAA Part 139 Cert Alert No 21-05 issued October 4, 2021

"While FAA and DoD testing continues, interim research has already identified safety concerns with candidate fluorine-free products that must be fully evaluated, mitigated, and/or improved before FAA can adopt an alternative foam that adequately protects the flying public."

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RelyOn Nutec - The Netherlands

Live fire training is on top of every Chief Fire Officer's list when it comes to ensuring that their responders are well prepared to engage with the risks posed by a serious incident. Petrochemical firefighting and other large scale liquid or gas fires demand special attention to the risks and hazards involved. "Let them feel the heat and exposure" is often muted when having conversations with clients setting up an annual training programme. There is no substitute for realism, but realism has a cost to the environment, particularly when training with hydrocarbon liquids.

Many jurisdictions have restricted the use of liquid fuels and foam concentrates in training. This now puts the responders at a disadvantage, having no awareness as to effects of a serious fire, subsequently compromising their safety. The best responders are those who have experienced the demands of an incident, in particular able to determine the most effective response and more importantly to determine when it is no longer safe for the personnel to remain there. With environmental restrictions and escalating fuel costs live fire training may have to be reduced or simulated in other ways.

Table simulations

The last three years RelyOn Nutec Fire Academy has designed a series of table simulations which help bridge the gap on understanding, without impacting the environment or breaking the budget. Scale models can demonstrate all the objectives of full scale training simulators at the fraction of the cost and impact on the environment. These tables can demonstrate methodologies, firefighting effects, techniques, tactics and strategies. In the petrochemical industries there are three main concerns requiring knowledge and skills to resolve incidents. They are the use of water, use of foam and the effects of uncontrolled releases of products, in particular gases. The traditional way to train these skills would be to use full scale simulation using thousands of litres of hydrocarbon liquids or gases and emitting tons of carbon dioxide and other toxic gases to the atmosphere. Table simulators can enhance the learning experience.

On site training

The tables do not need expensive investment at a training facility to be used. No expensive pump installation, fuel systems or treatment plants. They are designed to be self-contained and can be set up everywhere even on a customer's location, subject to their work permit.

Storage tank farm simulator

Our storage tank farm simulator can demonstrate all the techniques and tactics of storage tank and bund fires with only 20 litres of fuel. Theoretical knowledge can be imparted during very hands on practical demonstrations on the 1:100 scale model. The table consists of bunded tanks with foam chambers, rim seal pourers, subsurface injection systems and a means to demonstrate over the top mobile application of foam. On this table, participants can see up close a foam chamber working, the effects of foam degradation on the hot tank shell and can learn how to position an over the top mobile foam attack.

Traditionally a full life size simulation of a full surface tank fire is witnessed from ground level and the foam is applied from a ground monitor. In this case it's very difficult to see if the fire decreases in intensity and if the fire is extinguished. On the miniature table you get a bird's eye view showing how positioning is crucial and how the foam interacts with the surface of the burning fuel etc. This is a fantastic way to develop understanding of tank firefighting reducing the need for large full scale simulations.

Foam laboratories

Firefighting foam is an important factor in storage tank firefighting, therefore to compliment the tank table simulator and to complete the understanding in this area, we have developed a mobile firefighting foam workshop, where we delve into the chemistry and mechanics of firefighting foam. The workshop laboratory gives an insight to the properties and characteristics of firefighting foam, in particular foams suitable for storage tank firefighting. The workshop can also bring your personnel up to date with new developments such as fluorine free foam concentrates. As fluorinated foam compounds are being phased out and replaced with fluorine free products, personnel need to realise that they can behave in different ways compared to the old style foams. How can you adapt your approach to accommodate the changes and build confidence that they will work for your specific needs. The foam laboratory can also be suitable for other disciplines where knowledge of firefighting is required.

Cooling table simulator

The cooling table is essential as a precursor to understanding how to use water to control heat impact of a fire. The cooling table shows best cooling techniques and other uses of water to mitigate the effects of an incident. Corrective, preventative, 360° cooling, effects of thermal shock and stop lines can be visualised. Creating a better awareness in determining when the cooling may be insufficient, could prevent a major catastrophe such as a BLEVE (Boiling Liquid Expanding Vapour Explosion), an event where the containment vessel holding liquefied gases ruptures resulting in a massive fire ball and blast damage.

