

# Managing risks in explosive gases: best practices and experiences

TransH2 | GIVE Assogastecnici - Federchimica |

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Workshop:

**“Challenges and Opportunities from Hydrogen  
for Cross-Border Maritime Mobility”**

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<https://www.italy-croatia.eu/web/transh2>

## Gruppo Idrogeno Vettore Energetico - GIVE

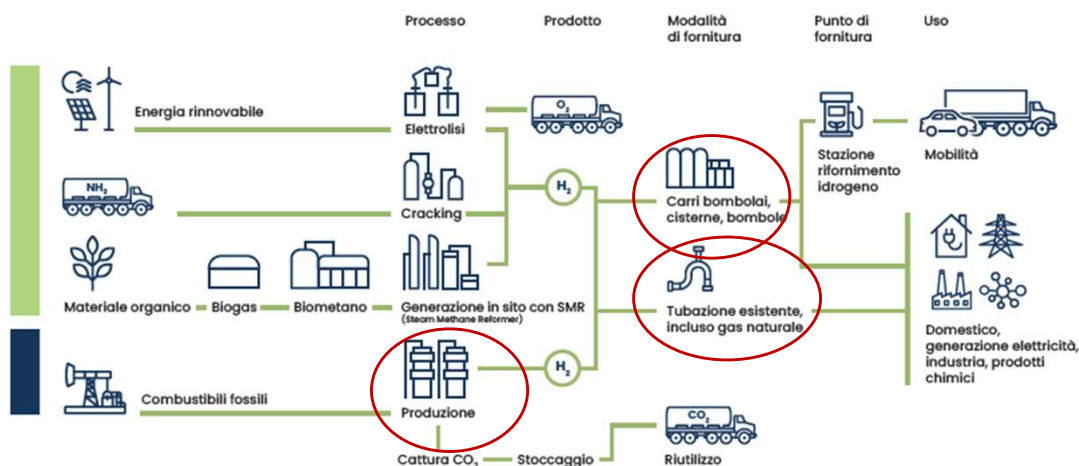
**Assogastecnici**, which is part of **Federchimica**, is the industry Association representing Italian Manufacturers of Technical, Special and Medicinal Gases. It is also part of Assogastecnici is part of **EIGA** (European Industrial Gases Association), where the main technical guides for industry safety are developed



FEDERCHIMICA  
ASSOGASTECNICI  
GRUPPO IDROGENO VETTORE  
ENERGETICO



## Gruppo Idrogeno Vettore Energetico - GIVE



**Production:** 280,365 thousand cubic meters

**Distribution:** over 250 tank wagons

GIVE's technical gas companies are **leaders** in the management of hydrogen according to the most advanced **safety standards**, from production to distribution, to end users. They have been operating in the hydrogen sector for **over a century**, with **unique skills** in the Italian context.

## Hydrogen

- Hydrogen is a **colourless, odourless, nontoxic** chemical element
- It is the **least dense** of all gases → rapid diffusion
- Hydrogen is **not significantly reactive**. Hydrogen is not corrosive but depending on temperature, pressure and other conditions it can cause embrittlement of certain steels.
- It has a **wide range of flammability** → flammable at most concentrations (in air at typical ambient conditions from 4% to 74.5%) and minimum required energy of ignition is very low



# Hydrogen and Flammability

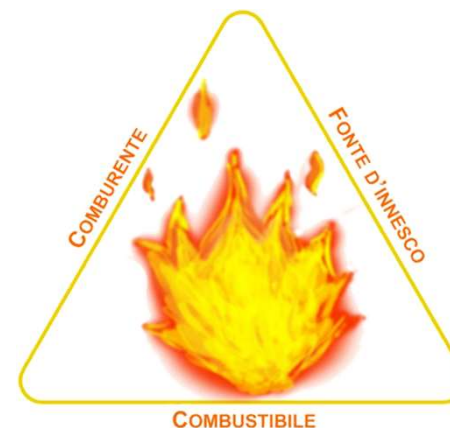
Campo di infiammabilità ampio, ma LFL alto

Combustibili	LFL % vol in aria	UFL % vol in aria
Idrogeno	4.0	75.0
Metano	4.4	17.0
Propano	1.7	10.9
Benzina (vapori)	1.0	6.0

LFL: limite inferiore di infiammabilità

UFL: limite superiore di infiammabilità

Fonte: ISO 15916 Elementi base di sicurezza per i sistemi ad idrogeno



- Bassa energia di ignizione ad alte concentrazioni

H<sub>2</sub> e CH<sub>4</sub> hanno energia di ignizione comparabile a concentrazioni inferiori al 10%

