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HyResponse

# European Hydrogen Safety Training programme for First Responders: HyResponse outcomes and perspectives

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# Motivation

- Transport and stationary FCH technologies in-deployment
- Fire Authorities' awareness and knowledge about these new technologies is limited
- Any mishandling or inappropriate interventions could affect FCH deployment and generate a negative impact on social acceptance of hydrogen technologies
- Therefore, First Responders must be trained adequately to know how to handle potential incidents to protect public without putting in jeopardy their own life

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# HyResponse at a glance

- HyResponse is a Coordination and Support Action project supported by the FCH JU
- Starting date: 12/06/2013
- Ending date: 30/09/2016
- Project duration: 3 years
- FCH JU contribution: 1 857 897 €
- Project coordinator: ENSOSP
- Consortium :

ENSOSP
AREVA forward-looking energy
University of ULSTER
AIR LIQUIDE ADVANCED BUSINESS & TECHNOLOGIES
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# What has been done in the last three years ?

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# Educational training program

- International Curriculum on hydrogen safety training for First Responders (FRs)
- State-of-the-art in hydrogen safety science and engineering and develop science-informed training materials dedicated to FRs
  - 11 lectures e.g. FCH applications, hydrogen properties, release, fire, explosions, protection and mitigation techniques, etc.
- RCS-informed training materials (Regulation, Codes and Standards)
  - Provide First Responders up-to-date RCS knowledge related to FCH technologies
- Intervention strategy and tactics for assessing accident scene status and decision making
  - FC stationary installations, hydrogen refuelling stations and storage installations, and FC vehicles

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# Operational training facility

- 2500 m² platform
- More than 109 scenarios
- Fuel comparison
  - H2 (700, 350, 200 bar)
  - CNG (200 bar)
  - LPG (20 bar)

# Operational training exercises

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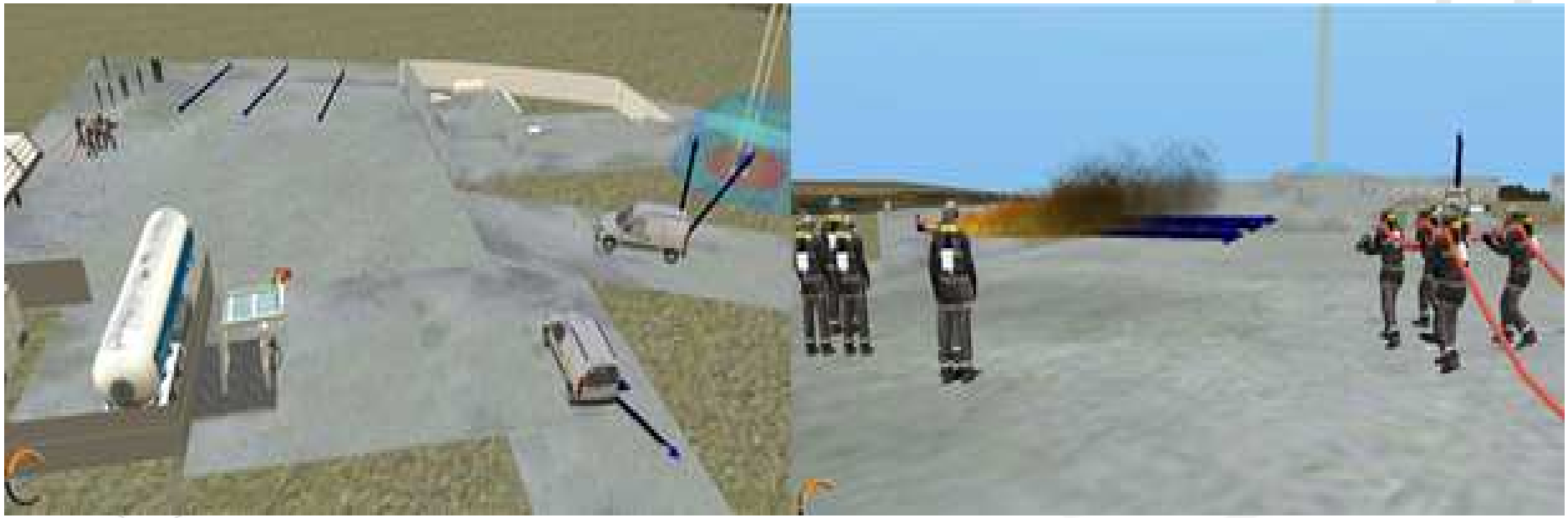
# Virtual Reality (VR) training platform (1/5)

