Alternative fuels emergencies

COSH24

WHO WE ARE

RICARDO IS A GLOBAL STRATEGIC, ENVIRONMENTAL AND ENGINEERING CONSULTING COMPANY

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.

This incident in

1972

involving fuming sulphuric acid, led to the setting up of the NCEC in 1973

CIA Chemical Industries Association

Responsible Care® OUR COMMITMENT TO SUSTAINABILITY

Department for Transport

chemsafe

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carbon

Methanol

Over the next 40 minutes…..

- Lithium-ion batteries – fires which are extremely difficult to extinguish
- Hydrogen – gaseous and liquid
- Sharing newly developed, useable guidance to help prevent incidents and promote safety
- The importance of collaboration.

Thermal runaway

Which devices present the main risks from lithium-ion batteries?

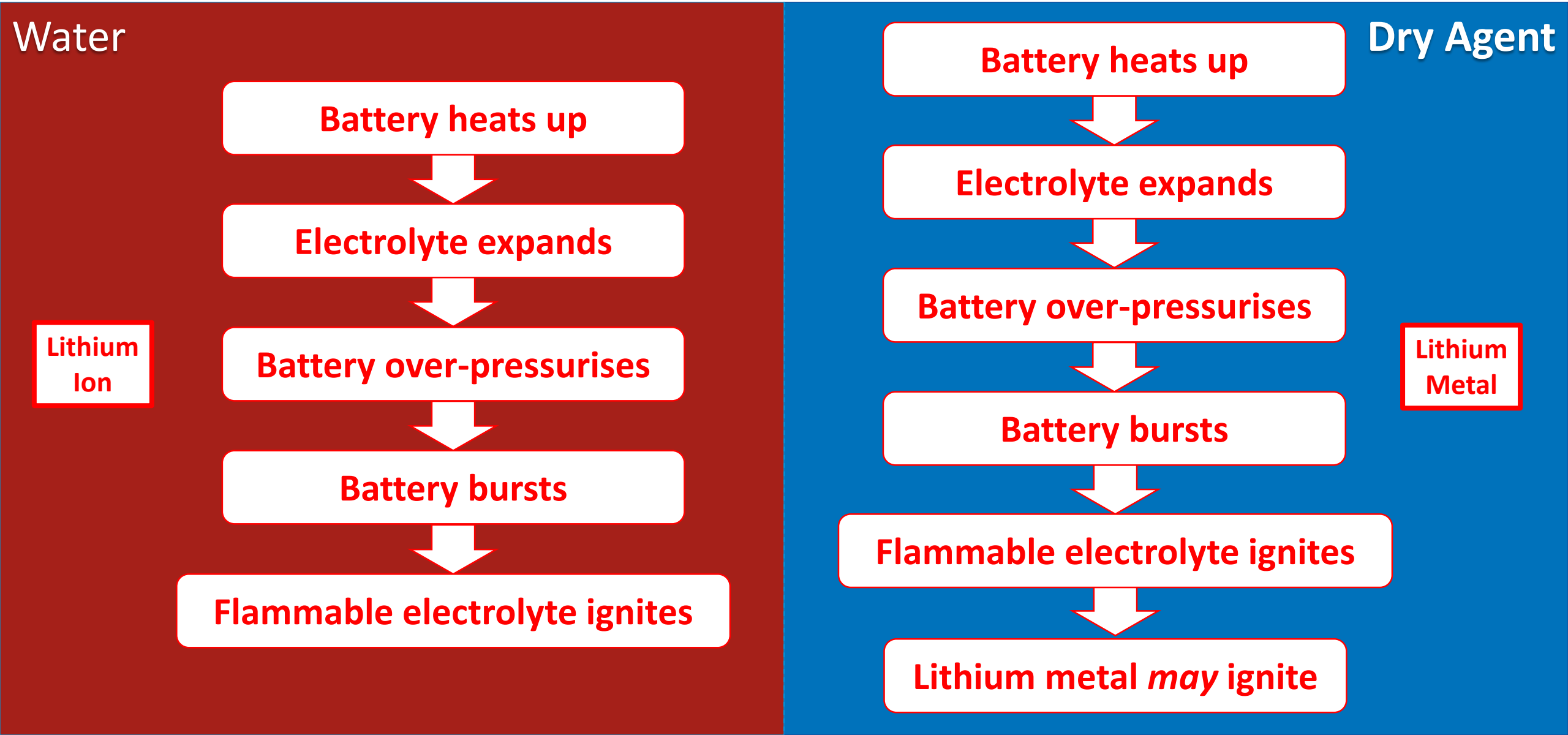
UK fire stats doubled ‘22 – ‘23.

