

# THE CATALYST

Q4 2023



**JOIFF**

The International Organisation For Industrial  
Emergency Services Management

## JOIFF NEWS

JOIFF appoints new chairman and highlight  
New Members, Events and Qualifications  
Awarded

## JOIFF Shared Learning Event Ireland

JOIFF held a Shared Learning meeting in Ireland in  
conjunction with the National Maritime College of Ireland,  
Ringaskiddy, County Cork.

## News from Accredited Training Providers

Showcasing successful JOIFF audits from Q3 2023 as well  
as welcoming new accredited training providers

## IN THIS ISSUE

Training for competence

Industrial disasters: can they be prevented?

Liquid hydrogen: how can we harness its benefits safely?

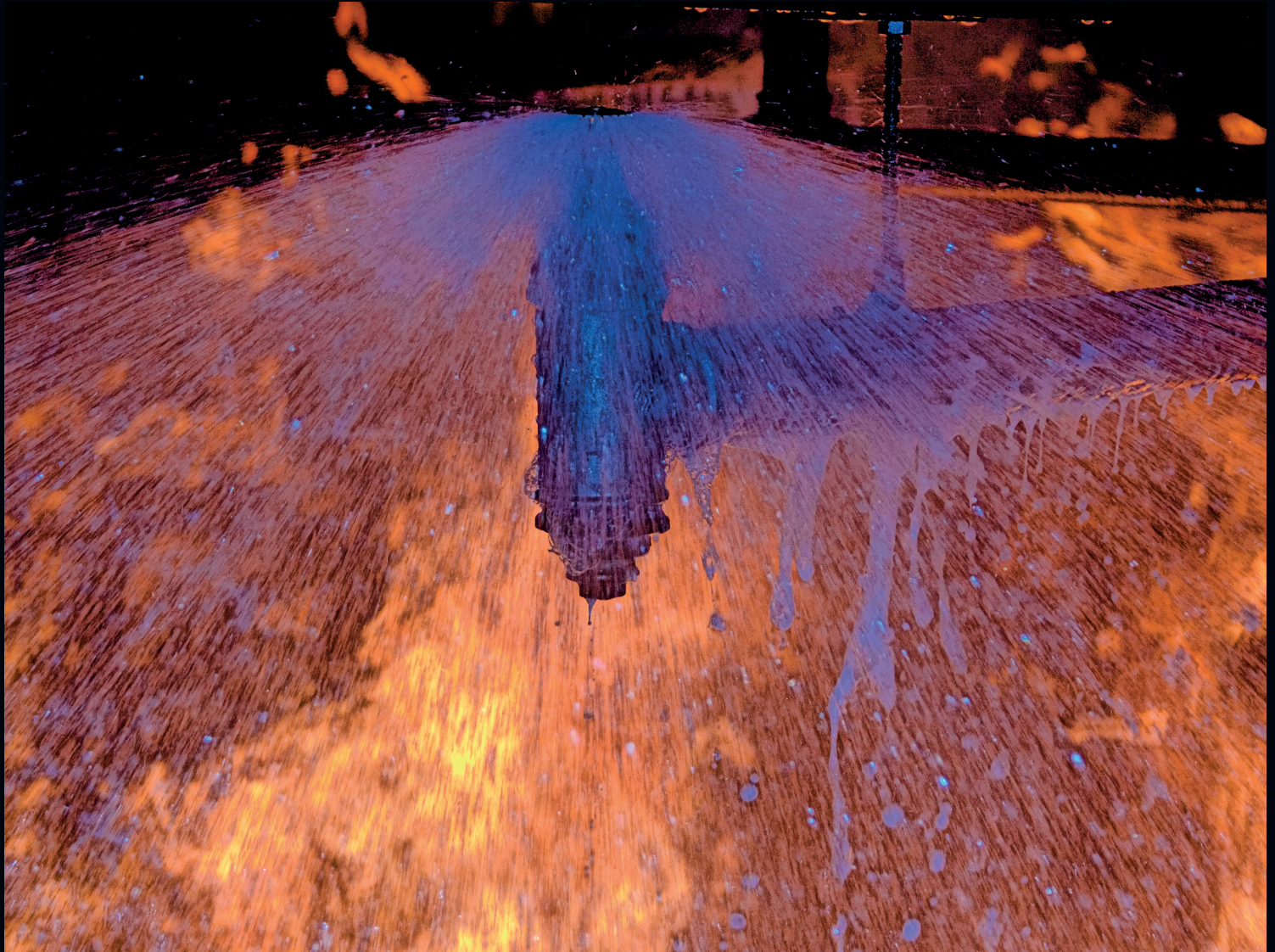
Private-public fire fighting power

Challenges for Emergency Fire Services in Coping with Corrosion Under Insulation Incidents at Oil Refineries

**RelyOn Nutec**  
Fire Academy



# Listen to the latest JOIFF podcast.



## Scan the QR code.





## ABOUT JOIFF

**J**OIFF, 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

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 organisations worldwide. The Catalyst magazine is published by ENM Media on Behalf of JOIFF.

### Publisher & Advertising Sales:

Paul Budgen

Tel: + 44 (0) 1305 831 768

Email: [pbudgen@edicogroup.net](mailto:pbudgen@edicogroup.net)

### Design & Production

Adam Long

Tel: +44 (0) 1305 831 786

**Annual Non – Member  
Subscription Rates:**  
**UK & Europe £60:00**  
**Rest of World: £ 90:00**

## Message from JOIFF

The Directors of JOIFF extend their good wishes to you and thank you for your continuing support of JOIFF.

Since our last update, there have been changes in the JOIFF Board of Directors. For personal reasons, our colleague Pine Pienaar retired as Chairman of JOIFF but continues to be a JOIFF member and maintains a strong interest in JOIFF.

JOIFF Vice Chairman Kevin Deveson has been appointed Chairman of JOIFF.

Some months ago, we welcomed 2 new members to the Board –Trevor Fiford from South Africa and Mark Feldman from Ireland. Trevor and Mark are actively working with the other Directors on the operation of JOIFF and are introducing and developing new ideas and plans for the continuing expansion of JOIFF's growth and influence.

### JOIFF Website:

Our business partner ENM has greatly expanded the operation of the JOIFF website, Members who visit the Members Area can find the JOIFF Membership Directory, Shared Learning Incident Reports and Archive, Presentations from JOIFF webinars and other JOIFF events, JOIFF Guideline and a Gallery.

### Podcasts:

We are pleased to announce that in conjunction with ENM, we are now providing podcasts which will be available in the Members Area. The first podcast entitled "A manufacturer's take on the transition to fluorine-free foam" is already on the JOIFF website and we will advise members when further podcasts are completed.

### Shared Learning:

Members receive a regular email on "Global Incident Report Round Up" giving details of incidents that tragically continue to happen around the World. We encourage members to take advantage of the "Peer Assist" facility of JOIFF Shared Learning by seeking information from the JOIFF membership on specific work issues on which they are seeking information. JOIFF supports the cascading of Shared Learning information through member organisations.

### Catalyst

JOIFF members possess a huge amount of knowledge and experience and we invite members to submit for possible publication, articles on issues that they would like to address in their areas of expertise. Please support The Catalyst with your knowledge and expertise.

### JOIFF Working Groups:

The JOIFF Directors are asking Subject Matter Experts in the JOIFF membership to become involved in JOIFF Working Groups. The JOIFF Aviation Working Group recently completed a revision of the JOIFF Guideline on Emergency Services Management of Airports. Work of the newly formed Petrochemical Working Group has just commenced and the Directors are currently setting up a Working Group to deal with Command and Control.

The Board believes that there are many more subjects within Industrial Emergency Services Management from which our members could benefit and encourages members who feel that they can participate Working Groups to contact us with their proposals.

The outcomes of each Working Group will be made available to members as appropriate.

We look forward to continuing to grow the membership and influence of JOIFF on matters relating to High Hazard Industrial Emergency Services Management in the coming months and years and to the ongoing support of our members.

Please visit [www.joiff.com](http://www.joiff.com)  
for more information.



5-day

# Industrial Fire Team Leader



REGISTRATION  
NOW OPEN

**JANUARI 15 - 19, 2024**

- Learn to perform as Industrial Fire Team Leader in the petro and chemical industry
- Open Enrollment Program
- Including unique night-training
- 40% theory, 40% practical and 20% workshop and case studies
- H2K training facilities in Rotterdam region



Accredited by

**JOIFF**



Info and registration at [www.h2k.nl](http://www.h2k.nl)



# CONTENTS

OCTOBER  
2023

## 03 Message from JOIFF

JOIFF give updates on the Board of Directors, JOIFF Website, Podcasts, Shared Learning, Catalyst and Working Groups.

## 07 Roll of Honour

The Catalyst celebrating persons who were awarded JOIFF qualifications during July, August and September 2023.

## 08 JOIFF Shared Learning Meeting Ireland

JOIFF held a Shared Learning meeting in Ireland in conjunction with the National Maritime College of Ireland, Ringaskiddy, County Cork.

## 10 New Members

During July, August and September 2023, the JOIFF Board of Directors were pleased to welcome new Members.

## 11 News from JOIFF accredited training providers

Showcasing successful JOIFF audits from Q3 2023 as well as welcoming new accredited training providers

## 13 NMCI Join as an accredited training provider

NMCI provide us with an overview of their training services.

## 16 Training for Competence

JOIFF discusses the importance of competence within training and how that is linked directly to the JOIFF accreditation.

## 18 Industrial Disasters: Can they be Prevented?

The Catalyst researches past major industrial incidents, aiming to inspire action to prevent future incidents and avoid unnecessary losses.

## 20 Liquid hydrogen: how can we harness its benefits safely?

Unveiling liquid hydrogen's potential and safety measures, this article explores its role in sustainable energy across industries and transport.

## 27 Private-public fire fighting power

A Case Study on Shared Safety Interests, Incident Response, and Collaborative Power in Harbour Safety

## 31 Challenges for Emergency Fire Services in Coping with Corrosion Under Insulation Incidents at Oil Refineries

Emergency Firefighting in Oil Refinery CUI Incidents

## 33 JOIFF Accredited Training Providers 2023





Well **prepared for the heat** of the moment

# WHY TRAIN AT RELYON NUTEC FIRE ACADEMY?

- Brand new, innovative training location
- 35 years of experience
- Realistic fires: liquid, gas, class A fuels
- Tailor-made scenarios on client's request
- Training supported by XVR (virtual reality), scale models, full scale fire simulators
- 360° safety solutions; education, training and consultancy
- Advice on and training programmes based on national and international industrial standards and best practices

**IFBIC COURSES AVAILABLE ON:**  
18-22 MARCH 2024 | 01-05 JULY 2024  
02-06 SEPTEMBER 2024 | 14-18 OCTOBER 2024  
18-22 NOVEMBER 2024

Training centre accredited by:



**JOIFF**

**RelyOn Nutec Fire Academy** | Beerweg 71 | 3199 LM Maasvlakte-Rotterdam | The Netherlands  
T +31(0) 181 376 666 | E [fireacademy@nl.relyonnutec.com](mailto:fireacademy@nl.relyonnutec.com) | [www.relyonnutec-fireacademy.com](http://www.relyonnutec-fireacademy.com)

**RelyOn Nutec**  
Fire Academy



# ROLL OF HONOUR

During Q3, 2023, the following person was awarded JOIFF Professional Qualification:

PROFESSIONAL MEMBER OF JOIFF

**Tim Bird MJOIFF**  
**Managing Director**  
**Eddystone Consulting Ltd.**  
**Hathersage,**  
**England.**

Tim Bird MJOIFF is a member of the Institute of Explosive Engineers and the Institute of Leadership and Management. He is a qualified UK Mountaineering Leader and Instructor and a qualified electrician and served in the uniformed services for 18 years. Before founding Eddystone Consulting in 2006, Tim helped develop emergency management best practices with many blue-chip organisations from bases in Aberdeen and Dubai and supported emergency management development in over 250 high risk, high profile and high reliability organisations across 17 different sectors.

