



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

Lessons learnt from safety-related events involving hydrogen storage

Online workshop on
Safe Storage of Compressed Gas Hydrogen
in road transport applications
and related infrastructure

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Workshop on Safe Storage of Hydrogen



HIAD 2.0 (593 validated and public available events)

HIAD 2.0 DATA COLLECTION



- HIAD (273 initial cases)
- ARIA
- eMARS
- MHIDAS
- CBS news
- Occupational Safety and Health Administration
- National Transportation Safety Board
- National nuclear authorities
- RISCAD

DATA
PROCESSING

EVENT
VALIDATION AND
PUBLISHING

STATISTICAL ANALYSIS

LESSONS LEARNT

RECOMMENDATIONS

REPORTING

PUBLISHING AND
DISSEMINATION

JRC

EHSP

FCH 2 JU



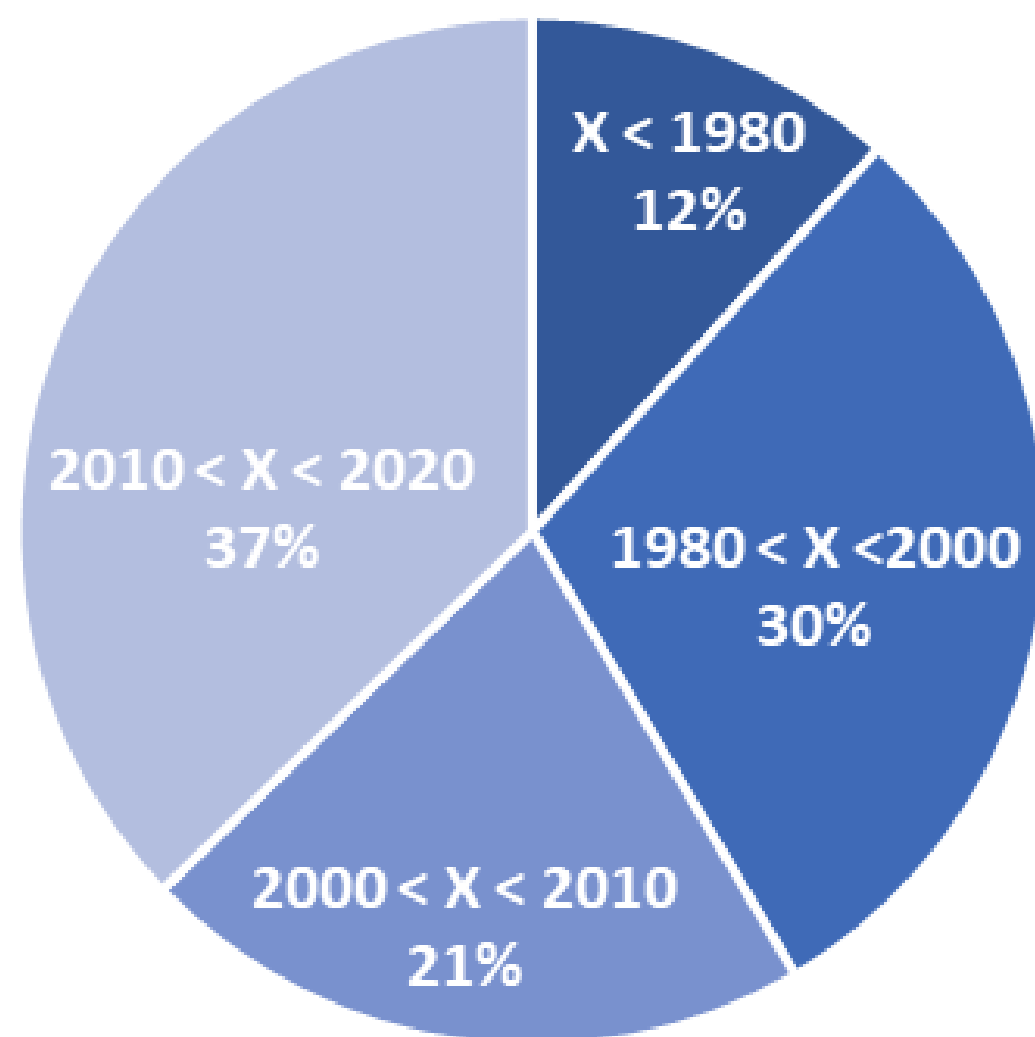
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Workshop on Safe Storage of Hydrogen

