

European Hydrogen Emergency Response training programme for First Responders



# HyResponse Operational training platform

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International workshop on Hydrogen Safety Training for First Responders  
3<sup>rd</sup> of September 2014, Aix en Provence (France)



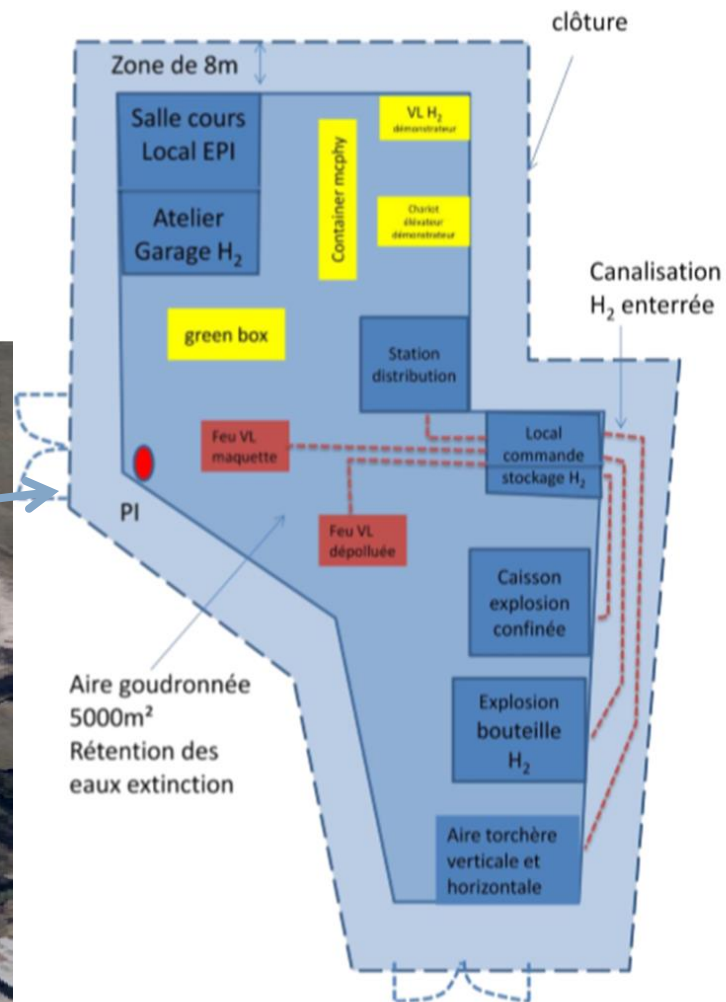
# HyResponse: key objectives



- To develop a comprehensive training for First Responders dealing with all safety aspects of H<sub>2</sub> transport and stationary applications
  - An educational training including hazard and risks from H<sub>2</sub> applications
  - An operational-level training on mock-up real scale transport and stationary installations
  - A virtual reality training exercises reproducing entire accident scenarios
- Organize three pilot sessions to train 50 FR in a face to face mode to test and get feedback regarding the developed training
- Deliver an Emergency Response Guide
- Disseminate and perpetuate FR training to facilitate permitting process and social acceptance of hydrogen-energy technologies



# Operational training facility



# Operational training facility



- Small Hydrogen and Fuel Cell Didactic system
  - to illustrate, teach and train First Responders regarding fuel cell technologies
- Hydrogen behavior platform
  - Comparison of H<sub>2</sub> behavior with CH<sub>4</sub>, butane, propane
    - Thermal and pressure effects
    - Noise
    - Personal feeling (visibility, noise, smell)
  - Hydrogen phenomena
    - Releases and jet fire,
    - vented explosions,
    - Fire tests of pressurized small tanks,
    - Bonfire tests,
    - etc.
- Intervention Training Platforms