What causes thermal runaway?

Causes:

- **Physical damage**
- **Short circuit**
- **External heating**
- **Nearby cells failing**
- **Overcharging**

Can we use water on battery powered vehicles?



Considerations for a response to an electric vehicle – emerging risks working group

- If safe, remove assets surrounding the vehicle
- Beware of high temperatures, fumes, vapour cloud explosion, ground level jetting flames to 2-3m from the sides of the vehicle, danger of re-ignition, projectile possibility

- Risk of vehicle movement
- Electrolyte gas can be lighter or heavier than air. It can easily be mistaken for smoke or water vapour
- Situation can evolve from a minor to major incident very easily
- Loss of visibility in a confined space
- Specialist PPE is required for anyone approaching a fire incident. Consider implementing an exclusion zone
- Consider by risk assessment: immersion bath, fire blanket in certain suppression situations, controlled burn, water to cool
- Consider environmental protection above and below ground firewater run-off.

Responder guidance for incidents involving energy storage systems – emerging risks working group

- Evacuate the property – people first!
- Consider evacuation of neighbouring/adjoining properties

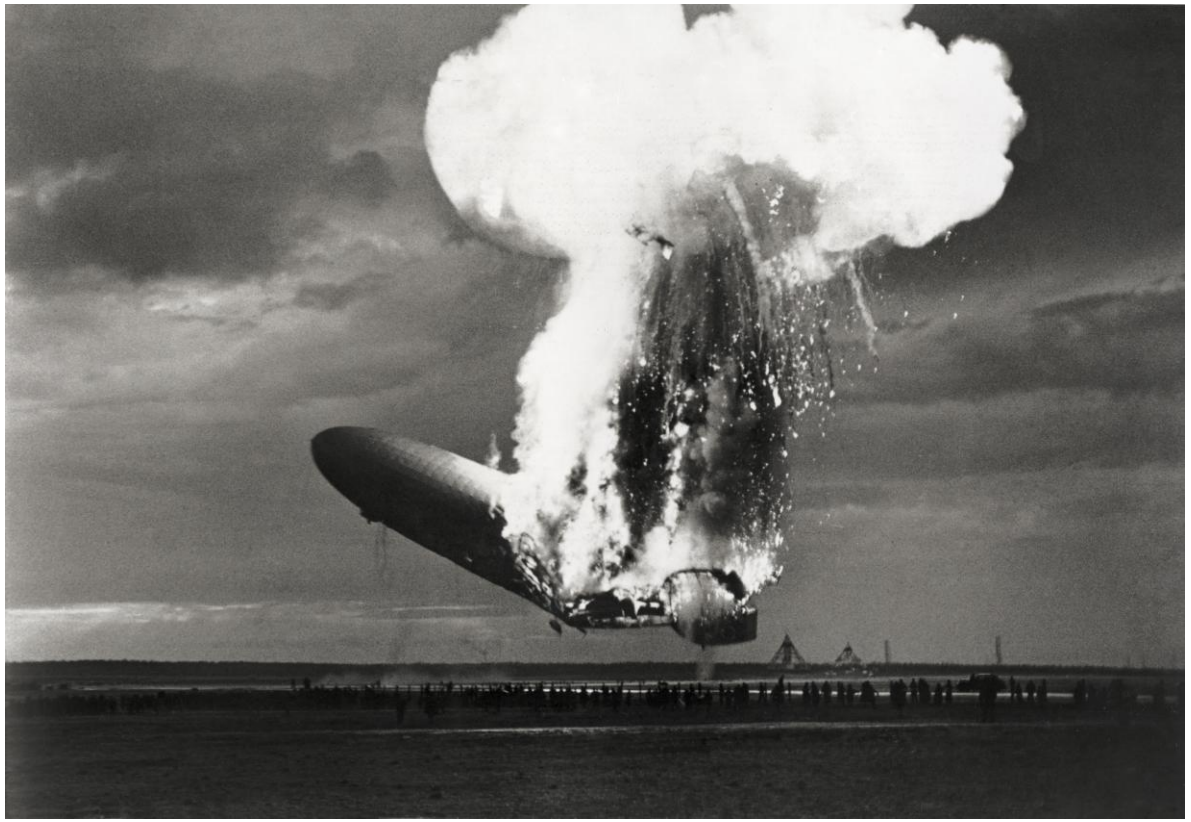
- Liaise with the responsible person or electrical contractor to gain knowledge on the type of the power installation, & how to conduct electrical isolation of the property
- Once isolated, extinguish the fire that is consequential to the battery fire but consider a controlled burn of the battery packs
- Responder to inform local network operator of the incident if connected to the grid
- Consider environmental protection.