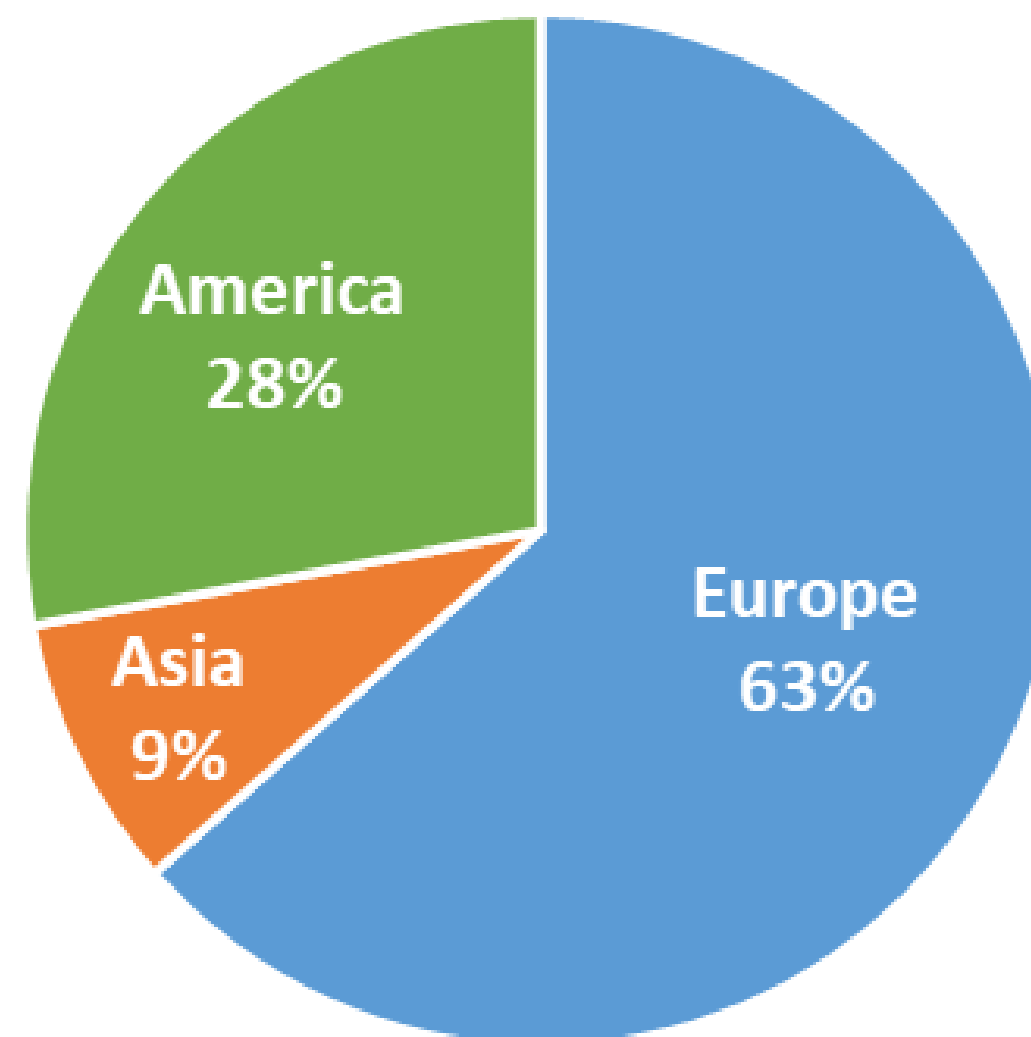


Events related to hydrogen storage (95 events)