# Hydrogen behavior Platform



# High pressure releases and jet fires

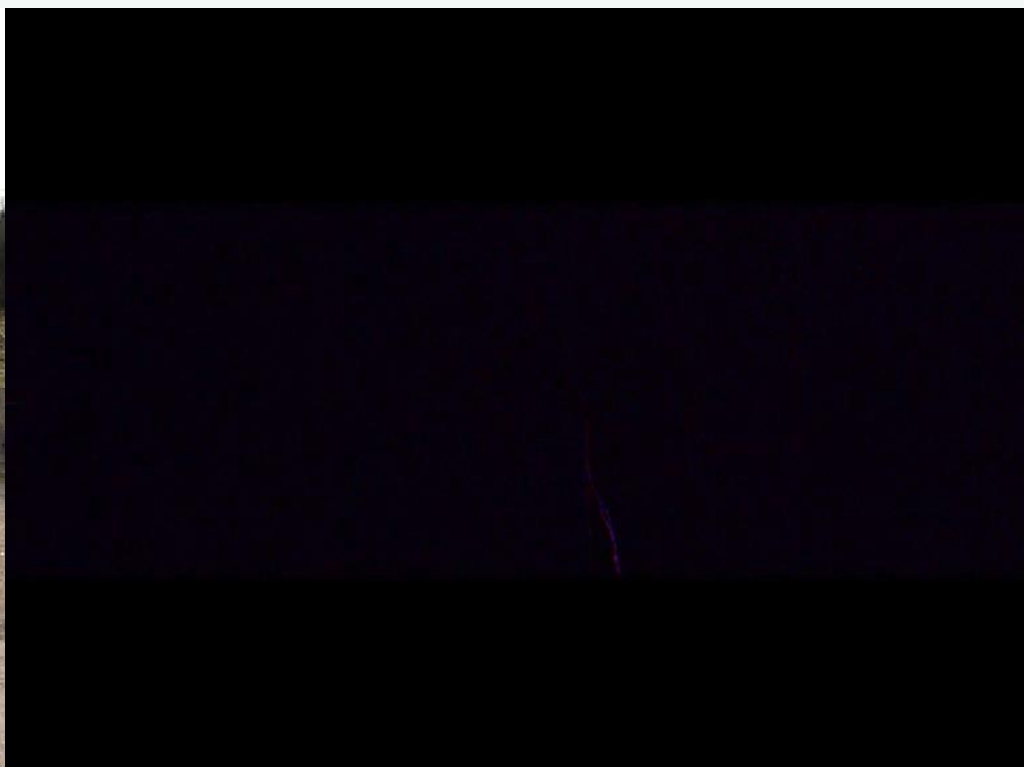


- Perform and compare  $H_2$  and  $CH_4$  high pressure releases and ignition
  - Noise
  - Flame visibility and length
  - Measure the length of the flames
  - Thermal and pressure thermal camera
- Firefighting approach exercises