UK Case study

Incident details

- ISO container with 800 Li-ion electric scooter batteries
- Container was filled with water, however, wasn't sufficiently watertight
- Batteries transferred to 40000 litre dam
- Batteries still gassing off 30 minutes after full submersion.

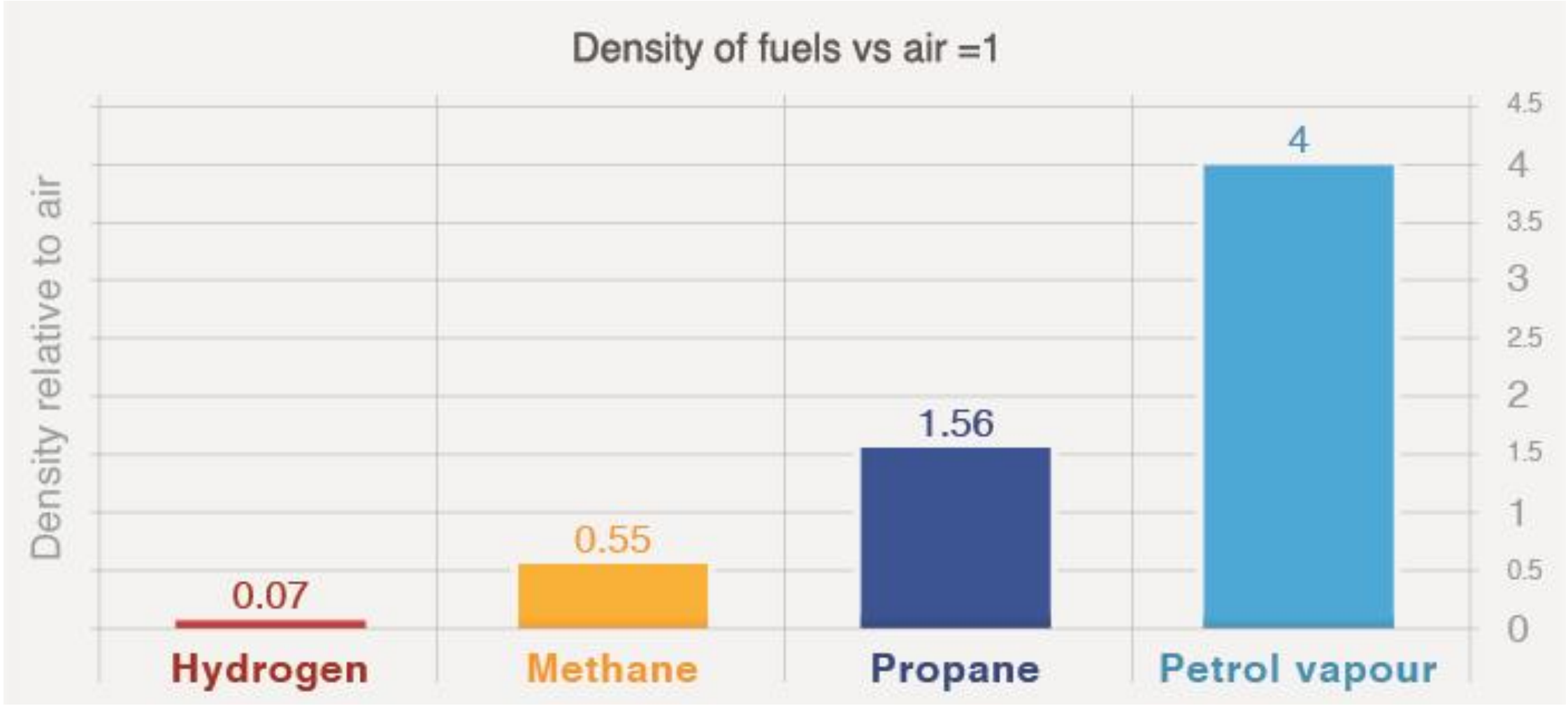
Hydrogen