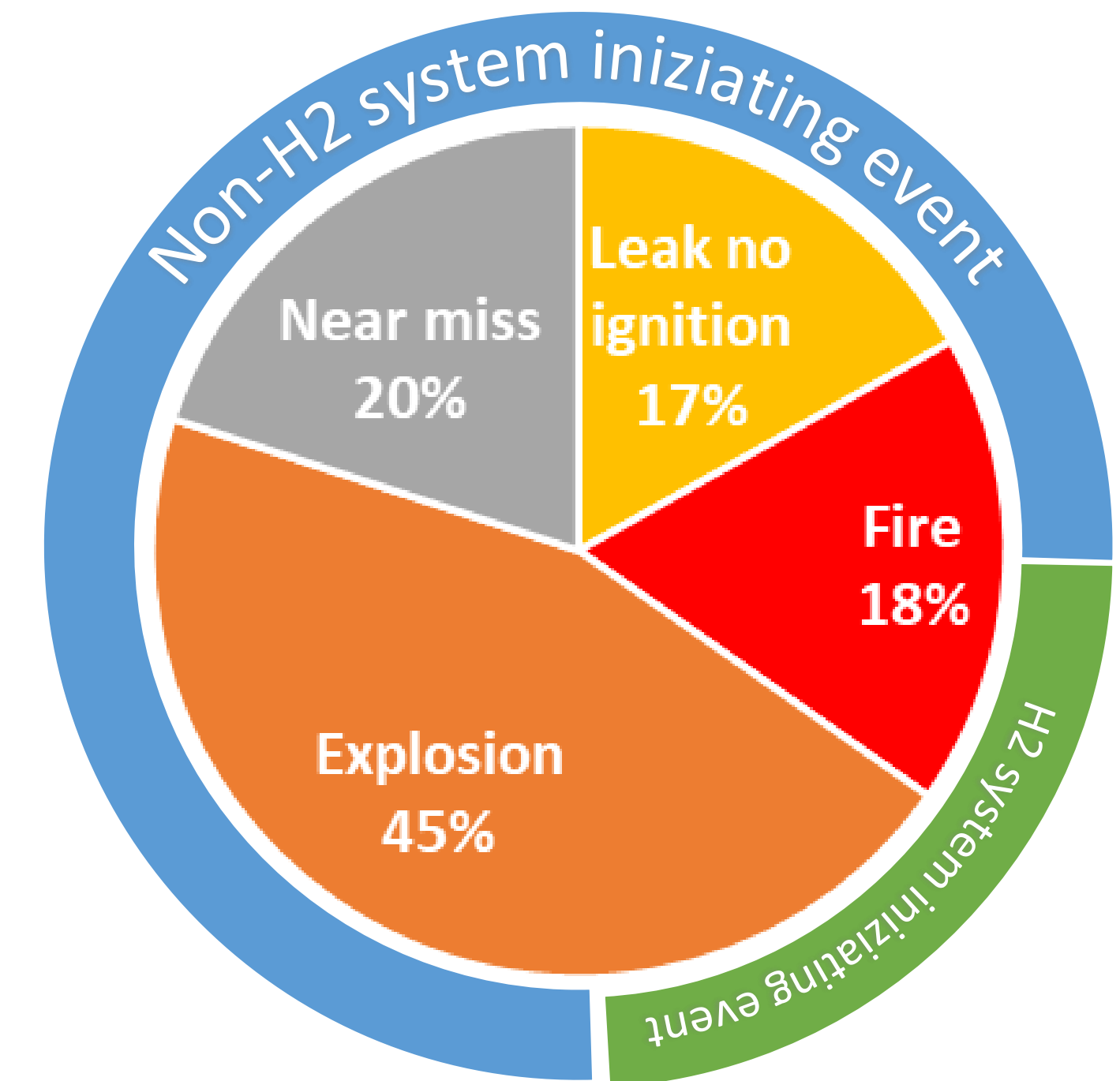
YEAR



REGION



NATURE OF EVENT

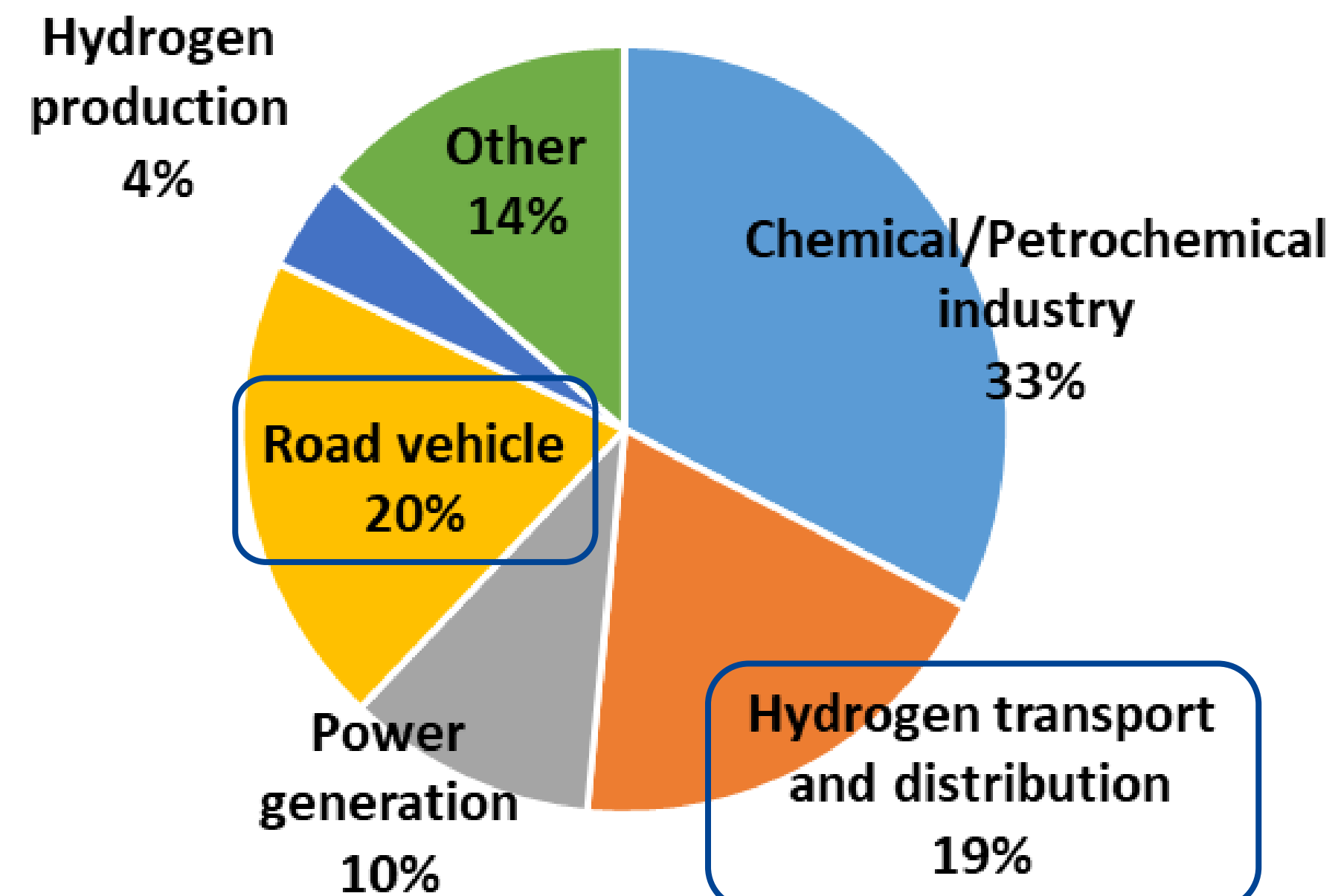


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APPLICATION STAGE



Road vehicle (19 events)

