EIGA Winter Summit 2024: Safety, refuelling and applications of hydrogen

By Anthony Wright on Jan 26, 2024 | 0 DECARBONISATION

The second and final dayof the EIGA Winter Summit 2024 showcased discussions on crucial topics shaping the future of the industrial gas sector. Emphasising safety, talks delved into hydrogen refuelling station distances, secure bulk hydrogen storage, efficient transport methods, and innovative furnace design for hydrogen fuel applications, highlighting industry advancements.

Safety distances for hydrogen refuelling

Often called safety distances, a separation distance can be used to mitigate a foreseeable accident and prevent an event escalating, in this case for hydrogen refuelling stations.

EIGA outlines these risks in three publications: Methodology for Determination of Safety and Separation Distances, Safety in Storage, Handling and Distribution of Liquid Hydrogen and Gaseous Hydrogen Installations.

In his talk, Stuart Williams Process Safety Manager at Air Products posed the question: “With hydrogen refuelling we’re stepping up to 1000 bar, do these existing codes and standards still apply?”

Firstly, foreseeable events must be taken into account. These are defined as events that occur above a ‘tolerable threshold frequency’ and have the potential to cause harm to the general public, operators and other equipment.

“We can’t eliminate risk but we reduce it to a tolerable level,” said Williams.

This requires observing foreseeable events such as leaks from couplings, line breaks and hose rupture.

“What we don’t consider is catastrophic rupture events such as Boiling Liquid Expanding Vapour (BLEVE). These occur at a threshold lower than our threshold frequency.”

Leaks can create a flammable cloud because of the atmosphere that is formed around the leak, leading to a vapour cloud explosion.

This is when a mixture of fuel and air exists within the explosive range, and ignition then occurs. Flame propagates through mixture, initially slowly but can accelerate to generate a supersonic shockwave.

Immediate ignition can lead to jet flame fires and can cause injury from thermal radiation exposure.

“We model the jet flame, apply a set of criteria and this gives us the separation distance from the leak”

Delayed ignition can lead to jet explosion and injury and damage to equipment from overpressure exposure.

Distances can be developed from options such as a full Quantitative Risk Assessment – considered by Williams as an onerous approach.

NFPA takes an approach to define an equivalent leak size based on acceptable risk criteria.

“This is an interesting approach where the storage volume takes no part in the safe distance, it’s dependent on pipe size and pressure.”

“We can’t always make our safety distances, often we have to use other measures where we can’t meet those separation distances.”

Safely storing and moving megajoules

“Green electrons are at the heart of the power energy transition”, was the statement made by Stephen Harrison, Founder of sbh4 Consulting.

Although losses occur when converting these green electrons to green hydrogen, there is still a net benefit.

“When we do Power-to-X we are creating something that’s much easier to store. That’s a benefit of going to hydrogen for molecular storage.”

“Those losses can be justified by having a longer duration of energy storage or enabling grid balancing,” he explained.

In 1937, the Hindenburg disaster had a profound impact on hydrogen’s future prospects.

“It’s clear that public perception about hydrogen is driven by events such as the

Hindenburg, they stay in the public mind for a long time."

Professionals must go back and look at root causes.

Helium-filled rigid airship the USS Akron went down in a thunderstorm in 1933, all 73 people died, twice as many as the Hindenburg and no hydrogen was involved.

'These huge bulky airships were simply not safe. I don't see hydrogen as being the bad guy, the whole concept of the airships was flawed'.

What role can the industrial gas sector play in advancing hydrogen?

This requires creating the correct technical standards and growing the role of hydrogen to help to bring the public along with the industry.

'We need to work internally and externally to bring public opinion and policy with us to make sure the right changes take place.'

'In terms of public perception there is a fear of the unknown when it comes to hydrogen.'

The key is to desensitise the public to the risk. 'Over time we become desensitised to risk. How often do we see people using phones when refuelling their cars? Hydrogen on the other hand is new.'

Close to 98% of hydrogen production is from fossil fuels, as a result 830m tonnes of CO_2 is emitted each year to produce 74m tonnes of hydrogen. Key developments have been made in aviation, maritime and road transport to reduce the reliance of these industries on fossil fuels.

By improving safety with rigorous testing and the integration of technologies such as pressure relief devices, the public perception of hydrogen as a fuel is likely to become far more positive.

'I believe in hydrogen as a clean energy vector. I believe in ammonia as a derivative, its toxicity needs to be managed carefully.'

Compared to the alternatives, Harrison believes that the safety achieved with hydrogen can help lead into a clean decarbonised future.