Modelling of Physical Phenomena in Liquid Hydrogen Releases for Safety Analysis and Risk Assessment

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Related projects: **FME Hydrogeni**

- MSc. in Mechanical Engineering – University of Bologna
- BSc. in Mechanical Engineering – University of Salerno

Estimated progress of the PhD project:

Just started ...	< 50 %	> 50 %	Almost done ☺

Introduction

Hydrogen is an energy resource that could play a key role in global decarbonization. However, its use, especially in liquid form (LH2), presents several critical challenges. When LH2 is released into the environment, part of it rapidly **vaporizes**, while some may reach the ground, forming an **LH2 pool** that subsequently evaporates and might ignite. Additionally, the extremely low boiling point of liquid hydrogen can cause the **solidification** of **oxygen** and nitrogen from the surrounding air, potentially **enriching** the flammable **hydrogen-air mixture with oxygen**. Therefore, the **loss of containment** in LH2 storage systems due to accidental scenarios can have severe consequences, which must be prevented.

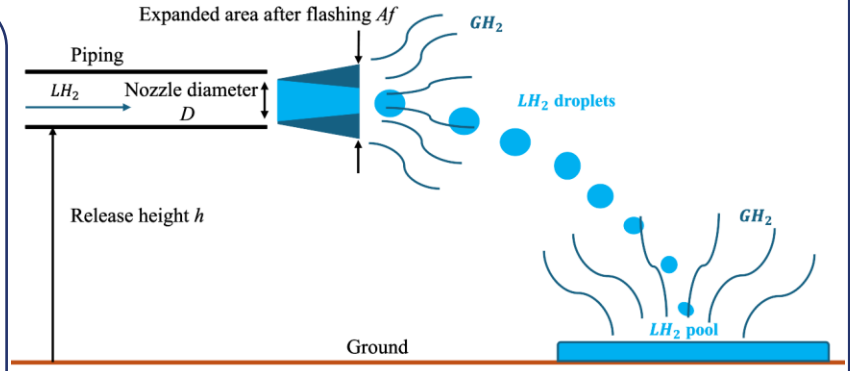
Primary objectives

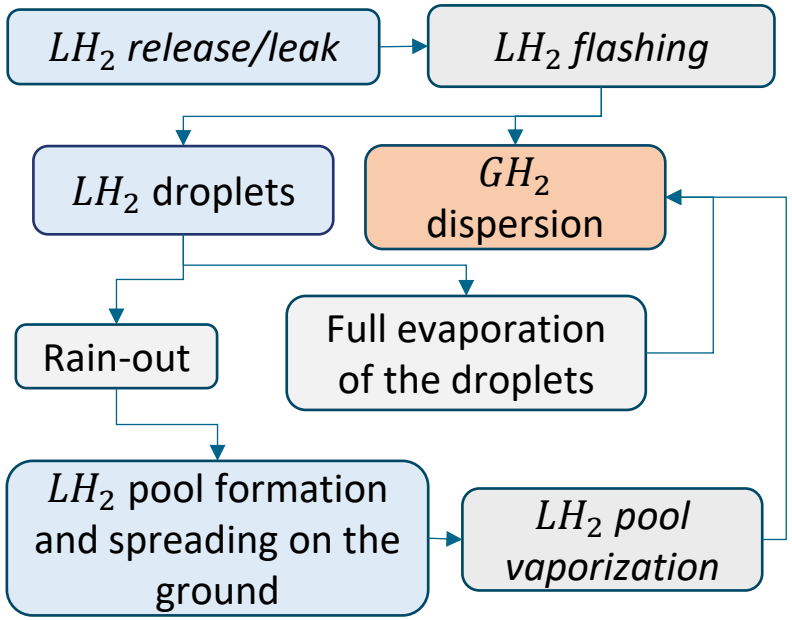
Modelling of:

- LH2 rainout
- LH2 pool formation, spreading, and vaporization
- Oxygen enrichment phenomena and condensed-phase explosions due to phase changes in air components during an accidental release of LH2

Secondary objective

- Investigate the behavior of thermal insulation material and its integrity when in contact with LH2 due to a loss of containment





Publications (planned)

- Modeling of Accidental Liquid Hydrogen Spills and Rainout
- Validation of a Semi-Empirical Model for LH_2 Pool Spreading and Vaporization

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