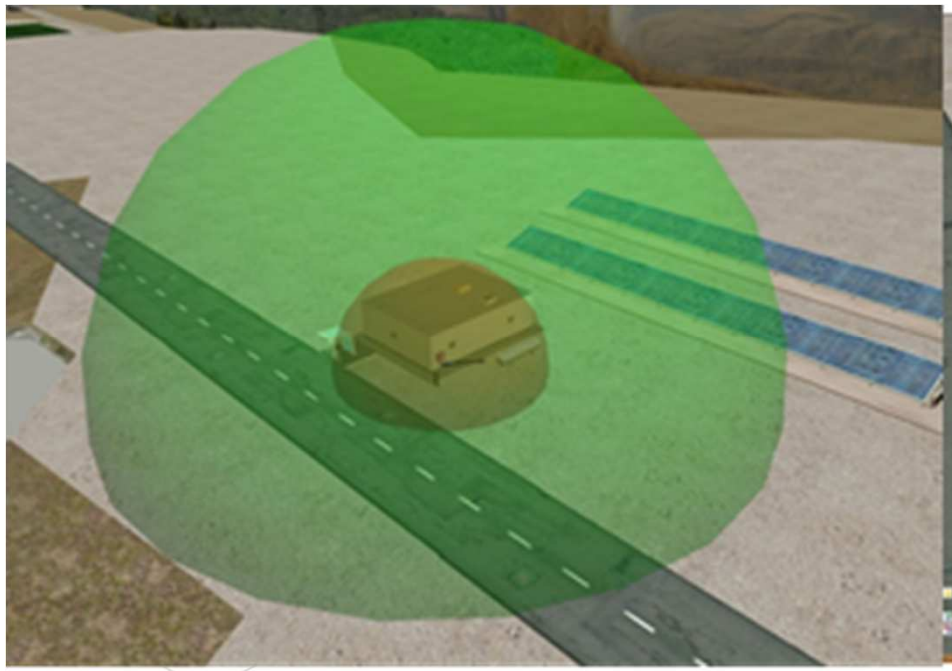
VR tool were used in many different ways :

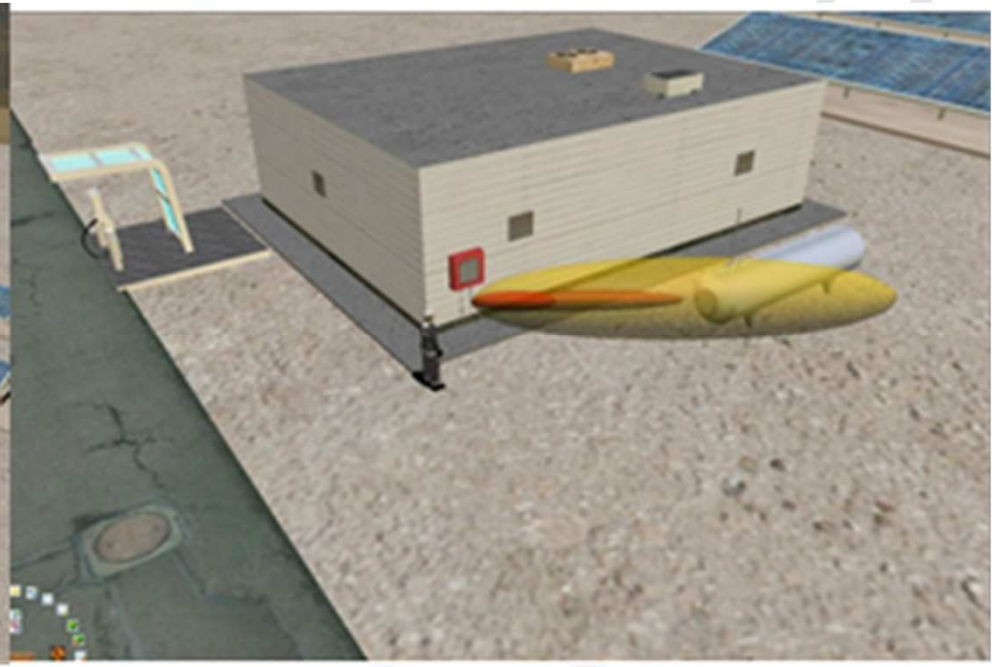
- Presentation of the operational platform and safety briefing  prior to training exercises