As managing director of Eddystone, Tim works with customers to understand their needs around emergency, incident and crisis management. He has developed a range of products and services to meet these needs, including competency frameworks, accredited training and assessment packages. He also delivers consultancy as a principle consultant at both strategic and tactical levels, facilitating exercises, writing response documents and providing on-the-ground support when incidents occur.

Eddystone also runs the National Response Academy (NRA) which provides open courses for small customers or customers who need individuals to be trained outside of in-house closed course frequency.

Tim has been a stalwart supporter of JOIFF since Eddystone Consulting became a member in 2014 and the JOIFF Adjudication Panel was very happy to award Tim MJOIFF – Professional Member of JOIFF.



=====

**The Directors of JOIFF extend congratulations to all those in the JOIFF  
Roll of Honour.**

=====



# JOIFF Shared Learning meeting Ireland



JOIFF held a Shared Learning meeting in Ireland in conjunction with the National Maritime College of Ireland, Ringaskiddy, County Cork. The one day meeting was well attended by persons from all over Ireland, including Fire Authorities, Industry and Companies supplying goods and services.

The meeting was opened by Ray Johnston, Operations Manager of NMCI Services. Ray said that ships deliver over 80% of world trade, so disruptions in ports and on shipping lanes mean food, energy, medicine and other essential items don't reach those in need, businesses are left without supplies and prices for producers and consumers soar. He discussed some of the recent marine incidents that have taken place in various parts of the World and the difficulties in dealing with such incidents in shipping.

JOIFF Chairman Kevin Deveson welcomed all and thanked NMCI for hosting the event.

Alec Feldman, JOIFF Director, explained about JOIFF, its 4 pillars, JOIFF Accredited Training, JOIFF's Professional Qualifications and invited applications for JOIFF membership.

Dr. Thomas Leonhardt, Chairman Section Firefighting Agents within Eurofeu, the European umbrella organisation for the National Trade Associations of Companies active in the fire prevention business spoke about the phase out of fluorochromicals. The UN Stockholm Convention adopted PFOS, PFOA and PFHxS as persistent organic pollutants and the EU is preparing a complete phase-out any fluorochromicals, China is preparing restrictions on PFAS, the USA already has very tight restrictions in numerous States and Australia is tightening the restrictions already in effect. He explained the current position with regard to phase-out and said that Companies dealing with foams will need to be aware and trained to deal with interactions of fluorine free foam and fuel types – fluorine free foams are much more responding to interaction with the fuel than AFFFs were. To deal with the new conditions will need ensuring that the systems and equipment are cleaned and ready for use with the new foams and personnel are trained in application and other techniques including the properties of foam and foam agents and their impact on performance.

Jan Knappert, International Sales Director, Dr. Sthamer talked about practical issues on the change over to Fluorine Free Foams (FFF – 3F). He discussed the risks that are currently being dealt with by the use of foam. All the equipment that is used to store and discharge foam – foam making equipment, foam pumps and proportioners, foam tanks and pipework, foam systems etc. – will need to be checked for suitability with 3F. Existing foam containing fluorine will need to be removed, decontaminated and disposed by specialist procedures.

This was followed by a presentation by Jamie O'Neill, Product Manager of Angloco Ltd. manufacturers of firefighting and rescue vehicles and equipment. Jamie talked about the issues that need to be dealt with in the change-over from current foams to 3F foams and discussed a number of the change-over projects with which Angloco had assisted.

Dr. Nigel Blumire discussed the advantages and disadvantages of a number of fuels that are currently being used in vehicles as alternatives. LPG (liquid petroleum gas), LNG (liquid natural gas) and CNG (compressed natural gas) are



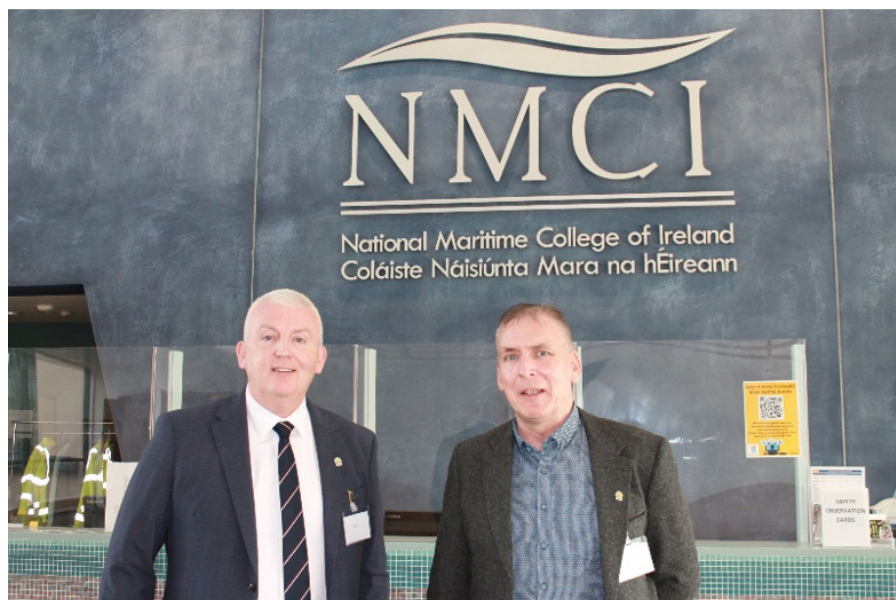
fossil fuels and so will not fully achieve the aim of eliminating fossil fuels in vehicles. In the UK there is a reduction in the number of vehicles powered by LPG as LPG filling services are currently being removed from UK service stations. People buying vehicles fuelled by CNG are moving towards the use of hydrogen and electric vehicles. Hydrogen is being trialled and used at present by a wide range of transport but a big problem with hydrogen is that to the process of making hydrogen requires energy, often from fossil fuel sources. The increasing use of electric powered vehicles is bringing its own problems. Raw materials for the lithium-ion batteries will be limited and there are a growing number of incidents where electric vehicles are involved in fires and the difficulties in extinguishing them.

His conclusions are that less vehicles will be using LNG, CNG and LPG in future years, an increasing number of personal vehicles will be dominated by lithium-ion batteries, and if enough green hydrogen can be made, hydrogen powered vehicles will become part of the blend, sustainable bioenergy aviation fuels may be the fuel of choice for aircraft, rail will be using electric power and some hydrogen power and shipping may use a blend of electric and hydrogen fuels.

Adam Gunton, Senior Instructor, Vital Fire Solutions, County Durham and Darlington Fire and Rescue Service gave a presentation on high volume pumping. He gave examples of the practical use of high volume pumping and how high volume pumps can be of great value in a variety of incidents including flooding, water transfer, wildland fires etc.

Tim Bird, Managing Director of Eddystone Consulting talked of the practicalities of an emergency incident occurring on site. He said that whilst all industries under the Seveso/COMAH regulations are required to prepare responses to Major Accident Hazard (MAH) events, it is possible for almost all non Seveso / COMAH regulated industries to have MAH events and therefore it is necessary to explore and plan scenarios for all MAH events. It is no longer enough to expect the Fire and Rescue service to deal with a major incident on a site without support from the site and he discussed the role of a Site Incident Controller, a Site Main Controller and a Crisis Team and gave an example of actions that needed to be taken in a major accident event. He concluded by saying that sites need a systematic approach to management of emergencies.

Declan Kelly, Managing Director, Moyne Roberts Ireland Ltd and Apex Fire Ltd, Chairman



**Declan Kelly and Ray Johnson**



**Adam Gunton and Ray Johnson**

of National Standards Authority of Ireland (NSAI) Fire Safety Standards Committee and Convener of WG3 CEN TC 70 explained the scope of the Working Groups on NSAI and the CEN Technical Committee TC 70, which is responsible for standards for manual means of firefighting equipment. He said that according to a survey from companies in the four main trade associations in the UK fire sector, the number of fires being successfully extinguished by portable devices has increased from 80% in 2003 to 93% in 2021.

He emphasised the absolute necessity for all portable fire extinguishers to be provided with a pressure relief device and gave examples of injuries and death caused by extinguishers without such devices exploding. He talked of the hazards of the increasing number of lithium-ion batteries now in use and gave examples of fires

and release of toxic gases when these batteries burn. His Company is working on developing new fire extinguishers for use in certain sizes of lithium fires. He also discussed the use of pictorial signage on portable fire extinguishers in place of having to use different languages on labels.

The final paper was presented by Martin Iverson of Ambipar Response Ireland Ltd. Martin discussed a wide range of issues with regard to dealing with oil spill response and waste disposal of chemicals including disposal of PFAS foams.

The attendees commented on the excellence of the Speakers, the location and the facilities and requested that this event should become an annual event.



# NEW MEMBERS

JOIFF NEWS

During July, August and September 2023, the JOIFF Board of Directors were pleased to welcome the following new Members.

*ALDB Academy, Triq iz-Znuber, Malta* represented by Charlot Caruana, Operations Director/ QA Coordinator and Angele Farrugia, administration Coordinator. ALDB Academy Ltd delivers industry-leading programs that equip individuals and organizations with the knowledge and skills necessary to create a safe and secure working environment. Their team of qualified instructors, industry experts, and dedicated staff ensure that their courses are designed and delivered to meet the specific needs and requirements of their clients. They strive to provide engaging, interactive, and practical training experiences that empower participants to make a positive impact on workplace safety.

**ALDB**  **ACADEMY**  
Safety Training

*Al Murabit Company, Erbil, Iraq* represented by Hawkar A. Dizaye, Managing Director. Al Murabit Company is one of the first and longest-standing private oil supply and services companies in Iraq and the Region with a wide range of services including safety and fire fighting supply and services. They have been in the business for over 11 years, and management and staff have acquired exceptional insight into the markets they operate. Al Murabit Company are proud and honoured to be a critical player in their Country's Development and they are currently working on initiating emergency response services.



*Emergency Services Training Centre (ESTC) UK*, represented by Lesley Ashcroft. The Emergency Services Training Centre carries out Industrial training including Confined Space Entry, Working at Heights, Maritime training including Diver Medic Technician and Oxygen Administration and Medical and Trauma Care training, including Pre-hospital Trauma Care, Basic Life Support and First aid at Work. They are equipped with state-of-the-art training rigs that can simulate extremely challenging and realistic conditions, providing students with a truly immersive learning experience.



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



# News from JOIFF

## Accredited Training Providers

### SUCCESSFUL JOIFF ACCREDITATION AUDITS

During Q3 2023, a successful JOIFF re-accreditation audit was awarded for:



### ***EDDISTONE CONSULTING LIMITED*** ***Hathersage, United Kingdom***

Eddystone Consulting Ltd. Team  
with their JOIFF certificate of accreditation

Andy Appleyard, Instructor, Becky Harby,  
Quality Manager, Tim Bird Manging Director,  
Mandy Turner, Accounts Manager.

### NEWLY JOIFF ACCREDITED TRAINING PROVIDERS

During Q3 2023, JOIFF was pleased to welcome the following a newly JOIFF Accredited Training Providers following a successful accreditation audit.



### ***NMCI TRAINING SERVICES*** ***Ringaskiddy, Co. Cork, Ireland***

NMCI Training Services being presented  
with their JOIFF certificate of accreditation

Ray Johnston, Operations Manager, Gerry  
Johnson, JOIFF Auditor, Jim O'Byrne, Manging  
Director, Alec Feldman, JOIFF Auditor.