Gas table simulator

The gas behaviour table can provide a clear understanding of the powerful effect of gas releases, in the open, congested and confined settings. Basics regarding explosion limits will be explained but the workshop goes further into discussing how the reactivity of gases and the geometry of the gas cloud will influences flame speed and the pressure wave generated. Experience deflagration of a gas cloud ignition and ultimately the transition into detonation events in a safe way. This will lead more importantly towards how to mitigate a gas release using techniques using water curtains and dispersion strategies.

Dust explosion simulator

The fourth table in the series is a dust explosion simulator which will give the delegates einsight as to the explosive nature of combustible dusts. Primary and secondary ignitions together with methods on how to mitigate the explosion risks through modifying attack techniques, using venting or suppression systems are thoroughly discussed during the workshop.

Hydrogen awareness simulator

Finally, the last simulator in the series to date is a hydrogen awareness table, which compares hydrogen gas to hydrocarbon gases such as LPG. With the desire due to the global energy transition to move away from hydrocarbon fuels, clean hydrogen is becoming an important alternative but the risks which hydrogen poses are very different to LPG. The hydrogen table will compare the differences between the two gases and shows the necessary changes in tactics and techniques to ensure a safe response.

These tables are the first generation of interactive table simulators and RelyOn Nutec Fire Academy are constantly innovating new ways to improve awareness and teaching skills in Emergency Response. Stay connected to us for future developments.

Whether you are a facility Fire Brigade, a municipality Fire Brigade or an operator who has these risks within your jurisdiction, contact RelyOn Nutec Fire Academy to enquire where you can profit from this special training format and prepare your personnel effectively.

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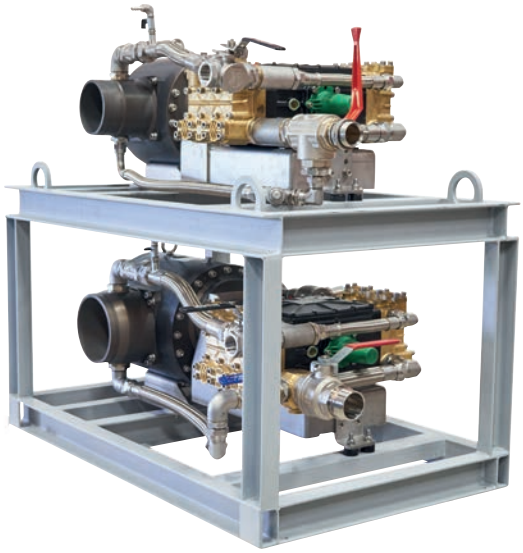

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Our clients range from top private sector spill response organisations to global public sector government organisations. The team continues to work with each client diligently to support their continuous learning and development with training delivered to more than 800 emergency responders in 2021.

During 2022, the Hazmat Academy team is developing more free resources and expanding on the range of courses available, to continue to support responders to be safe, effective, competent and confident during their response to a hazmat incident. The following emergency response courses are available to book now:

•Hazardous materials adviser initial: 27 June, 5 September & 21 November '22

•Hazardous materials first responder: 23 May '22

•Hazardous materials instructor: 12 September '22

•Hazardous materials adviser revalidation: 7 November '22

All the Hazmat Academy courses are accredited by the International Organisation for Industrial Emergency Services Management (JOIFF) and our in-person hazmat courses are delivered in partnership with the Fire Service College.

The academy's distance learning courses are available to book all year around. You can find out more about the hazmat and chemical training courses through our website. If you would like to speak with one of the hazmat academy experts for a more bespoke requirement, please contact them at support@thehazmatacademy.co.uk.

NCEC provides chemical emergency response to more than 650 organisations around the world, including international emergency services and private sector organisations. We support our clients with 24/7 Level 1 telephone emergency response, hazmat training and are the providers of Chemdata®, the industry leading chemical hazard database.

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