# Virtual Reality training platform (2/5)

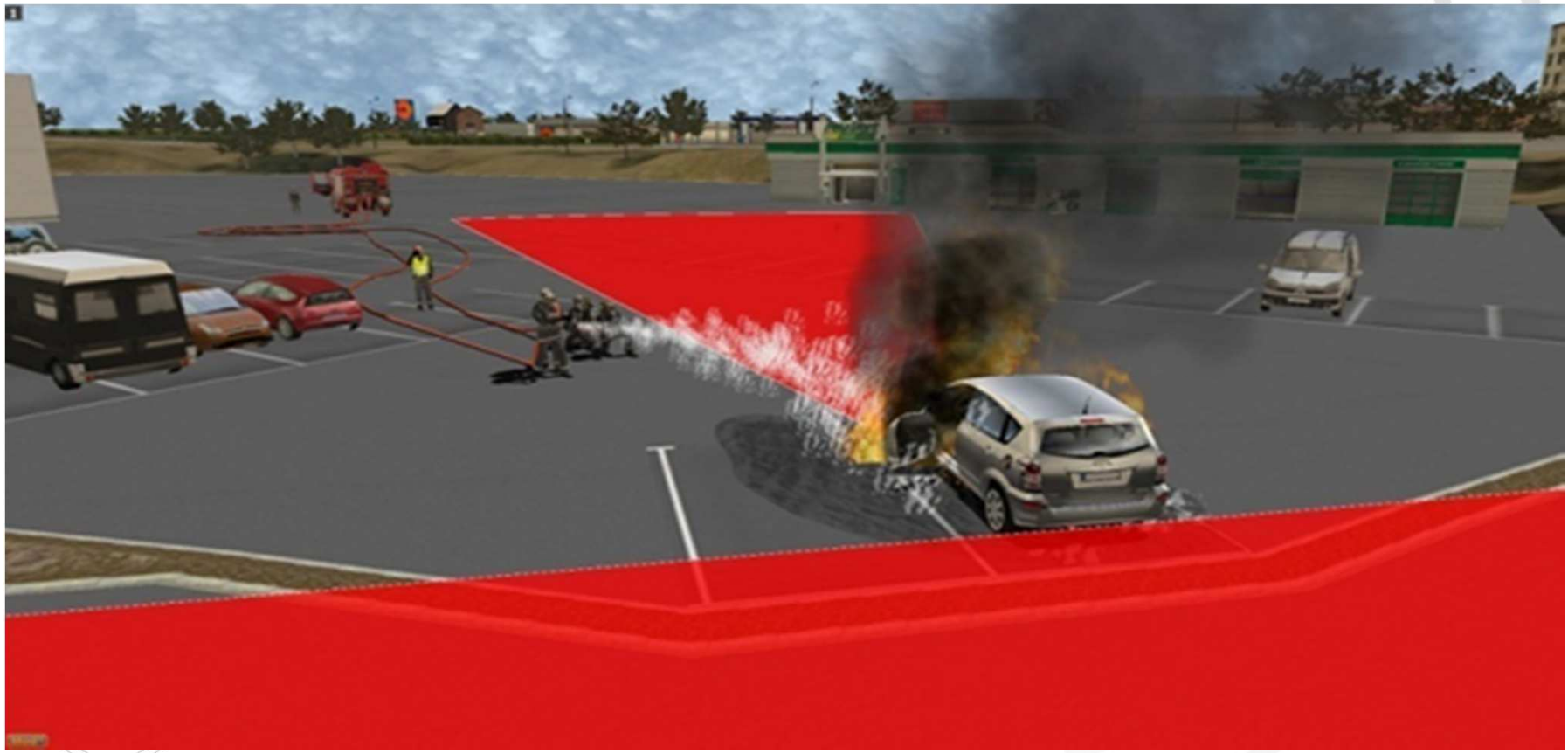
- Illustration, visualization and understanding physics and chemistry
  - E.g. sound, blast overpressure, separation distance, heat patterns, etc.