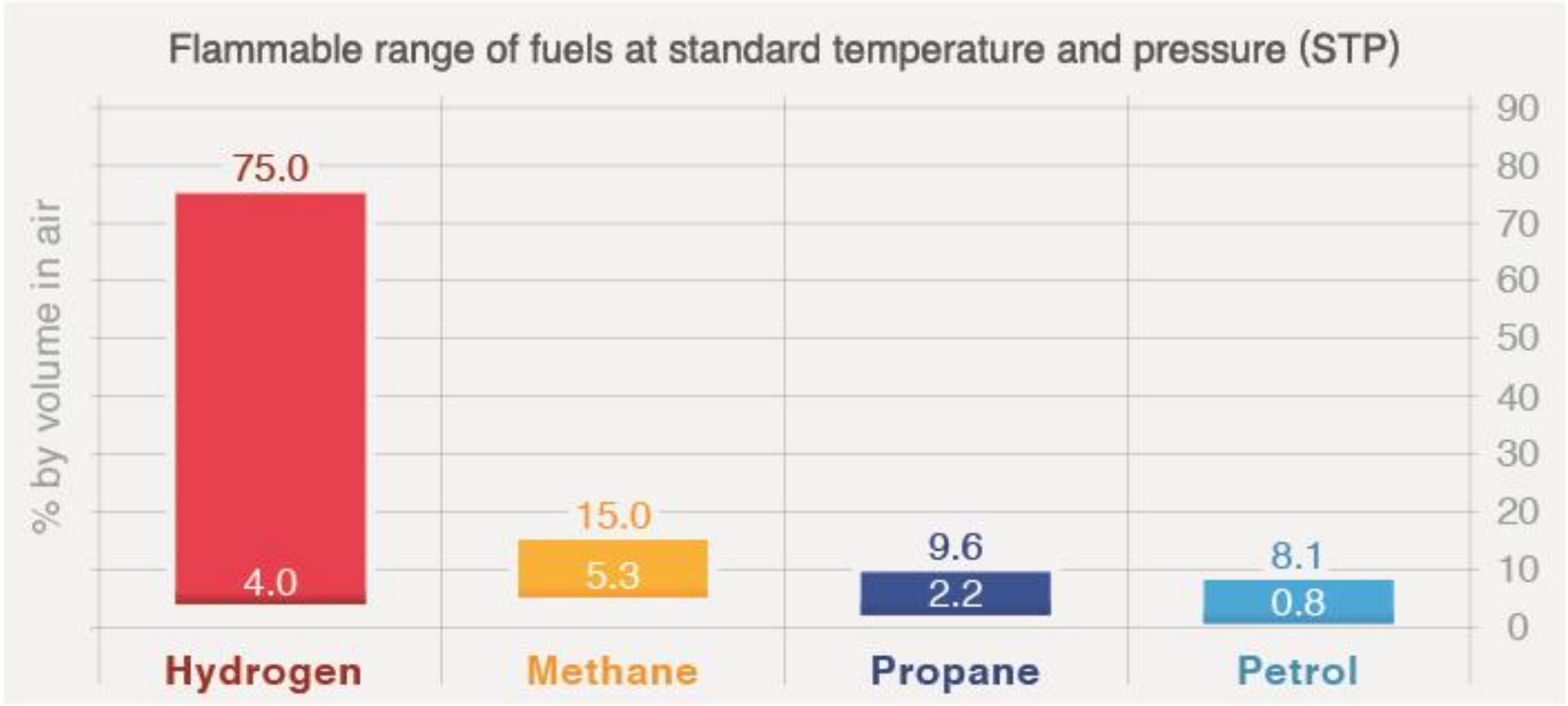
1937 Hindenburg flight from New York to Frankfurt.

- Comparison with the risks from hydrocarbon fuel types with which we've become accepting of
- Hydrogen is here to stay, and we need to develop safe working strategies to prevent incidents, and to respond safely and effectively
- 1836 – the first hydrogen fuel cell.