# BRISTOL

INNOVATIVE  
FIREFIGHTING  
SOLUTIONS  
SINCE 1974



**CONTAINERIZED PUMP**



**ATTACK TRAILER**



**HIGH-FLOW INDUSTRIAL PUMPER**



**FOAM TOTE TRAILER**



**EN 1789 CERTIFIED AMBULANCE**

**FIRE EXTINGUISHER**



**HIGH-FLOW FIRE HYDRANT**





# NEWLY JOIFF ACCREDITED TRAINING PROVIDER

NMCI Training Services, Ringaskiddy, Co. Cork, Ireland



*"No one ever steps in the same river twice"* Similarly, the professional training requirements for those that work in high hazard Industries often change swiftly.

Where the only constant is change, the National Maritime College of Ireland (NMCI) Training Services stands as a beacon to adapt and impart knowledge.

We are steadfast partners, with a firm belief in shared learning across all industries.

## Who We Are:

In picturesque Cork Harbour, Ireland, stands the National Maritime College of Ireland, an illustrious waterside campus which forms part of Munster Technological University, dedicated to advancing maritime education and safety training. NMCI Training Services, a division of the NMCI, is a centre of excellence that has garnered acclaim and recognition on a global scale.

NMCI Training services is the division of the National Maritime College that can provide training for high hazard industries offshore and onshore.

While our campus is nestled in Cork, our reach

extends far beyond the Irish coast. NMCI Training Services has a global footprint, supporting clients and students globally. We take great pride in our unwavering commitment as a trusted partner.

## What We Do:

Our mission at NMCI Training Services is clear – provide professional training for the maritime, offshore and onshore industry.

At NMCI Training Services, we recognise that responders in high hazard industry deserve the highest level of training. We recognise that responders are often volunteers and we have a moral responsibility to ensure that their training is of the highest quality.

We were honoured to become an accredited JOIFF training centre in September of this year. This achievement is crucial to satisfy our obligation to provide quality training for responders in high hazard onshore industry.

NMCI Training Services accreditations include, JOIFF, Standards of Training, Certification and Watchkeeping (STCW), the Offshore Petroleum Industry Training Organisation (OPITO), and the Global Wind Organisation (GWO).

These accreditations testify our dedication to delivering training to the highest industry standards, ensuring relevance and the provision of internationally recognised certification.

## A Centre of Excellence:

In the world of education, one size does not fit all, and NMCI Training Services understands this better than most. We pride ourselves on our ability to tailor courses to meet the specific needs of our clients.

Our training programs are meticulously designed, client specific, complying with industry and regulatory requirements. This ensures that every student who walks through our doors receives an education that is not just comprehensive but also customised and relevant.

We are proud to offer a world-class training experience all on one expansive 10-acre campus. NMCI students have access to exceptional facilities in one central location. The following is a sample of what we offer:



### Sea Survival Pool:

Our 5m deep sea survival pool is not merely a training pool; it is a place where we prepare maritime professionals and volunteers for the most challenging maritime scenarios. We can replicate real-life storm conditions, night, rain, thunder, and lightning, which in a controlled setting provides students with actual conditions at sea.

### Fire Training Yard:

Fire is a hazard generic across all industry. Our fire training yard is equipped to simulate various fire-related scenarios, ensuring our students are not just well-versed in theory but also in the practical application of Control and firefighting. We train emergency response teams from local pharmaceutical industry in addition to maritime and offshore personnel.

### Confined Space Unit:

Confined spaces hazards pose unique challenges and applicable to most industry.

We incorporate where possible permits and SOPs and equipment relevant to the client.

Our confined space unit is designed to replicate environments, and effective response and rescue.

### Simulators:

Simulation technology has revolutionised training in the maritime and offshore industries. At NMCI, our advanced full mission bridge simulators replicate real-life maritime scenarios, allowing officers to develop their skills and decision-making abilities in a



controlled environment. Any port, vessel or scenario can be created by our experienced master mariners.

### Engine Rooms and Workshops

We provide our students with access to fully equipped, control rooms, engine rooms, generators, high voltage labs and workshops, ensuring they gain practical experience that is indispensable in their careers.

### A Commitment to Excellence

At NMCI Training Services, we recognise that our role goes beyond imparting knowledge; it extends to nurturing a culture of excellence and safety. We understand that the professionals we train are the emergency response lifeline for maritime, offshore, and onshore industry.

As a JOIFF accredited training provider we look forward to working together to create safer working environments for all.

The only constant is change and we do that well for industry!

NMCI Training Services  
Tel: + 353 21 433 5609  
E-mail: [nmci.services@mtu.ie](mailto:nmci.services@mtu.ie)  
Web: [www.nmci.ie](http://www.nmci.ie)  
[www.linkedin.com/showcase/gtss-ireland](http://www.linkedin.com/showcase/gtss-ireland)





HFS



Hytrans Fire System



hydraulically driven pumps



high speed hose laying

- ✓ Fight large tank fires
- ✓ Full support for fluor-free foams
- ✓ 35 years track record



large diameter hose



up to 45.000 l/min @12 bar



integrated foam systems



automatic hose recovery

hytrans.com

BRANDWEER  
Industriebrandweer  
Gezamenlijke Brandweer

hytrans.com

Complete solution for industrial firefighting



# Training for Competence



## Training:

One dictionary definition of Training is “the action of teaching a person a particular skill or type of behaviour”. Does that definition fit the reality of training? Here are three examples.

Some people undergo training because there is a requirement in an organisation’s tick box list that at regular intervals, personnel must attend a specified training course. Some people undergo training that will result in them being awarded a qualification. Some people undergo training because they want to become competent in the way that they execute their work in their workplace.

The outcome of the first example is that the trainee – or their manager - can tick the relevant box in the knowledge that they have done what was required. Perhaps the trainee might get a Certificate of Attendance as a reward. The outcome of the second example should be that the trainee has acquired a qualification which says that the recipient has the knowledge to do a particular job in an accurate and efficient manner. This does not necessarily mean that the trainee is competent to carry out the job. The successful outcome of the third example should

be that the trainee has become competent in what is needed of them in their workplace. In conditions of emergency response, both qualifications and competence may be needed, but it will likely be the person with competent skills that will mitigate the incident.

## Competence:

A person is deemed to be a competent person where, having regard to the task s/he is required to perform and taking account of the size or hazards of the undertaking or establishment in which s/he undertakes work, the person possesses sufficient training, experience and knowledge appropriate to the nature of work to be undertaken. This definition combines quantitative requirements – “having regard to the task that s/he is required to perform” and “taking account of the size and/or hazards of the undertaking or establishment in which s/he undertakes work” - and qualitative requirements – “s/he possesses sufficient training, experience and knowledge appropriate to the nature of the work to be undertaken.

Training that is based on competence is a systematic method of managing and organising the development, delivery and evaluation of

job specific Training. The learning objective in training emergency responders should be appropriate to the hazard profile of the tasks identified through risk assessments and associated control measures and procedures. This should be aimed at enhancing the knowledge, skills and understanding of each person in their role, to identify and verify what responder’s need to be able to do at their workplace and to what standards they should do it. All competence-based training should be assessed, validated and recorded to ensure that the outcome is what was supposed to be delivered has actually been delivered and records can be provided for each trainee to confirm this. Training standards without assessment and recording are questionable.

Competence in Emergency Response should include practical experience and is necessary at all levels of the organisation, not just the front line. After initial training has been satisfactorily completed, competency-based training can only be maintained by the augmentation and regularity of a robust onsite training programme. As competence needs to be continually demonstrated, there should be refresher training with appropriate reassessment.

It is critical that whether full time or part time, members of emergency response teams expected to carry out the same duties, must have the same amount and type of competency-based training.

### **JOIFF Accreditation:**

The JOIFF standard of training for industrial emergency responders is aimed at not only meeting minimum legal requirements, but also at demonstrating the intent to maintain a consistent level of expertise and knowledge amongst emergency services personnel. Such training is provided by JOIFF Accredited Training Providers who are authorised to issue JOIFF certificates of competence to successful students.

JOIFF accreditation is a system of quality control of the policies, procedures and protocols operated by an organisation that provides training for Industrial Emergency Response. The training provided should be directed at developing the competence of individual personnel when dealing with potential accidents/incidents to which they are required to respond within their Area Emergency Response Plan.

To obtain JOIFF accreditation, a Training Provider must meet the criteria set down

by JOIFF for the three pillars that make up effective provision of training emergency response personnel:-

- Establishment/organisation including facilities, Safety Management Systems and procedures;
- Instruction and
- courses/programmes.

All aspects together must be to the required standard for JOIFF accreditation to be awarded and the applicant organisation must demonstrate proprietary ownership of all 3 pillars.

### **Competence proficiency:**

People go through a series of four stages as they move toward competence proficiency: - unconscious incompetence, conscious incompetence, conscious competence and unconscious competence. A good example of these 4 stages is provided by the professional women and men of Sport who have recently brilliantly demonstrated competence at the highest levels in their sport – the Women's Soccer World Cup, the Women's Solheim Cup, the men's Ryder Cup and the men's Rugby World Cup.

Many of those who watched these sports may never have played any of them, but they were

enthralled with what they saw to the point that they want to become involved in some way in the sport. These people could be categorised as having unconscious incompetence – they don't know enough to gauge their own skill in the sport but are keen to give it try. Many of those who watched the sport were serious players and/or followers of the sport for some time and so had a level of knowledge of the sport. These persons could be categorised as having conscious incompetence - they had gained enough experience to become aware of mistakes and to recognise their own lack of skill on the scale of the professionals. It is probably fair to say that many of the runners up in each of the competitions demonstrated their conscious competence – they had proficiency in the skill, and they were able to think through the process of a skilful approach, but they hadn't reached the highest level in their sport. Without question the winners in each of the Sports demonstrated their unconscious competence - their game was part of their nature so thoroughly, that it no longer required conscious thought and the skill has become intuitive to them.

With the continuous death, destruction and damage to the environment being caused so regularly by tragic incidents in high hazard industry Worldwide, incidents that on many occasions are recurring, the level of competence of emergency responders in those industries needs to be at the highest possible levels.



*Image Source:*  
*JOIFF Training Provider - International Fire Training Centre*



# INDUSTRIAL DISASTERS

## Can They Be Prevented?



*Sunoco Nederland Oil Terminal | Image Source: Houston Chronicle*

The Catalyst researches and provides reports on some of the major industrial incidents that have taken place in past years in the hope that this may stir people to action so that future incidents and subsequent unnecessary losses can be prevented.

### 12th August 2016 SUNOCO NEDERLAND OIL TERMINAL TEXAS

#### Background:

A contractor of Sunoco Nederland Terminal in Texas, USA, was conducting hot work on a section of pipe that contained residual crude oil. A Job Hazard Analysis identifying the task steps of the job, associated hazards, and how to eliminate or manage those hazards, had been completed and the Hot Work permit was issued. The issued hot work permit required a fire watch, fire extinguishers, and a continuous flammable gas monitor for the job. According to the work permit issued the night of the incident, atmospheric testing was conducted at 7:00 p.m. and did not detect any flammable vapours. There were no accounts of the specifics on the exact location(s) of where atmospheric testing was conducted, nor were there accounts from the welders that the continuous monitor alarmed at any time during welding activities, which would be indicative of flammable vapours in the area.

#### The Incident:

On 12th August 2016, during the welding operation on the inside surface of a flange by a contractor of Sunoco, vapor inside the pipe gathered between two of the installed isolation tools and ignited. The ignition caused a build-up in pressure which led to a violent explosion at either end of the isolated pipe.