# Virtual Reality training platform (3/5)

- Tactical and operational explanation prior to real exercises on the operational platform



# Virtual Reality training platform (4/5)

- VR group exercises with different applications and environments :
  - For each exercise, a group of trainees to provide: situation briefing, stake assessment, strategy and the tactics to undertake

# Virtual Reality training platform (5/5)

- Interactive trans-border VR exercise :
  - To test the coordination between two countries
  - From first responders to command officers, cr took part in the scenario and
  - Media report to be prepared by each team at the end of the exercise

# Face-to-face training sessions

- 3 training sessions in 2016
- **71 trainees from 15 countries**
  - Germany, Austria, Belgium, Croatia, Spain, USA, France, Italy, Norway, Netherland, Poland, Portugal, UK, Sweden, Czeck Republic
- **21 Observers from 10 countries**
  - Germany, Belgium, Denmark, Spain, France, Netherland, Portugal, USA, Japan, Taïwan
- **15 instructors or lecturers**
- Advisory board:
  - Commission "Extrication and New Technologie" of the International Association of Fire and Rescue Services (CTIF)
  - Toyota

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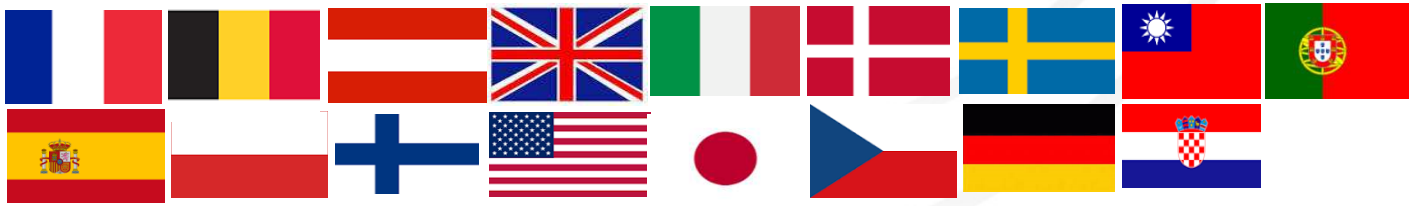

# Face-to-face training sessions

| | Monday | Tuesday | Wednesday | Thusday | Friday |
|---|---|---|---|---|---|
| 8h00-9h45 | FCH application and safety | Safety of storage | Harm and damage criteria | Hazards of H2 use indoors | Ignition sources and prevention |
| | Hydrogen properties | Methodology and response guide | Unignited H2 releases and their mitigation | Dealing with hydrogen explosions | Motorway accident involving a H2 trailer and hazmat truck |
| 10h15-12h00 | H2 fires | FC vehicles (car, bus, forlift, etc.) | Refuelling stations, storage and FC systems | Stationary and mobile applications | |
| | RCS for First Responders | | | | |
| 12h00-14h00 | Lunch | | | | |
| 14h00-15h30 | VR tour for presentation of the operational platform | Multi-vehicle accident - FC car in a fire | H2 leak at a refuelling station | Multi-vehicle accident - H2 jet fire from H2 trailer | |
| | CNG and H2 explosions at various concentrations | Multi-vehicle accident – CNG/LPG car in a fire | FC system default - H2 leak | H2 leak from storage – urban refuelling station | |
| 16h00-17h30 | H2, CNG, LPG jet fires | FC bus in a fire on a small road | FC car in a fire at a refuelling station | Urban accident - FC bus in a fire - urban environment | |
| | Firefighting exercises | Forklift in a fire inside a warehouse | H2 jet fire from industrial storage | Fire in an industrial environment with FC system | |
| 17h30-18h00 | Debrief | Debrief | Debrief | Debrief | |