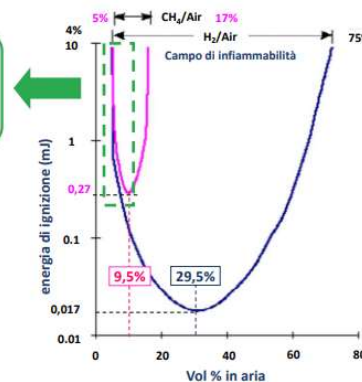




Figure 8: Example of placarding for Gaseous Compressed H<sub>2</sub>  
23: Hazard identification: Flammable Gas  
1049 : Hydrogen, compressed

## Safety Requirements

- For flammable products, all equipment complies with the European **ATEX Directive**
- Equipment shall be designed, constructed and installed in accordance with **appropriate local and national codes**.
- To identify the hazards, all 'packages' (vessels, tanks, containers, receptacles etc.) containing hazardous and dangerous goods are **labelled correctly** on the outside in accordance with the **respective regulation** (ADR, RID or IMDG).







Table 1 – Typical minimum horizontal safety distances for hydrogen stations

Typical type of outdoor exposure	Distance in metres of hydrogen from
1. Open flames and other ignition sources (incl. electrical)	5
2. Site boundary and areas where people are likely to congregate such as car parks, canteens, etc.	8
3. Wooden buildings or structures	8
4. Wall opening in offices, workshops, etc.	5
5. Bulk flammable liquids and LPG storage above ground in accordance with national codes, where they exist, for the particular substance. Otherwise	8
6. Bulk flammable liquid and LPG below ground	
6.1 Tank (horizontal distance from shell)	3
6.2 Vent or connections	5
7. Flammable gas cylinder storage, other than hydrogen	5
8. Gaseous oxygen storage (cylinders)	5
9. Liquid oxygen storage (not greater than 125 000 litre tank capacity) <sup>2)</sup>	8 <sup>1)</sup>
10. Non-flammable cryogenic liquid storage, other than oxygen, for example argon, nitrogen <sup>1)</sup>	5 <sup>1)</sup>
11. Stocks of combustible material, for example timber	8
12. Air compressor, ventilator intakes, etc.	15

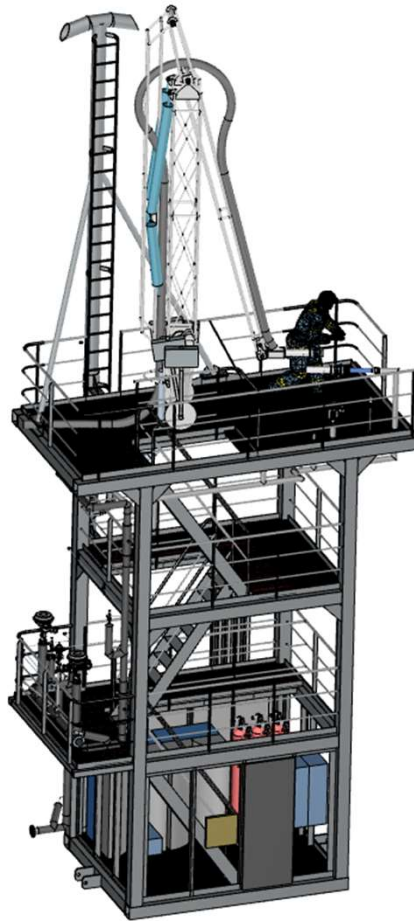
<sup>1)</sup> Where satisfactory arrangements are made to divert liquid spillage away from the hydrogen system, these distances may be reduced.

<sup>2)</sup> For tank capacities greater than 125 000 litres see EIGA Document 127, *Bulk Liquid Oxygen, Nitrogen and Argon Storage Systems at Production Sites* [21].

## Safety Requirements

- **Control system** must be **reliable** and always **available**
- **Safety distances** → The installation shall be sited to minimize risk to personnel, local population and property
- Installations at user's premises shall be **situated outdoors** or under canopies with **suitable ventilation**
- **Readily accessible** to distribution vehicles, firefighting services and provide unrestricted means for escape of personnel in the event of an emergency





- **LH2** Bunkering Tower with cool down loop
- Prevent unintended liquid and gaseous H2 release
- Requirement for a bunkering system
  - Easy operation
  - No release of H2 during overfilling
    - Tight process piping, secondary barrier design
  - Sustainable cold service
  - Drip free quick connect between ship and bunkering
  - Quick connect: allow coupling / release in cryogenic service
  - Emergency release of quick connect (compare to LNG service)
  - Equipment: ATEX
  - LH2 collection, vaporization and release to safe location system (stack)







## **Federchimica - Assogastecnici**

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