- Incidents involving mainly FCE buses (near misses)
- 1 car incident (with explosion): H2 tube trailer involved
- 1 Hydrogen leak on a fuel cells bus (in confined space)

Hydrogen transport and distribution

- Number of cases: 18
 - ✓ Tube trailers 9
 - ✓ Fuelling station 3
 - ✓ Hydrogen storage 6

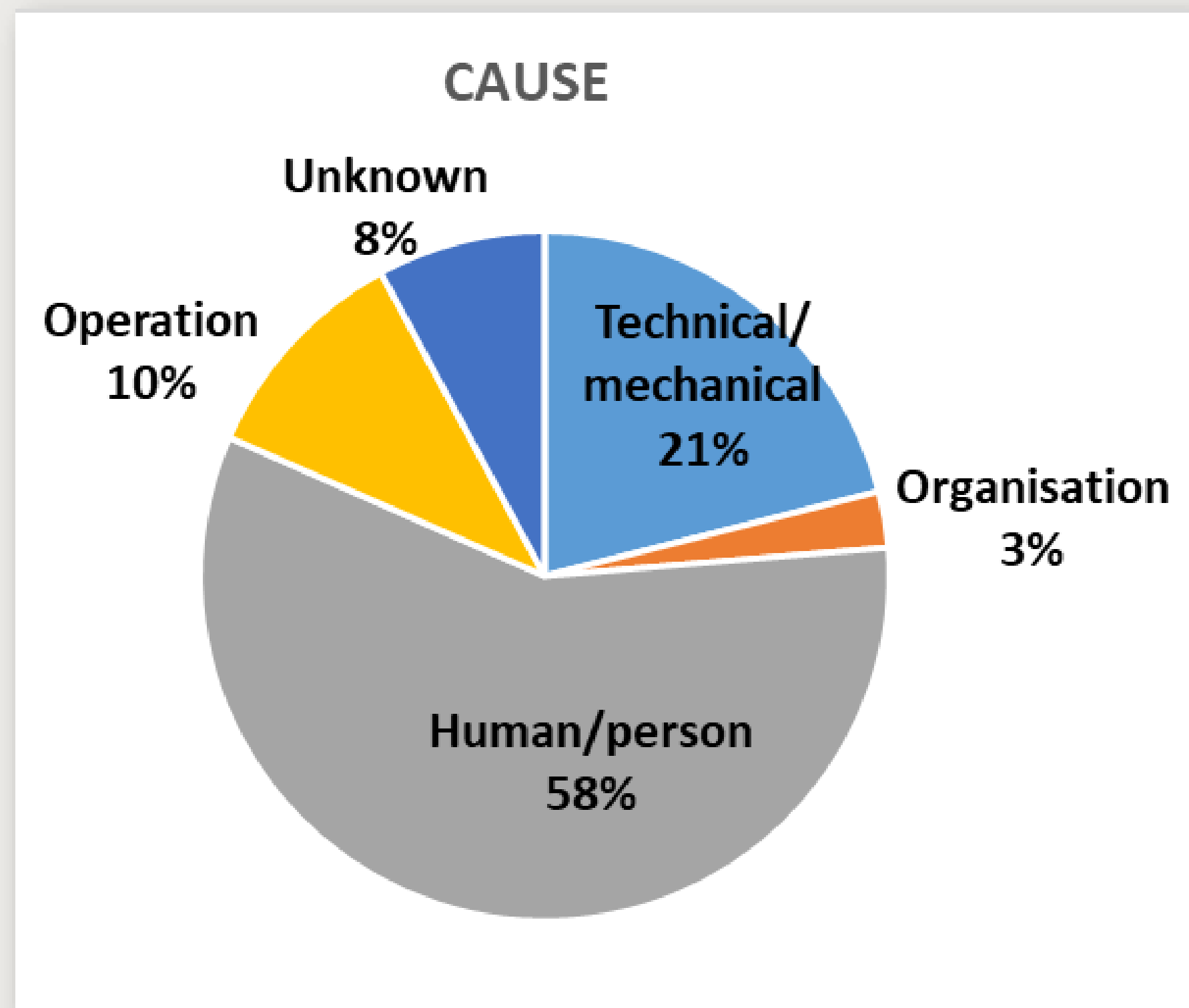


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Hydrogen transport and distribution & Road vehicle (38 events)



Main causes (not including near misses)

- Poor maintenance and inspection
- Maintenance procedure not followed
- Need to update communications plans and training program
- Not adequate design or/and material selection
- Not adequate preventing measures



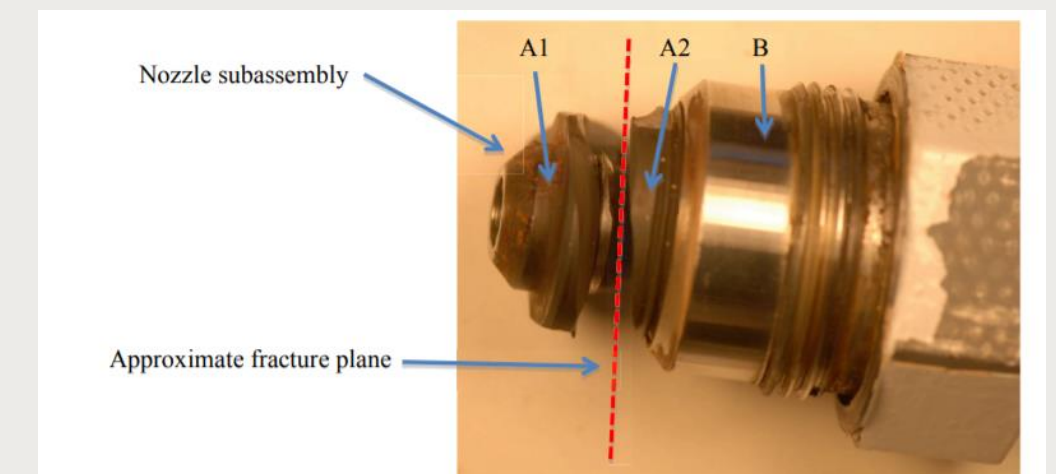
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Fueling station at the Emeryville AC Transit facility (04/05/2012)

- A pressure relief valve failed causing the release of approximately 300 kg (30 kg in the first minute)
- This rapid release of hydrogen mixed with air in the vent tube, this mixture subsequently ignited producing explosion



Bus fire in the garage in Doetinchem

- The cause of the fire is not known and is still under investigation



Explosion at HRS (Norway, 2019)

- ~3Kg of H₂ released
- Human error during assembly. The two bolts were screwed in place by hand, but not tightened



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Conclusions (based on HIAD, H2Tools, HELLEN and expert advice)

Road vehicle

- Main causes: human/person
- Flexible and mobile connections are used, mostly operated by hands, thus requiring careful training and instructions
- Probably the safety design has in first instance focussed on the safety of the stand-alone system and not interconnected to each-others
- The transfer requires perfect interoperability (i.e. the fitting must work perfectly on both side of the transfer)

EHSP

- Actions required to prevent an escalation of a prototypical hydrogen accident (https://www.fch.europa.eu/sites/default/files/Safety_Planning_for_Hydrogen_and_Fuel_Cell_Projects_Release1p31_20190705.pdf)

- **Reminder to all FCH JU Projects: report to HELLEN**





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For futher information

www.fch.europa.eu
www.hydrogeneurope.eu
www.nerghy.eu



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