# Networking!!

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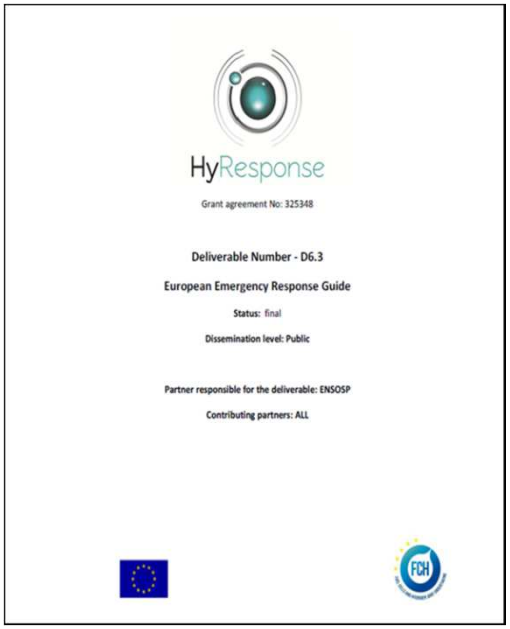
# European Emergency Response Guide covering transport and stationary FCH applications

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- For decision-making for emergency response personnel, both by front-liners and commanders
- "Tactical sheets" for each transport and stationary FCH application and generic accidental situations
  - For each situation, a step- by- step sequence proposed i.e. recognition, rescue, preparedness, incident settlement, protection, clear out, overhaul.
  - For each step, key questions and information are proposed to tackle the incident/accidental scene
- H2 intervention strategies and tactics is a mix of standard operation procedures for flammable gases incidents and electricity powered applications
- Stack assessment to reduce firefighters and public exposures
- Improved knowledge in H2 behaviour allows a relevant stake assessment and an appropriate tactic choice

# What’s next?

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# Perspectives

- Enlarge a portfolio of hydrogen safety trainings
  - Different population (operators/firefighters), different levels (first responders/high-rank officers), different training duration (2 days/1 week)
- Pursue Hydrogen safety trainings for first responders
  - ENSOSP organizes a training session from the 27th to the 1th of December, Aix En Provence, France
- "Train the trainer" to further develop and empower relevant international, national and regional efforts and collaboration.
  - Educate a first and second responders and hazmat officer **instructors**, **becoming** responsible ambassadors to establish national hydrogen safety training programs based on HyResponse's outcomes and using the operational training facility and the novel virtual reality training platforms

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# Conclusions

- Comprehensive training for First Responders dealing with all safety aspects of **FCH transport and stationary** applications:
  - Educational training
  - Operational training
  - Virtual reality training
- 71 trainees from 15 countries, 21 observers from 10 countries and 15 instructors or lecturers
- European Emergency Response Guide
- HyResponse website for free access to teaching materials, vidéos, photos, European Emergency Response Guide, Links to European First Responders community
- ENSOSP organizes a training session from the 27$^{th}$ to the 1$^{th}$ of December, Aix En Provence, France
- "Train the trainer" programme to widespread HyResponse outcomes to first and second responders and hazmat officer instructors, responsible to establish national hydrogen safety training programs using their own country's language

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# Thank you for your attention

http://www.hyresponse.eu/

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