# Green Hydrogen

# Bridging the Gap

# through Robust Safety Standard

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**(Under Ministry of Petroleum and Natural Gas)**

# OISD – Technical Directorate of MoPNG

# Green Hydrogen: fuel of future



## Why Green Hydrogen?

- **Environment-friendly:** whereas hydrocarbons have 75-85% Carbon content; hydrogen is carbon neutral
- **Energy independence:** reduces reliance on imported fossil fuels, contributing to energy security.
- **Versatile source of energy:** can be used as a fuel or feedstock by several sectors, including Oil and Gas, transportation, chemical, steel, and fertilizer.
- **Stimulate renewable energy growth**: Hydrogen production requires large-scale renewable power generation for its production.
- **Can help decarbonize hard-to-abate sectors**: Heavy industry and aviation have huge power requirements which can be met by hydrogen
- **Can be easily integrated** into existing infrastructure**.**

# Hydrogen Safety

- **Safety issues can make or break the acceptance of Hydrogen**
- **Assumptions:**
  - We already know how to use hydrogen (apathy – established users)
  - Hydrogen is like any other flammable gas (misconception- new players)
  - Hydrogen is too dangerous (fear)
- **Some half-truth**
  - Hydrogen is safe as it disperses very quickly
  - Reverse joule Thompson effect heats the leaking gas sufficiently enough to self-ignite (auto ignition)

# Effect of properties of hydrogen

| Property | Effect | Remarks |
|---|---|---|
| High dispersion rate | Disperses quickly in open space | • Avoid confined space<br>• Confined areas have the risk of explosion. |
| High buoyancy | Due to low molecular weight (It is 14 times lighter than air ) | • Adequate ventilation is a must otherwise, pockets will be formed |
| Toxicity and corrosive properties | Non- toxic and noncorrosive | • Due to high buoyancy, the risk of asphyxiation is rare |
| Better leak detection | Makes louder noise in even small leaks | • Detectors shall be placed after dispersion analysis |

# Effect of properties of hydrogen

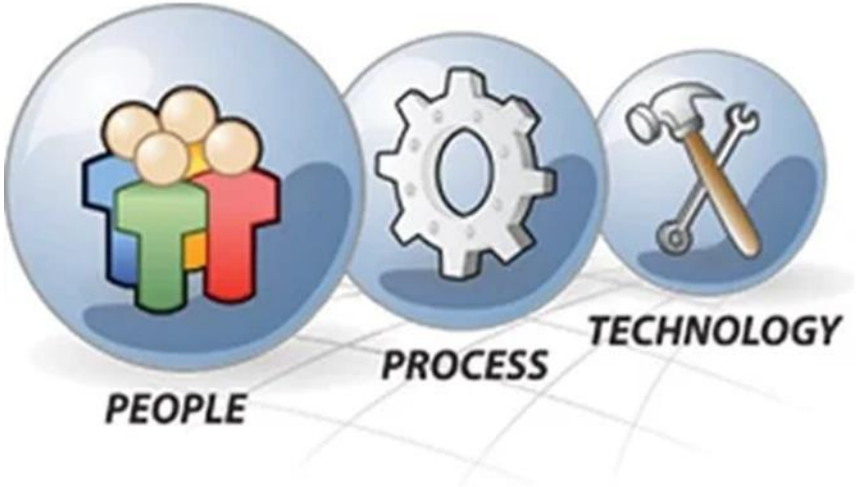
| Property | effect | Remarks |
|---|---|---|
| Very low ignition energy | • H2 has very low ignition energy (30 times lesser than methane) | • Effective installation and maintenance of electrical equipment and wiring as per Hazardous area classification |
| Wide range of flammability & High flame speed | • Low ignition energy & wide range means a very high probability of fire in case of a leak<br>• Results into detonation | • Ensure robust leak detection<br>• Reliability of process and safety controls system to be ensured |
| Material compatibility of hydrogen | • Embrittlement<br>• High-Temperature Hydrogen attack (HTHA) | • Use of material as per applicable national/ international Standards |

# Hydrogen incidents…


Source:
https://www.koreaherald.com/view.php?ud=20190523000739

- **Electrolyser**
  - Explosion due to oxygen contamination in the storage vessel. Membrane degradation, lack of inspection
- **Failure of the Hydrogen Valve resulted in a fire**
  - Incorrect MoC, proper fabrication protocol not followed
- **Hydrogen Tanker loading**
  - Unauthorized repair attempt and absence of SOP
- **Hydrogen Bus fueling station**
  - An incompatible pressure relief device installed

# Asset Integrity




- Asset Integrity Management (AIM) is crucial in ensuring the safe and reliable operation of assets within the green hydrogen value chain.
- Management commitment, resource allocation, skilled manpower, and safety culture in process safety management are essential
- The AIM program should be implemented throughout various stages of the value chain to maintain the integrity of assets and mitigate risks

# Follow the Basics….

Like other flammable gases,
**Hydrogen safety**
relies on
these
key considerations

- Identify Hazards
- Eliminate hazards **or** define mitigation measures
- Ensure asset integrity accordingly
- Provide ventilation as per standards to prevent accumulation
- Manage process and storage vents
- Detect and isolate leaks
- Train personal
- Public awareness

Photo: courtesy BPCL R&D Center

# Gaps in regulation

- Existence of gaps in regulation
- Need for a comprehensive review of regulation and regulatory mechanism
- Focus on the entire value chain of hydrogen

# OISD Standard on Hydrogen

## Background

- Oil industry is having rich experience in handling Hydrogen
- With help of Industry experts, regulators and referring to national and International standards, OISD is developing a Standard on Hydrogen Safety

## Scope :

- This standard establishes minimum safety requirements for hydrogen, including design, construction, materials, equipment, testing, operation, and maintenance.
- It applies to hydrogen production, storage (gaseous and liquid), monitoring and control devices, road transport, pipeline transportation, and blending with natural gas.
- The standard also covers refueling stations for vehicles using compressed gaseous hydrogen

# Coverage of the standard

## Our standard covers the following aspects of safety

- ✓ Hydrogen properties and general safety considerations specific to $H_2$
- ✓ Safety in Electrolyser installations
- ✓ Safety distances
- ✓ Risk analysis procedure
- ✓ Hazardous area classification
- ✓ Detection system
- ✓ Fire fighting
- ✓ Safe Hydrogen disposal

OIL INDUSTRY SAFETY DIRECTORATE

हाइड्रोजन और हाइड्रोजन मिश्रणों के उत्पादन, भंडारण और संचरण में सुरक्षा

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SAFETY IN PRODUCTION, STORAGE AND TRANSPORTATION OF HYDROGEN AND HYDROGEN BLENDS

OISD-STANDARD-241

DRAFT

| | |
|---|---|
| Inception | February 2023 |
| 1st Amendment | |
| 1st Revision | |

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# Summing up

- Collaboration and Knowledge Sharing among various stakeholders
- Review of the regulatory framework
- Robust risk assessment
- Skilling of manpower
- Public Awareness

# THANK YOU