#### Emergency Response:

The fire team established a triage area to begin monitoring and caring for the injured workers until the EMS services reached the site. Jefferson County Sheriff's Office and the Nederland Fire Department responded to the incident to assist in controlling the scene and transporting injured workers to receive medical attention.

#### The Cause:

The atmosphere inside the pipe at the time of the incident was explosive, due to flammable vapours mixed with air in a confined space. Contributing to the incident was the ineffective implementation and execution of policies and procedures of the Hot Work permit. The procedure stated that equipment shall be isolated and decontaminated by purging or flushing. In this instance, Sunoco did not take

measures to decontaminate the equipment prior to conducting hot work.

#### The Casualties:

The incident resulted in injuries to seven contractor personnel. Four of the seven injured were transported to the hospital and treated for burns, bone fractures, and other blast related injuries. Three of the seven injured were treated for minor injuries and released.

injuries. Three of the seven injured were treated for minor injuries and released.

#### The Blame:

Sunoco and their contractor did not implement adequate mitigation strategies to prevent a fire or explosion during hot work activities. It was not adequately stated that hot work on equipment that currently or previously contained flammable material, was not permitted.

#### Note to readers:

Chapter 6 of the JOIFF Guideline on Emergency Services Management of Airports available in the Members Area of the JOIFF website, sets out detailed information re. Hot Work.



## 4th August 2020 PORT OF BEIRUT EXPLOSION

### Background:

In 2013, a merchant vessel carrying 2,750 tons of Ammonium Nitrate was making its way from Georgia to Mozambique and after more than a month at sea, it docked in the Port of Beirut, reportedly due to technical problems. But the real reason, according to the Captain, was that the owner was experiencing financial difficulties and had hoped to pick up some cargo from Lebanon enroute. The additional load took up too much weight and the crew refused to carry on, leaving the ship unseaworthy and impounded for port duties. The owner refused to pay the port duties and the crew members were forced to remain on board for 11 months because of immigration restrictions. They were eventually released on compassionate grounds in 2014 and the explosive cargo was confiscated and transferred to large hanger in the port where it remained until the explosion on 4th August 2020.

### The Incident:

On 4th August 2020, an uncontrolled fire broke out in one of the hangars at the Port of Beirut, Lebanon. 9 firefighters and a paramedic were deployed. Shortly after their arrival, a gigantic explosion ripped through the foreshore of Beirut. The hangar contained over 2,750 tons of ammonium nitrate which caused an explosion estimated at the equivalent of around 1.1 kilotons of TNT. The blast was so powerful that it blew out windows at Beirut Airport,

five miles from the port, it physically shook the whole country of Lebanon, it was felt in Turkey, Syria, Palestine, Jordan, and Israel, as well as parts of Europe, and was heard in Cyprus, more than 240 km (150 miles) away. It was detected by the United States Geological Survey as a seismic event of magnitude 3.3, and is considered one of the most powerful artificial non-nuclear explosions in history.

### Emergency Response:

The devastation was so severe that military bulldozers were used to clear roads for firefighters and ambulances. Some hospitals were destroyed by the blast and other health care facilities were severely damaged. Hospitals were overwhelmed by the blast and had to turn away injured people due to the number of wounded.

Because of the ruined buildings, care was given to people on the pavement outside the ruins and in car parks by flashlight as the human toll of the explosion escalated.

### The Casualties:

The explosion caused the deaths at least 218 people, 7,000 people were injured and hundreds of thousands were left homeless. The explosion caused US \$15 billion in property damage.

### The Cause:

As of 2022, the exact cause of the explosion is still under investigation but it is believed that the explosion was caused by sparks from

welders who were attempting to fix holes in the walls of the hangar.

### The Environmental and structural damage:

The massive blast set off a great ball of fire. A white dome of water vapour forced out of the air by the shock wave engulfed large parts of the city followed by a red/brown haze of smoke and ash. Surrounding warehouses and grain silos were flattened and several docked ships were blown out of the water and the explosion carved out a large ground crater which was immediately filled with sea water, laying waste most of the port's critical infrastructure.

The inferno blazed for more than 7 hours enveloping the city with a thick black smoke that filled the air with the smell of sulphur and burnt rubber caused by massive amounts of nitrogen oxide released from the ammonium nitrate.

### The Blame:

From 2014, the Port Authorities made many approaches to Government officials advising of the threats posed by the highly explosive chemical being housed in unsuitable conditions, but nothing was done and officials ignored the Port Authorities warnings even after the risks were exposed

Promises were made that a full and transparent investigation would take place. Lebanese authorities arrested more than 20 port and customs officials. Less than 6 days after the explosion, the Government resigned. The investigation did take place but not a single top official was successfully prosecuted. In December 2021, the interim prime minister and 3 former ministers were charged with negligence but the politicians that the judge had indicted, had him removed from the probe claiming he was not impartial.

**Could these incidents have been prevented? What do you think?**



Beirut Explosion | Image Source: BBC



# Liquid hydrogen: how can we harness its benefits safely?

by Stuart Devereux (Ricardo) and Hector Wilson (Air Products)

## Introduction

As one of the most abundant elements on the Earth, hydrogen offers real potential as one of the most sustainable energy carriers. For the global transport, energy and heavy industry sectors, hydrogen could be a key enabler in achieving the Paris agreement targets and help to decarbonise manufacturing processes such as cement, plastics, ammonia and steel which remain heavily dependent on fossil fuel.

In order to be usable in this way, hydrogen must be extracted, either from water (H<sub>2</sub>O) or fossil fuels like methane (CH<sub>4</sub>). This extraction requires energy and a subsequent storage solution. Currently, three storage systems are available: compressing the gas and storing it in high pressure gas cylinders; cooling it as liquid hydrogen; or storing it within solid structures called metal hydrides.

With more than 100 years of engineering experience in improving mobility efficiency and over 60 years of leading-edge expertise in delivering environmental and energy solutions, Ricardo is uniquely placed to guide clients who are looking to hydrogen to decarbonise challenging energy, industrial or transport applications. In this article, industry experts from Ricardo, share their insights on some of the properties of liquid hydrogen, the challenge of cooling temperatures and its safe storage issues, while experts from Air Products, a hydrogen producer, discuss how they safely approach use and storage of the gas.

## Properties of liquid hydrogen – insights from Ricardo's safety expert

Liquid hydrogen is lighter than water: 1m<sup>3</sup> of liquid hydrogen only has a mass of 70kg. It is transparent with a light blue tinge. On expanding back to a gas, it increases in volume 845 times and does so very rapidly, but its

most important property is its extremely low boiling point.

Hydrogen needs to be cooled to -253°C to liquify. By comparison, the air around it will become solid as oxygen freezes at -218°C and nitrogen at -209°C. What this really means is that air will condense on any cold surfaces which are not insulated, producing what looks like regular water droplets but which are in fact heavily enriched with oxygen, increasing the flammability and oxidation risks. For example, a liquid hydrogen spill onto a bituminous tarmac surface results in an increased fire risk because the fuel and oxygen are readily combined.

The fact that we can liquefy a gas means that there are attractive forces between gas molecules. These forces are not large and are only effective over very short distances. Liquefaction of a gas occurs when the attractive forces dominate over the energies of the gas molecules. To bring the molecules close together, pressure needs to be applied. However, as the temperature of the gas is raised, the energies of the molecules increase, and can overcome the attractive forces between them. Finally, a temperature is reached where no amount of pressure can keep the molecules close enough for the attractive forces to be effective and the gas will no longer liquefy. The highest temperature at which a gas liquefies is called its critical temperature and the critical pressure is the pressure required to bring about this liquefaction at the critical temperature.

For hydrogen the critical temperature is -240°C and critical pressure is 12.8 bar. If liquid hydrogen warms up from -253°C as far as -240°C then no amount of pressure will keep it in its liquid state. It will behave as an ideal gas and expand rapidly, a property that has consequences for how liquid hydrogen must be stored.

The flashpoint (the temperature at which the

fuel generates sufficient vapours to facilitate a flame given an ignition source) for hydrogen is -231°C, which is the lowest temperature compared to other fuels.

## So how do you cool hydrogen to -253°C?

Producing liquid hydrogen is an energy intensive process due to the extreme temperatures involved to cool it, handle it, and transport it to the customer. To understand just how the gas is cooled to such temperatures we need to understand the Joule-Thompson effect and throttling.

Most liquefaction of gases, including how your own domestic refrigerator works, uses a variation of the Linde process. This involves compression followed by expansion of the gas to reduce the gases temperature.

However, hydrogen along with helium at 'normal' temperature and pressure (say 1 bar and 20°C) actually heats up following this process and must be pre-cooled if they are to reduce in temperature upon expansion. Let's explain why.

At normal temperature and pressures hydrogen atoms, being so small, are still very far apart and have very small forces keeping them together, making collisions between molecules rare. Therefore, at these normal temperatures and pressures, if the hydrogen gas expands following a compression, internal energy is not required to break the forces between molecules. However, if the hydrogen gas is initially cooled (using liquid nitrogen) to below -78°C, the molecules have reduced energies and have some attraction. As this pre-cooled gas is compressed and then expanded, the gas must now do some work to break the connections. This uses up some of its internal energy, lowers the energy of the molecules and results in a large drop in temperature. This is the Joule-Thompson effect.

All gases have their own Joule-Thompson coefficient that describes the rate of change of temperature for the gases at different initial temperatures (see Table 1). A positive Joule-Thompson coefficient results in cooling upon expansion, a negative coefficient results in warming.

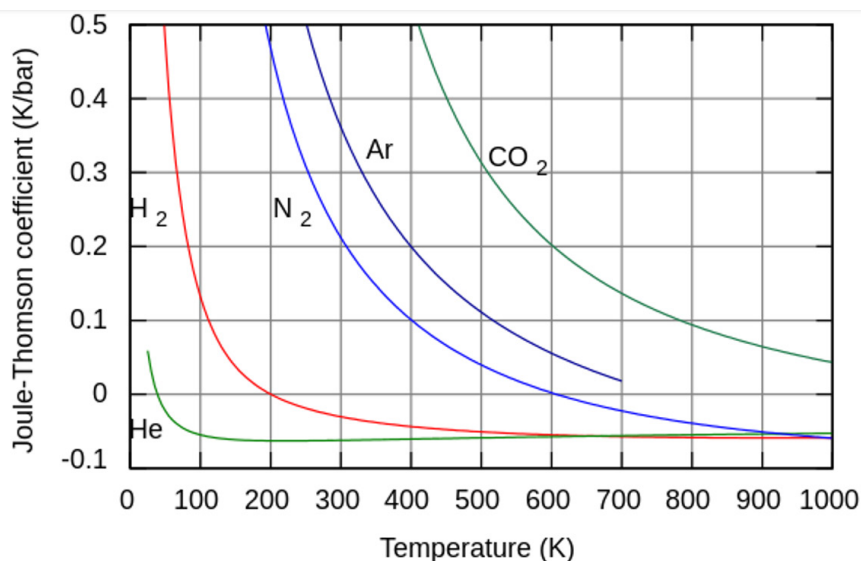
Nitrogen and oxygen do not require pre-cooling at ambient temperatures for them to experience cooling upon expansion. However, hydrogen requires cooling to -78 oC before its Joule-Thompson coefficient changes from a negative value to a positive value.