Relative vapour density of hydrogen

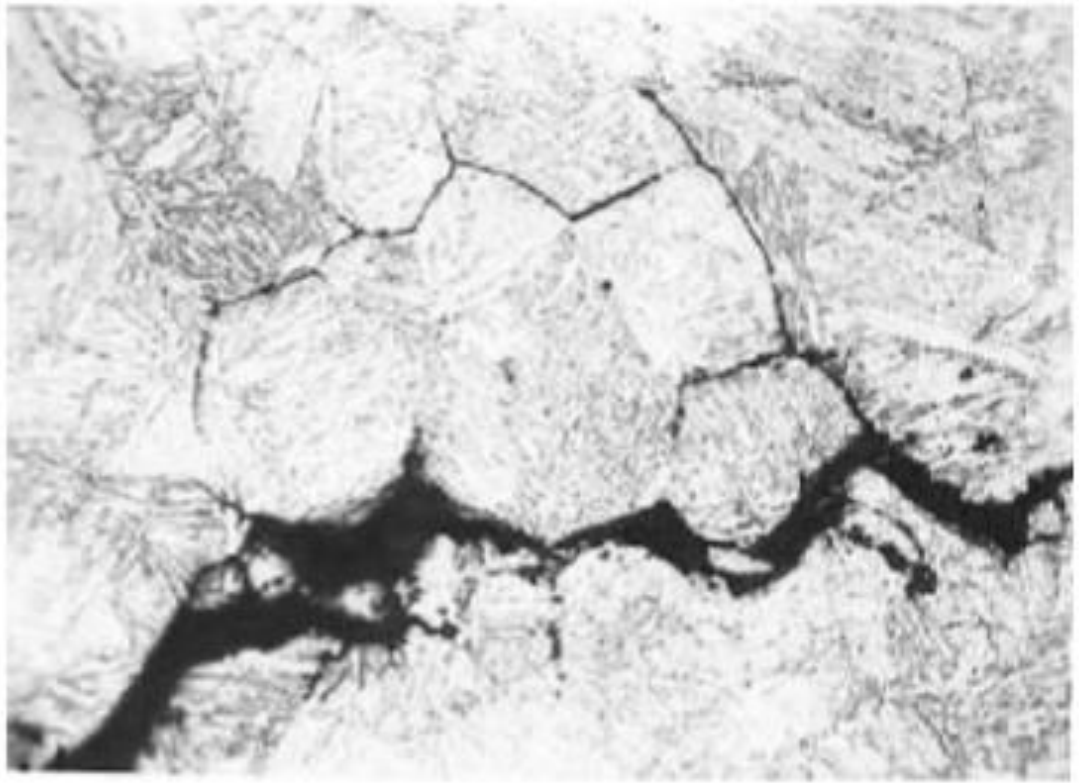


Flammable Range of Hydrogen



Use of equipment to identify a hydrogen flame

Mechanism of hydrogen embrittlement



Barthélémy, 1st ESSHS, 2006

Liquid hydrogen – properties & hazards

Properties

- 70 kg/m^3 compared to 30 kg/m^3 for gH_2 at 350 bar
- Insulated (Dewar) tanks
- Boiling point = -253 deg C
- Critical temp -240 deg C

Hazards

- Cryogenic hazard
- Oxygen enriched atmospheres
- Boil off risk
- BLEVE risk
- Purging of systems

Liquid hydrogen at atmospheric temp and pressure

Nitrogen

Physical Properties

Molecular mass:	28.01 [2]
Boiling point:	-196 C [2]
Melting point:	-210 C [2]
Relative vapour density (air=1):	0.97 [2]
Solubility in water:	poor [2]

References

[2] International Chemical Safety Cards (International Programme on Chemical Safety)

Oxygen

Physical Properties

Molecular mass:	32 [2]
Boiling point:	-183 C [2]
Melting point:	-218.4 C [2]
Relative vapour density (air=1):	1.1 [2]
Vapour pressure at temperature:	5080 kPa at -118 C [2]
Solubility in water:	3.1 ml/100 ml at 20 C [2]
Octanol/water partition coefficient as log Pow:	0.65 [2]

References

[2] International Chemical Safety Cards (International Programme on Chemical Safety)

Hydrogen has a boiling point of -253 C. So, what does this mean when we have a leak of liquid hydrogen?

Pre-incident considerations

- Consider safety at the design phase, not upon commissioning of installation
- Suitable and sufficient maintenance and testing regimes are critical
- Training of personnel & response teams, inc exercising of key stakeholders
- Consider those who may come to support during response phase such as fire service
- Consider legislation around systems – ATEX rated equipment, DSEAR
- Establish worst case scenario and develop suitable plans – and communicate them.

What can we do to ensure a safe and effective response to such incidents?

- Ensure an ‘all hazards’ approach – don’t rush in
- Situational awareness
- Resource requirements
- Ensure an understanding of safety systems i.e., allowing product to burn off instead of creating a flammable atmosphere
- Understand when safety systems are operating effectively
- Ventilation and isolation of ignition sources
- Geographical factors which impact incident
- Communication and collaboration are key to a successful outcome.

Planning & implementing a structured response to incidents

8 phases approach to managing hazardous materials incidents

1. Pre-planning & risk awareness
2. Mobilisation and safe approach
3. Arrival at the scene
4. Tactical planning
5. Implementing the plan
6. Development of the scene
7. Closing down and handover
8. Post incident considerations.

Any questions?

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		First issue.