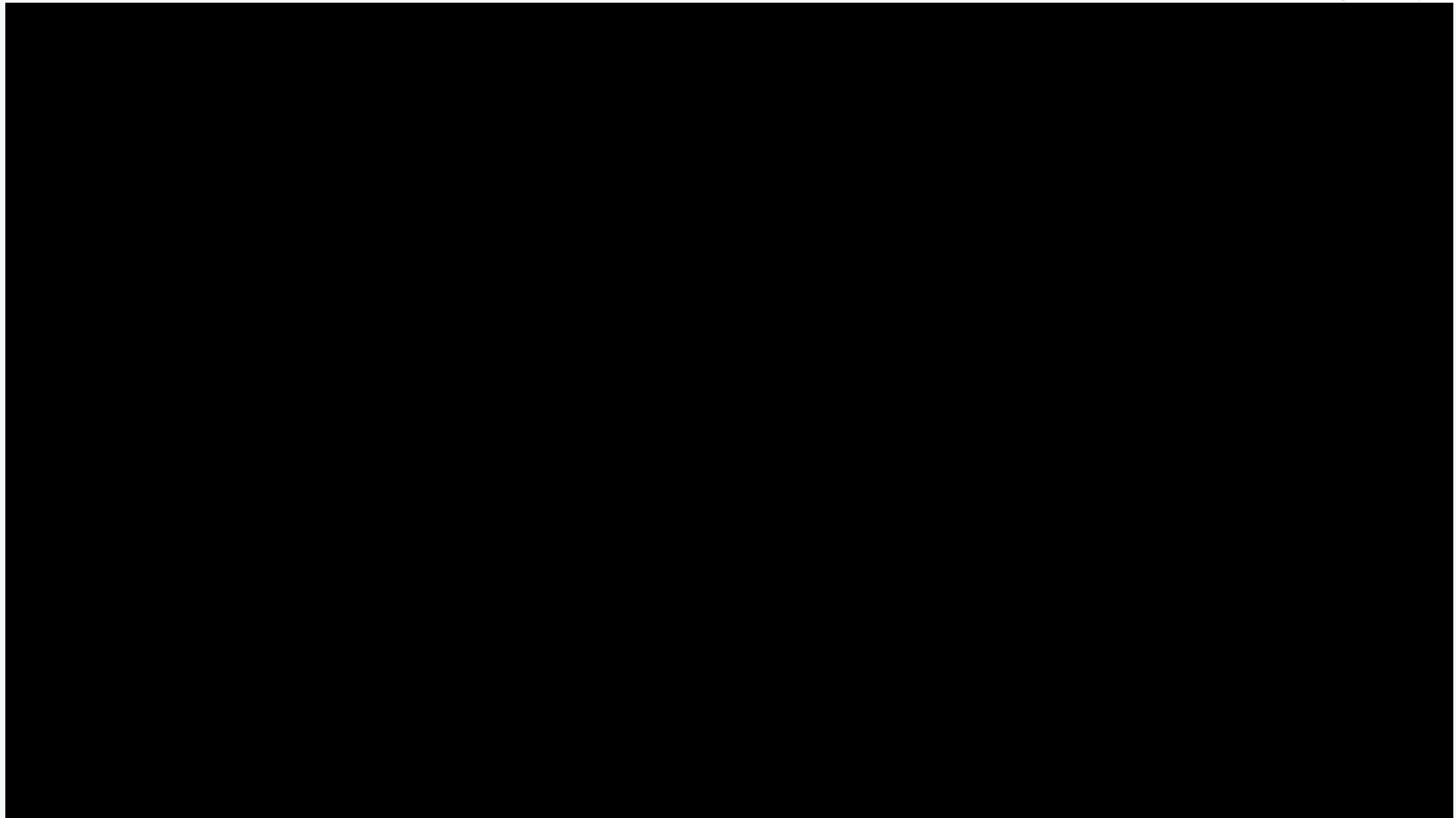




# Hydrogen releases and jet fires



# Firefighting approach exercises





# Vented explosion



- Build a small explosion box with a vent
- Perform and compare  $\text{H}_2$ -air and  $\text{CH}_4$ -air explosions at different mixture concentrations



# Vented explosion



10.5 % H<sub>2</sub> (vol.)



16.5 % H<sub>2</sub> (vol.)



21.1 % H<sub>2</sub> (vol.)



28.7 % H<sub>2</sub> (vol.)

# Fire tests of pressurized bottles



Perform and compare fire tests of  $H_2$ ,  $CH_4$ , butane small pressurized bottles





# Bonfire tests



To perform and compare bonfire tests of GNV, GPL, H2 reservoirs equipped with TPRD



# HyResponse Intervention Training Platforms

# H<sub>2</sub> gas storage



Understanding of the systems  
Awareness of the risks  
Viewing security organs

Perform intervention  
exercises

Surface : 10m<sup>2</sup>



# H<sub>2</sub>-based energy storage



Understanding of the  
system  
Awareness of the risks  
Viewing security organs

Perform intervention  
exercises

Surface : 30m<sup>2</sup>





# Mock FC forklift and warehouse refuelling station



Understanding of the system  
Awareness of the risks  
Viewing security organs

Perform intervention  
exercises

Surface : 50m<sup>2</sup>



# Mock FC vehicles and refuelling station



Understanding of the system  
Awareness of the risks  
Viewing security organs

Perform intervention  
exercises  
Check and validate FC car  
manufacturer intervention  
procedures

Surface : 50m<sup>2</sup>



# FC Vehicle fire training platform



Mock up car for fire attack  
from different positions

Check and validate FC car  
manufacturer intervention  
procedures



Extrication exercises on mock  
FC vehicles



# Garage training platform



Training exercises of car fires in a confined environment such as a garage



Training exercises Fire Workshop simulated using propane hot spot



# HyResponse Training platform - Conclusions



- European Hydrogen Training Platform with
  - Fuel Cell and Hydrogen didactic system
  - Hydrogen behavior platforms
  - Mock-up real scale transport and hydrogen stationary installations
- European Emergency Response Guide (operational and virtual training)
- Funding for training 50 European First Responders during 3 training sessions in a face to face mode of one week duration
- Website:
  - Free access to teaching materials and videos of H2 behavior, training exercises
  - Access to the European Emergency Response Guide
  - Links to European First Responders community