In its most basic terms, the Linde process (see Diagram 1), involves hydrogen gas (1) entering the system at ambient temperature and pressure. It is compressed (2), this results in a raised temperature, so the compressed gas enters a heat exchanger (3) where it is cooled with liquid nitrogen to take it below the hydrogen inversion temperature of -78 oC. The gas is passed through an expansion valve or throttle (4) where the resulting expansion causes a lowering in temperature. A fraction will become cold enough to liquify and this liquid fraction is drawn off. Any un-liquified gas is returned to the compressor via the heat exchanger.

It is estimated that between 10% and 30% of the available hydrogen energy is required for this liquefaction but the increase in energy density of liquid hydrogen over its gaseous counterpart still makes it a viable method of storing and transporting the hydrogen.

Gas	Inversion temp at 1 bar	
Hydrogen	195K	or -78 °C
Helium	45K	or -225 °C
Nitrogen	621K	or 348 °C
Oxygen	764K	or 491 °C

Table 1. Inversion temperature for some of the cryogenic gases.



Joule-Thomson coefficients for various gases at 1 bar. Note Nitrogen's coefficient becomes negative at 600K (327 deg C), but Hydrogen's doesn't become negative until 200K (-78deg C)

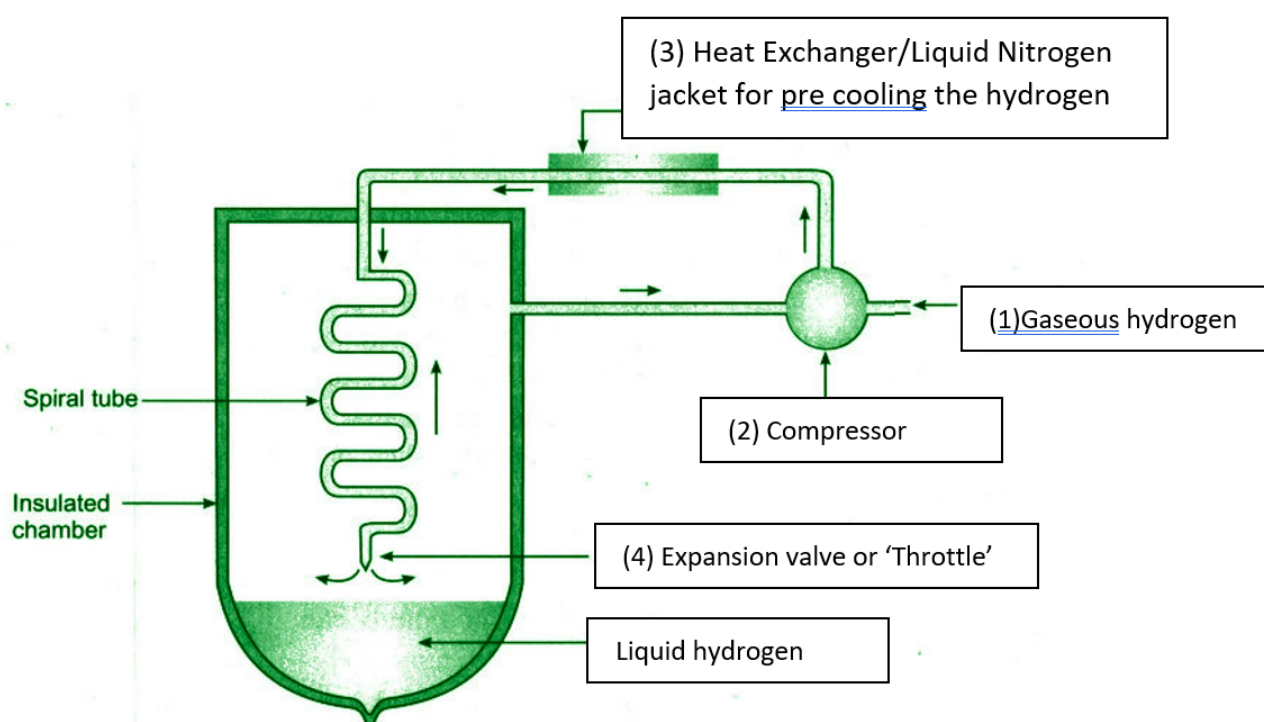
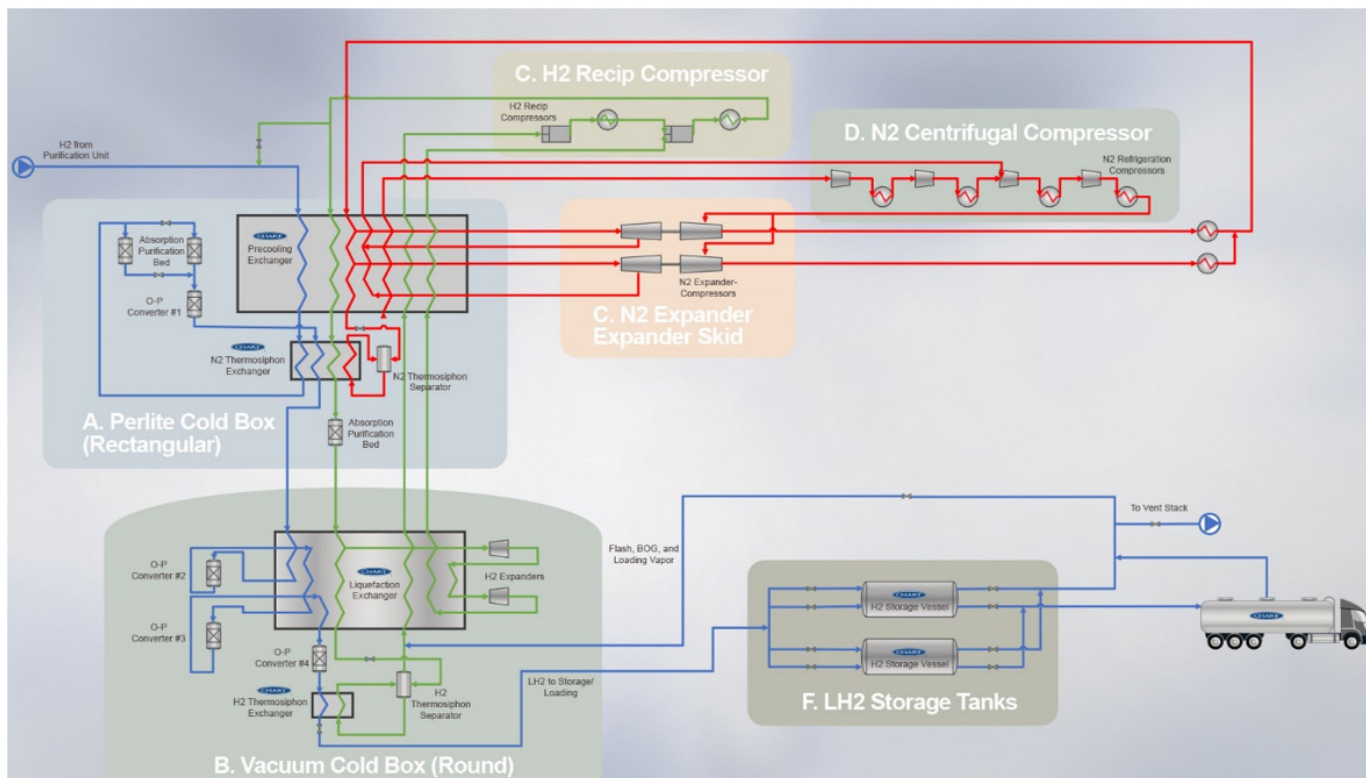


Diagram 1 – Simplified diagram of the Linde process showing precooling of hydrogen gas and expansion valve (Throttle) where the expansion of the hydrogen gas can drop its temperature to below its boiling point.1





**Diagram 2. Hydrogen liquefaction, a more accurate diagram showing a manufacturer's design of the requirement for reciprocating compressors for hydrogen, centrifugal compressors for nitrogen and multiple heat exchangers.**

## A hydrogen producer's approach – Air Products

Air Products is the world's largest hydrogen supplier and has more than 60 years of experience of safely producing, storing, handling and distributing hydrogen to market. The company has an unsurpassed safety record having earned more safety-related awards than any other industrial gas company and have taken a leadership role in supporting the hydrogen fuel community in the safe use of hydrogen.

Air Products' experience in the hydrogen for mobility market, through its work on a liquid hydrogen store and bulk trailer in Ghent, Belgium, indicates that liquid hydrogen technology brings significant advantages in terms of reliability, footprint, and scalability.

While a small fleet conversion using 500kg or less of hydrogen warrants gaseous hydrogen as the right solution, for larger fleet conversions a liquid hydrogen tank presents the best option and operates much like a diesel storage tank. In addition to supplying a larger capacity, a liquid hydrogen installation is much more space efficient than a gaseous solution. As part of our work, we have seen significant progress in the hydrogen bus market in terms of sustainable energy supply to vehicle fleets. Our hydrogen bus refuelling stations in the municipality of Hürth in Germany and the Go-Ahead Group near Gatwick in the UK are good examples.



**Liquid Hydrogen store and bulk trailer, Gent Belgium. 3**

The latter represents the largest renewable bus deployment to date in the UK fuelled (or supplied) by the largest liquid hydrogen-based station in Europe. For this project, Air Products will initially be providing fuel to 20 buses, but the equipment can, in time, support a full depot conversion.

As interest from bus and truck operators continues to grow, part of the conversation must be about the right mode of hydrogen supply. From Air Products' work supporting clients with the implementation of this new technology, the company knows that safety is the number one priority and all modern hydrogen fuelling stations are designed with numerous safety

systems incorporated. The design of the fuelling station includes process software that monitors the station's status, backed up by independent hardware safety instrumentation and safety devices. Dispensers monitor the fuelling process in real time and communicate with the vehicle. If the dispenser detects a leak or other anomaly with the fuelling event, it will shut off and prevent further fuelling. Flame and hydrogen detectors are deployed at the station to monitor for fires and hydrogen leaks. These systems are designed to shut off the supply of hydrogen in the event of an alarm.

## Storing liquid hydrogen: what you need to know

Having converted gaseous hydrogen to liquid hydrogen it is important to keep it that way until back to gas conversion is required. Ricardo's global expertise and commitments across multiple sectors and industries means the company truly understands the dos and don'ts, challenges, opportunities and risks to implement this technology safely. Despite the best insulation materials, some vaporisation and hence boil-off is inevitable and must be accommodated. With an expansion ratio of 848 a tank full of liquid hydrogen at 1 bar should it convert back to gas would experience a pressure rise to 1720 bar, thus hydrogen can only be stored in self-regulating systems fitted with pressure relief valves or bursting discs.

Boil-off quantities can be influenced by several factors including internal spin alteration, heat leakage, and, sloshing and flashing.

**Internal spin alteration of the hydrogen molecules:** Hydrogen atoms preferentially join to form a pair to comprise a hydrogen molecule (H<sub>2</sub>). In ortho-hydrogen, both the hydrogen atoms spin in the same direction. In para-hydrogen, each atom spins in opposite directions. The ratio of ortho:para hydrogen is temperature dependent.

Hydrogen at normal temperatures and pressures is typically 75% ortho and 25% para. However, below -120 °C the concentration of para-hydrogen increases up to 100%. Thus, during liquefaction, there is conversion of 75% of the hydrogen molecules from ortho to para hydrogen. This change in spin direction generates heat within the liquid and promotes boil-off until the conversion has taken place. It is important to allow this ortho to para conversion to take place during the liquefaction process rather than when the liquid hydrogen is in storage.

**Heat leakage:** Heat leakage from the vacuumed and insulated vessels can be 1% in smaller vessels but 0.06% in larger vessels due to greater surface to volume ratios. Perlite is a common insulation material used in storage vessels.

**Sloshing and flashing:** Sloshing is due to movement of the liquid while being transported. This generates kinetic energy which is transferred to thermal energy to the liquid in the tank. Flashing is caused by the introduction of hydrogen from a higher-pressure tank into one at a lower pressure. This injection of liquid hydrogen into the body of the liquid in the receiving tank generates

thermal energy and again promotes boil-off. Something to note here is that even transferring liquid from one container to another can create a lot of boil-off. It's not as simple as moving liquid from one tank to the other as you then also need to safely remove the gas produced in moving the liquid and it can easily be >10% of the transferred volume of liquid which will turn to gas.

## Safety issues

The dangers of liquid hydrogen fall into three categories: physical (embrittlement, storage tank failure), physiological (cold burns, hypothermia, asphyxiation and respiratory issues) and chemical (ignition and fire).

Direct contact with liquid hydrogen leads to severe burns and/or frostbite. Inhalation of cold vapour itself can cause respiratory ailments. Contact between skin and uninsulated surfaces can also cause the skin to stick and tear.

A large release of liquid hydrogen can lead to an accumulation of liquid hydrogen and solidified air outside a vessel. As oxygen condenses faster than nitrogen due to its higher melting point this solidified air will be oxygen rich. If this mix catches light, it will ignite with a greater amount of energy than gaseous hydrogen alone. A mix of liquid hydrogen and solidified air is also shock sensitive. A mitigating act can be to apply a water spray to the spill site which introduces heat to the accumulation and vapourises it. The ensuing large condensation cloud and potential ice field must, however, be anticipated.

While this is a possible course of action for a spill on the ground it is a dangerous action if applied to a tank or container. Water is capable of entering pipework, freezing and then blocking the pipe. If the blocked pipe is part of a vent stack the vessel is no longer able to release any over pressure. In 1974, during a chemical plant incident, emergency services sprayed water onto the vent stack after a rupture disc blew and subsequently ignited a leak on a 20,000-gallon liquid hydrogen tank. The vent stack became plugged with ice, with no venting facility left, the tank subsequently failed as the remaining liquid hydrogen warmed up and expanded to gas. The below signage was adopted following this incident and many facilities have subsequently started fitted a secondary vent stack should for some reason the primary stack become inoperable.



**Air Products liquid hydrogen storage tank showing vent stack and mandatory signage warning not to spray water onto vent stack.**

Vapours from liquid hydrogen are very cold and initially are denser than air. They accumulate initially at low level and then horizontally. The hydrogen vapours spread further in low wind conditions. However, as wind speed increases the dispersion increases greatly the safety distances can be decreased.

Overfilling a liquid hydrogen vessel, should it occur, can operate the pressure relief valve which may lead to a liquid hydrogen spill and/or prevent the pressure relief valve operating further due to solidified air blocking it. To add an extra layer of safety, a rupture disk may also be installed on the pressure relief valve line.

The European Industrial Gases Association (EIGA) has recommended several minimum separation distances for liquid hydrogen vessels. According to their list, the separation distances for liquid hydrogen facilities installed in public spaces, near an occupied building, or near combustible liquid or solid stores are



60, 20, and 10m respectively. EIGA also recommends that liquid hydrogen storage vessels are not installed inside buildings and are at least 10m from overhead lines.

## Harnessing the benefits

It is clear that liquid hydrogen has enormous potential as an energy carrier for the decarbonised world, but it is essential that for any industries seeking to achieve its undoubted benefits, it is cooled, stored and handled safely, and its hazards understood and mitigated. Recent tragic events highlight the absolute importance for any companies undertaking cutting edge innovation and implementing new technology to be able to demonstrate that they put the safety of their people above all else, and that they are innovating and implementing in consideration of these risks.

No matter how safely planned, implemented and operated a system is, there is always the risk of something going wrong – and the consequences of an incident involving hydrogen would be catastrophic.

As well as the widely known hazards to people, the environment and infrastructure, history shows that a single hydrogen incident will damage public perception. A lack of public adoption of hydrogen as an energy carrier, the reputational damage to its use and further legislation following an incident could result in all our efforts to use hydrogen as a mechanism to decarbonise being futile. Ricardo's recent project to support Brighton and Hove Buses [www.ricardo.com/en/case-studies/repowered-hydrogen-bus] is a clear demonstration of how safety is the number one priority of organisations on the decarbonisation journey.

It is hydrogen suppliers, industries, regulators, emergency services and each individual's responsibility to ensure that safety is the number one priority when looking to adopt innovative energy technologies.

## References.

1. EIGA DOC 06/02/E Safety in Storage, handling and distribution of liquid hydrogen
2. Liquid Hydrogen: A review on liquefaction, Storage, Transportation and safety. Muhammad Aziz. Energies article September 2021
3. Chemistry, the central science. Theodore Brown, Eugene LeMay. Prentice Hall publishing 1977

4. How the world really works. Vaclav Smil. Penguin Publishing 2022

5. Liu, Y.; Liu, Z.; Wei, J.; Lan, Y.; Yang, S.; Jin, T. Evaluation and prediction of the safe distance in liquid hydrogen spill accident. 2021

6. Air Products
7. Chart Industries Inc
8. Big Chemical Encyclopedia

## Image Sources:

1. www.geeksforgoeks.org
2. www.chartindustries.com with thanks to Peter Gerstl (Director of Hydrogen Sales)
3. www.airproducts.co.uk

## About Ricardo

Ricardo plc is a global strategic, environmental, and engineering consulting company, listed on the London Stock Exchange. With over 100 years of engineering excellence and close to 3,000 employees in more than 20 countries, we provide exceptional levels of expertise in delivering innovative cross-sector sustainable outcomes to support energy transition and scarce resources, environmental services together with safe and smart mobility. Our global team of consultants, environmental specialists, engineers and scientists support our customers to solve the most complex and dynamic challenges to help achieve a safe and sustainable world.

Ricardo supports organisations across transport, energy, government and industrial sectors in their transition to hydrogen. From working on the design for a multi-stack fuel cell system solution for the world's first truly green passenger carrying airline services to implementing hydrogen generation plants and assessing national adoption plans we are global leaders on the enablement of hydrogen.

In support of our commitment to safe enablement as the priority we offer a variety of hydrogen awareness and safety training, and development support. From entry level awareness through to full engineering control assessments, our world-class experts provide the scientific and emergency response at all stages of the journey.

For information on how Ricardo can support you with the safe implementation, use and evaluation of hydrogen applications visit [www.ricardo.com/hydrogen](http://www.ricardo.com/hydrogen) or contact [info@ricardo.com](mailto:info@ricardo.com).

## About Air Products

Air Products is a world-leading industrial gases company in operation for over 80 years focused on serving energy, environmental, and emerging markets. The company has two growth pillars driven by sustainability. Air Products' base business provides essential industrial gases, related equipment and applications expertise to customers in dozens of industries, including refining, chemicals, metals, electronics, manufacturing, and food. The company also develops, engineers, builds, owns and operates some of the world's largest industrial gas and carbon-capture projects, supplying world-scale clean hydrogen for global transportation, industrial markets, and the broader energy transition. Additionally, Air Products is the world leader in the supply of liquefied natural gas process technology and equipment, and globally provides turbomachinery, membrane systems and cryogenic containers.

The company had fiscal 2022 sales of \$12.7 billion from operations in over 50 countries and has a current market capitalization of about \$65 billion. More than 21,000 passionate, talented and committed employees from diverse backgrounds are driven by Air Products' higher purpose to create innovative solutions that benefit the environment, enhance sustainability and reimagine what's possible to address the challenges facing customers, communities, and the world. For more information, visit [www.airproducts.com](http://www.airproducts.com) or follow us on LinkedIn, X, Facebook or Instagram.

## Authors Notes:

Stuart Devereux is currently a Hydrogen Safety and Response associate tutor with Ricardo. With previous careers in secondary school science education and UK Fire and Rescue, Stuart has a keen interest in safe use of hydrogen as a future fuel and educating the supply chain on the benefits and risks as well as managing hydrogen incident response.

Hector Wilson is the H2 for Mobility, Energy Transition & Sustainability Operations Lead for Air Products with 20+ years of gas and process engineering experience. Hector is developing the operational strategy for H2fMET for both "Blue" and "Green" hydrogen.

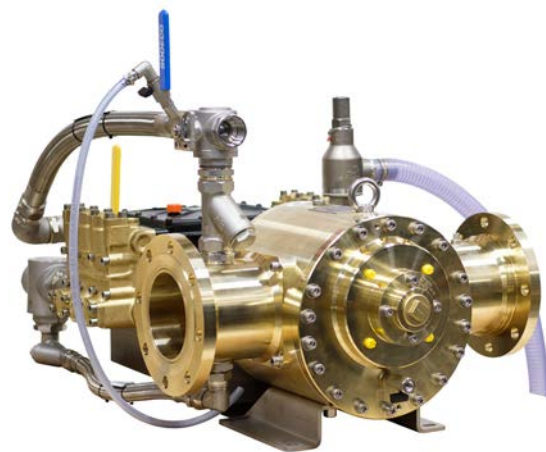
**Written by Stuart Devereux, Hydrogen Safety and Response Associate Trainer at Ricardo, and Hector Wilson, H2 for Mobility, Energy Transition & Sustainability Operations Lead for Air Products**

# WATER DRIVEN VOLUMETRIC PROPORTIONERS FOR FIRE FIGHTING

FIREMIKS is the reliable and easy-to-use  
pump proportioner, driven by the water flow only.

Industrial - Sprinkler  
Fire Brigades - Fire Trucks  
Marine - Offshore

[www.firemiks.com](http://www.firemiks.com)



## EASY TO INSTALL

COMPACT DOSING SYSTEM,  
NO NEED FOR PRESSURE TANK  
OR ADDITIONAL ENERGY SUPPLY.

## EASY TO USE

RELIABLE MECHANICAL  
PROPORTIONER, DRIVEN BY THE  
WATER FLOW, NO NEED  
FOR PRESSURE BALANCING

## EASY TO TEST

ECONOMICAL AND ENVIRONMENTALLY  
BENEFICIAL TESTING WITH  
A DOSING RETURN VALVE AND  
SEPARATE FLOW METERS





## 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.”

DYNAX CORPORATION

PO Box 285, Pound Ridge, NY 10576 USA

T 914 764 0202    [techinfo@dynaxcorp.com](mailto:techinfo@dynaxcorp.com)

F 914 764 0553    [www.dynaxcorp.com](http://www.dynaxcorp.com)

# dynaxC6



# Private-public fire fighting power

By Kees Kappetijn, consultant at Kappeijn Safety Specialists and Jimi Korst, tactical commander and team leader at Unified Fire Service Amsterdam



The success of public-private fire safety and response largely depends on shared safety interests and mutual confidence between the partners involved, as is demonstrated in the Amsterdam Sea Port area. In April 2020 a public-private firefighting organisation was established in the Dutch capital for the extensive harbour- and industrial zone west of the city.

Public authorities and industry joined hands in order to raise the level of fire safety and incident response in this dynamic economic hub in The Netherlands. Three years after take-off the initiative proves to be very successful and the next steps for further development are taken. Unified Fire Service Amsterdam started as collective company fire service for 15 industrial sites in the Amsterdam Sea Port. Three years later 16 new members joined the cooperation, proving that the industry is convinced of the added value of a dedicated industrial fire brigade. The key words behind the success are 'improved fire safety paired to shared costs and better quality and preparedness in the harbour area'.

The intensive logistic and industrial activity and the mutual 'chain dependency' in a densely populated urban area lead to an accumulation of risks, requiring smart concepts for ensuring

safety, security and incident response. The risk profile of the area runs from smaller fires and spills in logistic units and test-installations of start-ups, to fires in large solar fields and tank storage facilities.

Major incidents could cause extensive disruption to industrial continuity and logistical flows and also considerable financial loss for the port and industrial companies. Effective incident response by a dedicated industrial response team, trained and equipped for the typical risks in the area, are therefore a 'must' in this economic vital area.

## Stakeholders and interests

GBA took shape in Amsterdam there was a mutual aid organisation in the area already, focussing on preparation for tank and bund fires. In 2009 five large oil storage terminals in the Amsterdam agglomeration joined forces in establishing the Amsterdam Mutual Aid System (AMAS). They collectively purchased large scale firefighting equipment, such as high-capacity pumps, water transportation hoses, foam supply and high-capacity monitors.

The public component was added by two adjacent public firefighting organisations (Amsterdam-Amstelland and Kennemerland)

to form the AYMA-collaboration: Amsterdam-Ymond Mutual Aid, thus ensuring the availability of trained personnel for firefighting operations. Until three years ago the Amsterdam western harbour area had very little facilities for basic industrial incident response. There was no fire station in the extended area and only a few companies were required to maintain a company fire brigade by law. They largely covered their risks by implementing stationary fire safety systems. In case of fires and accidents in the harbour area the public fire service had to respond from fire stations in the Amsterdam urban areas, often at far distances, especially in the western parts of the industrial zone.

*"There is no majority for public or private partners, all decisions must be discussed and need a PPP majority."*

In 2015 a study for improving the fire safety and incident response in the western harbour area resulted in an advisory report, concluding that a public-private mutual aid fire brigade was the best option to raise the preparedness level in the area. All stakeholders involved: the Safety Region Amsterdam, the City of Amsterdam and the Port of Amsterdam as 'housekeeper' in the port area, saw the need of investing in a dedicated 24/7 fire brigade, properly equipped and trained for industrial incident scenarios.





After three years of preparation GBA was established in 2020 with a formation of 30 firefighters and a flex pool of 10 industrial firefighting specialists, ensuring the first incident response 24/7 with a six-member operational team from a fire station within the harbour area. One standard fire engine and an industrial foam tender are at their disposal.

### Port authority as partner

GBA is an independent incident response organisation, serving three 'customers': the industry collective, counting 31 member companies meanwhile, the Safety Region Amsterdam-Amstelland and the Port of Amsterdam. These three partners also form the board of the organisation, in a 6-seat model. Two seat for industry, two seats for the public fifti-service and two seats for the harbour authorities, being a PPP in itself. So there is no majority for public or private partners, all decisions must be discussed and need a PPP majority.

The strong position of Port of Amsterdam in the PPP-construction is what makes this safety platform special in Dutch ppp-models. Being responsible for the port- and area management in the harbour area, Port of Amsterdam embraces the value of effective and efficient

incident management. For the safety region Amsterdam Amstelland the main interest is public safety, while business continuity and protection of economic value is the key word for the member-companies. For Port of Amsterdam a safe and stable environment for deploying business activity is the leading principle.

By providing swift and professional incident response in case of fires and accidents GBA contributes to that safe business environment. Apart from incident response GBA also provides proactive and preventive safety advice and maritime and shipping incident response. In the first three years of its existence GBA proved its value in terms of rapid incident suppression and limited damage. The safety in the industrial zone has improved considerably, making the area attractive for new industries to settle. Altogether the Amsterdam PPP-model is a win-win construction for all three stakeholders involved.

*"GBA plays an important role in improving the safety in the harbour area of Amsterdam."*

### Added value for public and private partners

The Western Sea Port area of Amsterdam is the ideal environment for establishing a public-

private mutual aid incident response organisation. The harbour area is situated on the border area of three public safety regions, contains an extended cluster of industrial and storage facilities and has an intricate infrastructure for transportation.

While the public and private stake holders rely on each other in process chains and logistics, they share strong interests of safety and security. For that reason they decided to also share the costs for investments in better preparedness, response capacity, training and maintenance. The three stake holders each contribute for one third in the costs. The industrial contribution is split over a total of 31 companies, minimising the costs for individual member companies. Moto for the industry: for 2% of the cost you get 100% of the services.

The growth of the GBA organisation to 31 companies within three years proves that the industry in the Amsterdam harbour area believes in the ppp-model. The key to success are the services GBA provides to its members. That service extends beyond quick response in case of fire and accidents. GBA offers added services like safety advice, preparation by joined exercises, educating CMT-teams and support for fire safety audits. A fire brigade that is familiar with the company site, its risks and the values that have to be protected, is better prepared to set priorities in case of incidents



and to apply the right strategy to control the incident and limit the effects. This approach makes GBA not only the ideal safety partner for high risk-companies but also for capital intensive companies such as a shipyard, consumer alcohol storage, large logistic storage facilities for luxury products and cocoa production companies.

With all their customers GBA has established a sustainable relationship for the entire safety chain. This sustainable relationship is made possible by the special duty roster of GBA, spending as many hours as possible to provide services to the member companies. Also GBA has no hierarchy organisation and management, and maintenance tasks are a common responsibility for the team as a whole, creating short lines of communication between GBA and its members.

### Further evolution

GBA is the result of the joined ambition of the three stakeholders: Safety region Amsterdam-Amstelland, Port of Amsterdam and the collective of member companies, partners that dared to experiment with a smart and innovative organisation model without any management layers and with alternate duty schedules. In the design- and building phase, personnel were carefully selected, not only on operational skills but also on additional gifts like management capabilities

After being operational for three years it is clear that GBA plays an important role in improving the safety in the harbour area of Amsterdam. The number of responses is considerably higher than estimated in the design phase. In 2022 298 incidents were reported, most of which were relatively small and in the public area.

*“Effective incident response by a dedicated industrial response team are a ‘must’ in this economic vital area.”*

Meanwhile the Amsterdam PPP mutual aid initiative has its focus on the future, planning further evolution and added services. GBA hopes to extend the cooperation with other public services in the harbour regions in time, such as police and customs, in order to improve the integral safety in the area. Also, GBA has the intention to invest in the cooperation with other PPP-platforms in the Netherlands, by sharing knowledge and experiences and in time perhaps also their heavy-duty equipment and capacity in case of extensive industrial fires or temporary unavailability of equipment components. ‘Stronger together’ in specialised industrial incident response.



### About the authors:

#### Kees Kappetijn

Managing Director of Kappetijn Safety Specialists

Providing consultancy for organisations in harbor- and industrial area's that have to deal with threats of large incidents and business interruptions. Specialists for Mutual Aid and Public Private Partnerships. What you organize jointly, is stronger and enduring.

Contact Kappetijn safety specialists:

Tel: +31 (0) 85 3019554

Email: [contact@kappetijn.eu](mailto:contact@kappetijn.eu)

#### Jimi Korst

Tactical commander and team leader at Unified Fire Service Amsterdam.

Contact Gezamenlijke Grandweer:

Tel: +31 (0) 88 5110000

E-mail: [info@gez-brandweer.nl](mailto:info@gez-brandweer.nl)





# Dr. STHAMER

## FOAM FIGHTS FIRE



A NEW LEVEL OF  
PERFORMANCE

# vaPUREx<sup>®</sup> LV ICAO C 3% F-5



Online only



vaPUREx<sup>®</sup> LV ICAO C is one of the first **newtonian** foam concentrate 3rd-party listed with fire performance Level C without any PFAS added. As the key benefit of the low viscosity newtonian vaPUREx<sup>®</sup> ICAO C foam apart from its excellent and robust fire performance it allows for a one-to-one replacement of standard AFFF. The foam agent is successfully tested at its **nominal induction rate of 3 %** with different types of monitors, handlines and foam pipes. There is no need to retrofit equipment or even recalibrate the mixing systems. vaPUREx<sup>®</sup> LV ICAO C achieved an excellent 1+C-rating according to EN1568:2018 part 3 on jet fuel also in an independent 3rd party test.

vaPUREx<sup>®</sup> LV ICAO C is suitable for forceful and gentle foam application on spill fires or 3D-fires of jet fuel for both Level B and Level C applications on airports or in hangars and works well on fires of other non-polar class B fuels like hydraulic oils. Additionally due to its built-in wetting capabilities vaPUREx<sup>®</sup> LV ICAO C can be used on fires of solid materials (class A-fires) such as freight stocks, plastics or wood.

For foam transition support, demonstration and pricing get in touch with us by mail: [info@sthamer.com](mailto:info@sthamer.com)

 **FLUORINEFREE**  
foams for the future



# Challenges for Emergency Fire Services in Coping with Corrosion Under Insulation Incidents at Oil Refineries



Image: Powertherm Contract Services

## Introduction

The world of firefighting is fraught with unpredictability, but even seasoned professionals can find themselves facing challenges they never expected. One such formidable challenge that emergency fire services encounter is a Corrosion Under Insulation (CUI) incident at an oil refinery. When the lurking enemy is hidden beneath layers of insulation and strikes with the destructive force of a raging inferno, firefighters find themselves in a race against time and elements. This article explores the intricacies of CUI incidents at oil refineries and the exceptional challenges emergency fire services encounter when battling these hidden fires.

## Corrosion Under Insulation: An Unseen Threat

Corrosion Under Insulation (CUI) is a perilous, often undetectable problem in the oil refining industry. It occurs when moisture penetrates the insulation covering pipes, tanks, and other equipment, leading to corrosion of the metal underneath. This insidious process can continue unnoticed for years until it finally results in catastrophic equipment failure or, more alarmingly, a devastating fire.

## The Challenges of Hidden Fires

When a CUI incident escalates to a fire, it becomes a formidable foe. The insulation that conceals the corrosion also conceals the impending fire, making it nearly impossible to detect until flames burst forth. Emergency fire services must then confront a unique set of challenges:

1. Limited visibility: Unlike traditional fires, CUI fires start beneath the insulation. This limited visibility hampers firefighters' ability to assess the situation accurately and efficiently. Smoke and toxic fumes are trapped beneath layers of insulation, creating a hazardous environment.
2. Intense heat: The confined space of CUI incidents intensifies the heat, making it difficult for firefighters to approach and extinguish the fire. The insulation acts as a thermal barrier, further increasing the temperature and making it challenging to cool the affected area.
3. Rapid and unpredictable fire spread: CUI fires can spread quickly due to the insulation acting as a fuel source. This rapid propagation can outpace firefighting efforts, making containment a significant challenge.

4. Dangerous materials: Oil refineries house a plethora of hazardous materials. When a CUI incident turns into a fire, it can release toxic gases and chemicals, posing a grave risk to the health and safety of emergency responders and the environment.

5. Structural integrity concerns: CUI fires can compromise the structural integrity of equipment and structures, making it dangerous for firefighters to enter the area. Collapse hazards and equipment failure must be taken into account.

Addressing these challenges is paramount for emergency fire services to effectively tackle CUI incidents at oil refineries.

## Mitigating the Risks

1. Advanced detection technology: Oil refineries are increasingly investing in advanced technology for the early detection of CUI. Ultrasound and electromagnetic testing can be used to assess the condition of pipes beneath insulation, allowing for proactive maintenance and prevention of CUI incidents.

2. **Effective insulation management:** Proper insulation management involves regular inspections and maintenance to ensure that moisture is not penetrating the insulation. This can significantly reduce the risk of CUI and, subsequently, CUI fires.

3. **Comprehensive training:** Firefighters responding to CUI incidents must undergo specialized training to understand the unique challenges they will face. They need to learn how to navigate in low-visibility, high-heat environments while dealing with hazardous materials.

4. **Collaborative response:** Collaboration between emergency fire services and industrial safety teams is crucial. Oil refineries should have well-defined emergency response plans for CUI incidents and regular drills to ensure that all responders are prepared.

5. **Appropriate personal protective equipment (PPE):** Given the toxic and hazardous nature of CUI fires, firefighters must be equipped with the best PPE available. This includes specialized gear to protect against corrosive chemicals and toxic gases.

### Emergency Fire Services in Action

When a CUI incident escalates to a fire at an oil refinery, the emergency fire services must act swiftly, strategically, and courageously. Here is a step-by-step account of how firefighters tackle such an incident:

1. **Arrival and assessment:** Upon receiving a distress call, firefighters rush to the scene. Once there, they must first assess the situation. This includes identifying the location of the fire, evaluating the extent of insulation and corrosion, and determining the presence of hazardous materials.

2. **Preparation:** Firefighters must be equipped with specialized PPE that protects them from the harsh conditions of CUI fires. This includes chemical-resistant suits, self-contained breathing apparatus (SCBA), and thermal imaging cameras to enhance visibility.

3. **Isolation:** The affected area is isolated to prevent the fire from spreading further. This may involve shutting off fuel sources or isolating sections of the refinery.

4. **Extinguishment:** Firefighters use a combination of techniques to battle the CUI fire, including applying specialized foam, water, or chemical agents. The insulation must be removed to access and extinguish the

underlying fire source. This is a laborious and time-consuming process.

5. **Evacuation:** If the fire is not under control and poses an imminent threat, a refinery-wide evacuation may be ordered to ensure the safety of all personnel on-site.

6. **Containment:** After extinguishing the fire, firefighters focus on containing hazardous materials and ensuring that no environmental damage occurs.

7. **Overhaul and investigation:** Once the fire is completely extinguished, the area is carefully inspected to ensure there are no remaining hot spots. A thorough investigation is conducted to determine the cause of the CUI incident and to prevent future occurrences.

### Challenges Faced by Emergency Firefighters

CUI incidents at oil refineries are incredibly challenging for firefighters. The following are some of the specific challenges they face:

1. **Limited visibility:** The low-visibility environment created by the insulation can disorient firefighters, making it difficult to navigate and assess the extent of the fire.

2. **Intense heat:** The intense heat generated by CUI fires can overwhelm even the most advanced PPE. Firefighters are at risk of heat stress and exhaustion, and they must frequently rotate to avoid excessive exposure.

3. **Complex and time-consuming firefighting:** Removing insulation to access and extinguish

the fire is a time-consuming and physically demanding task. It requires precision to avoid further damage to the equipment. 4. **Hazardous materials:** CUI fires can release toxic gases and chemicals, posing a severe health risk to firefighters. They must constantly monitor air quality and take precautions to minimize exposure.

5. **Structural integrity:** The compromised structural integrity of equipment and structures can pose a danger to firefighters. The potential for equipment failure or collapse requires careful planning and consideration.

### Conclusion

Corrosion Under Insulation incidents at oil refineries are a hidden and deadly adversary. When these incidents escalate to fires, emergency fire services face a unique set of challenges that demand specialised training, equipment, and collaboration with industrial safety teams. While advanced detection technology and proper insulation management can help prevent CUI incidents, firefighters must remain vigilant and prepared for the unexpected.

CUI incidents are often fast developing, and all emergency services should be trained and drilled on how to deal with such incidents before they experience the real thing in an emergency

### Author

James Garuda  
Senior Process Safety Analyst & Emergency Services Consultants  
JGA Consultancy Inc.

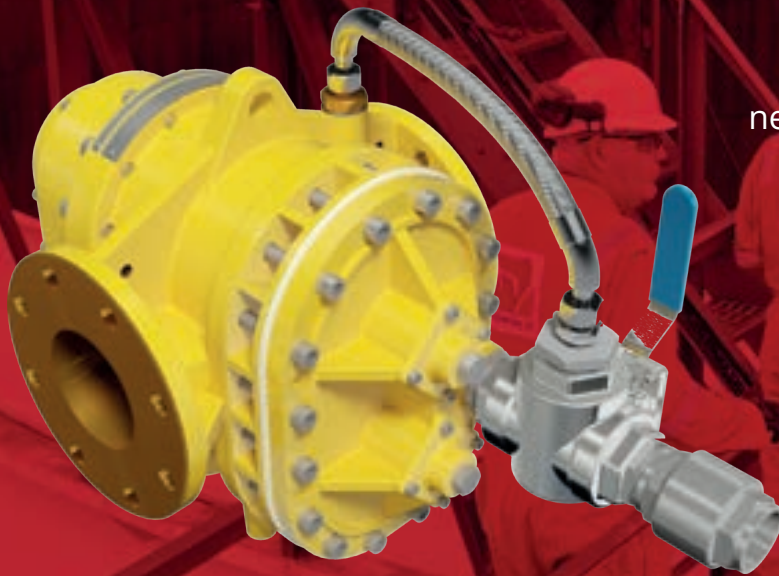


Image: Powertherm Contract Services



# Turbinator

Foam Mixing Technology



MECHANICAL



FIXED



TRUCK



MOBILE



Easily installed into  
new or existing systems



Plug and play



For low and  
medium flowrates

# FoamTronic®



ELECTRONIC



Reduce costs  
of testing



Pin-point  
accuracy



For high  
flowrates



## ARC FIRE TRAINING SERVICES LTD.

UNITED KINGDOM

[www.arcfiretraining@ntlworld.com](http://www.arcfiretraining@ntlworld.com)



Emergency Response Planning – Crisis Management for Hazardous Environments  
Site Specific Courses  
Fire & Safety Foundation 4 x 1 Day Modules  
Incident Controller 2 or 4 Days  
SCBA Initial & Refresher  
Confined Space Entry  
Confined Space Train the Trainer (with SCBA for High Risk)

On your own site. Subject to Risk Assessment & Facilities.  
For further information contact  
[arcfiretraining@ntlworld.com](mailto:arcfiretraining@ntlworld.com)

## INTERNATIONAL SAFETY TRAINING COLLEGE MALTA

Tel: + 356 2165 8281/2  
+356 9998 5211

Email: [enquiries@istcollege.com.mt](mailto:enquiries@istcollege.com.mt)  
[www.istcollege.com.mt](http://www.istcollege.com.mt)



Train the Trainer - 4 days  
Road Traffic Collision Technician Course - 5 days  
Fire Fighting Foundation Course – 10 Days  
Combined H2S, Industrial Breathing Protection and Confined Space – 5 Days  
LNG Awareness and Fire Fighting - 5 Days

The above courses and other JOIFF accredited courses on request.

## EDDISTONE CONSULTING LTD, INCORPORATING THE RESPONSE ACADEMY HEATHERSAGE

UNITED KINGDOM

[www.Eddistone.com](http://www.Eddistone.com)  
[www.responseacademy.co.uk](http://www.responseacademy.co.uk)  
Email: [opportunities@eddistone.com](mailto:opportunities@eddistone.com)  
Tel: +44 1433 659 800



Site Forward Controller (SFC) 1 day  
Site Incident Controller (SIC) 2 days  
Crisis Risk Radar 1 day  
Crisis Spokesperson 2 days  
Site Main Controller (SMC) 3 days  
Crisis Leadership 1 day  
Silver (TCG) COMAH Representative 2 days

All courses on your own site, or at the Eddistone Training Suite.  
All courses can be requested.

## NATIONAL CHEMICAL EMERGENCY CENTRE OXFORDSHIRE, UNITED KINGDOM

Email: [support@thehazmatacademy.co.uk](mailto:support@thehazmatacademy.co.uk)  
Website: [www.thehazmatacademy.co.uk](http://www.thehazmatacademy.co.uk)



Hazardous Materials Adviser Initial  
Hazardous Materials Adviser Revalidation  
Hazardous Materials First Responder  
Hazardous Materials Instructor

## FIRE SERVICE COLLEGE

UNITED KINGDOM

Tel: + 44 1608 650 831  
Website: [www.fireservicecollege.ac.uk](http://www.fireservicecollege.ac.uk)



Courses Available on request

## NEWCASTLE INTERNATIONAL TRAINING ACADEMY

UNITED KINGDOM

Tel: +44 0191 – 2143337  
Email: [trainingacademy@newcastleinternational.co.uk](mailto:trainingacademy@newcastleinternational.co.uk)



Course Information  
Available Upon  
Request

## H2K THE NETHERLANDS

Tel: +31 010 313 89 47  
Email: [info@h2k.nl](mailto:info@h2k.nl)  
Web: [www.h2k.nl](http://www.h2k.nl)



Foam School 5 Day  
Advanced Industrial Firefighting 5 Day  
Tank and Bund Fires 3 Day  
Integrated fire safety of IBC tanks and tank containers 3 Day

Other courses on request

## RELYON NUTEC FIRE ACADEMY MAASVLAKTE - ROTTERDAM THE NETHERLANDS

Tel: +31 181 376 666  
Email: [fireacademy@nl.relyonnutec.com](mailto:fireacademy@nl.relyonnutec.com)



Industrial Fire Team Member (IFTM) 10 days  
Industrial Fire Team Leader (IFTL) 10 days  
Industrial Fire Brigade Incident Commander (IFBIC) 5 days  
Tank Fire Specialist 4 days  
Brandbekämpfung Flüssigerdgas (LNG) für Einsatzkräfte 2 Tage  
Grundkurs Industrielle Brandbekämpfung 3 Tage  
Fortbildung Industrielle Brandbekämpfung für Einsatzleiter 5 Tage  
Brandbekämpfung Tanklager für Einsatz- und Anlagenpersonal 2 Tage



**SERCO INTERNATIONAL FIRE  
TRAINING CENTRE DARLINGTON  
UNITED KINGDOM**

Tel: +44 (0)1325 333317  
Email: [bookings@iftc.co.uk](mailto:bookings@iftc.co.uk)  
Website: [www.iftcentre.com](http://www.iftcentre.com)



3 day JOIFF Occupational Fire Fighter  
2 Day JOIFF Fire Fighter Refresher  
5 day JOIFF Team Leader

**THE FIRE TRAINING GROUP  
PART OF ABERDEEN  
INTERNATIONAL AIRPORT**

Email: [enquiries@thefiretraininggroup.com](mailto:enquiries@thefiretraininggroup.com)  
Tel: +44 1224 3485231  
Website: [www.thefiretraininggroup.com](http://www.thefiretraininggroup.com)



Courses Available on request

**SASOL EMERGENCY MANAGEMENT  
TRAINING ACADEMY SECUNDA  
SOUTH AFRICA**

Tel: + 27 17 610 6016  
Email: [isabel.dejongh@sasol.com](mailto:isabel.dejongh@sasol.com)



Full range of JOIFF Accredited  
courses on Emergency Response.

**YASSINE MARINE SERVICES  
YMS TRAINING CENTRE - SFAX  
TUNISIA.**

Tel : +216 36 408 290  
Email: [yms.training@y.marineservices.com](mailto:yms.training@y.marineservices.com)



Foundation Course 4 days  
Fire Team Member 3 days  
Fire Team Leader 3 days  
Helicopter Firefighting and Rescue 1 day  
H2S awareness 1 day

**JOIFF**  
**Accredited**  
**Training for 2023**



# Foam School 2024



**REGISTRATION NOW OPEN**

- **March 11 – 15, 2024**
- **Vernon – France**
- **Theory, legislation, lessons learned and best practices**
- **Workshops, demonstrations and practical firefighting**

**Dr. STHAMER**  
FOAM FIGHTS FIRE



**H2K**  
education • training • consultancy

Discover more at [www.h2k.nl](http://www.h2k.nl)