Historical Perspectives for Hydrogen Safety, Regulations, Codes and Standards - A View from the EU

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Relevance of Knowledge and Experience base for RCS on hydrogen safety in EU

2003

2008

2020

Framing EU research, incl. PNR for safety
Interaction of safety community with relevant actors
International cooperation

Perspective

HPMV

Regulation

HRS Standards

UPIH

Interactions

HFCV-SGS launched

HPMV type approval Regulation

GTR 13 phase 1

GTR 13 phase 2

HRS: Directive AFI

Present

2009

2015

2020

FCH 2 JU,
Streamlining of national efforts

Liaisons

ISO

IEC

Perspective
1) Historically: extensive experience with hydrogen in a number of industrial applications, where it is handled by well-trained experts with excellent safety track record

2) 2003: EU High Level Group Vision statement: large potential of HFC to contribute to EU policy goals

Use of hydrogen as energy carrier in a number of non-industrial applications:

- will expose non-experts and the general public
- introduces the need for addressing safety
  - in a similar way, and learning from other energy carriers and fuels
  - using up-to-date risk-informed approaches

Top-down policy push, call on mobilisation of industry
Recognised Needs:

- Improved understanding of specific hydrogen-related safety issues:
  - Hydrogen behaviour
  - Material compatibility
  - Detection systems
  - Risk-based approaches (RRR, QRA, ...)
  - ...

- Implementing appropriate safety requirements in legislation and in regulations

- Establishing harmonised permitting procedures

- Informing/educating/training
  
  decision-makers (industry, policy), permitting authorities, certification bodies, first responders, insurers

- Promoting public awareness and acceptance
EU Philosophy for RCS:

(1) Legislation (directives, regulations) specifies minimum/essential requirements

   performance, safety, emissions, sustainability, ....

(2) Legislation should not be prescriptive on technical implementation

(3) European standards can be referred to and compliance with standard implies conformity with the legislative essential requirements

Technology advances are accounted for through periodical revision of standards

   • global application of technologies: use international standards ISO, IEC

   • scientific basis for standard development and revision through PNR

EU provides support to PNR that addresses societal needs:

   health, safety, sustainability, security, ...

with explicit role for JRC: Regulation (EU) No 1025/2012
### EU co-financed safety-relevant activities

<table>
<thead>
<tr>
<th>demos</th>
<th>gaps, needs, roadmaps</th>
<th>PNR</th>
<th>RCS outputs</th>
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</thead>
<tbody>
<tr>
<td><img src="image" alt="ETOS Logo" /></td>
<td><img src="image" alt="HY-SOCIETY Logo" /></td>
<td><img src="image" alt="EIHP Logo" /></td>
<td>HRS: Guideline for design, installation, operation and maintenance of GHRS to ISO</td>
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</table>
| **FP5** 1998-2002 transport | [Vehicles, HRS, interfaces](#) | | Vehicles (2002): input to  
- UNECE GTR LH2, CGH2  
- EU type approval |

**HRS:** Guideline for design, installation, operation and maintenance of GHRS to ISO.
HySafe and JRC

facilitating, coordinating, performing, disseminating PNR on H2safety

e-Academy on Hydrogen Safety
hydrogen safety handbook
R&D projects InsHyde, HyTunnel

Comparison and validation of CFD simulations

Hydrogen Incidents and Accidents Database (HIAD)

Prioritisation of R&D topics

ICHS conferences

International Conference on Hydrogen Safety (ICHS2013)
Interaction and international cooperation

- 2003: HFCV-SGS launched
- 2008: HPMV type approval Regulation
- Present: GTR 13 phase 1
- 2015: HRS Standards
- 2020: GTR 13 phase 2

Interaction of H2 safety community with relevant actors

Demonstration projects

national H2-mobility programmes

formalised liaisons with

International cooperation

- RCS, E&T
- EU-DoE
- T19, 31
- International Energy and Transport
- Institute for Energy and Transport
- Hydrogen Implementing Agreement
- Institute of Hydrogen Energy

International cooperation
### Recognised Needs Addressed at EU level through EU actors Outlook transport Outlook stationary Outlook H2-chain

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<th>Recognised Needs</th>
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<th>EU actors</th>
<th>Outlook transport</th>
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<th>Outlook H2-chain</th>
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<tr>
<td>Improved understanding of specific hydrogen-related safety issues</td>
<td>prioritised, targeted, collaborative PNR</td>
<td>FCH-JU, JRC, HySafe, ...</td>
<td>Green</td>
<td>Yellow</td>
<td>Red</td>
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<tr>
<td>Implementing appropriate safety requirements in legislation, in regulations</td>
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<td>Informing/educating/training</td>
<td>education curricula, training courses, summer schools</td>
<td>FCH-JU, IPHE, ICHS, HySafe, H2FC, ...</td>
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<td>Red</td>
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<td>dedicated projects, demos</td>
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**Status and Outlook**

- **Likely adequate**: Green
- **May fall short**: Yellow
- **Inadequate**: Red

**Outlook for deployment**
Way Forward

1. Strengthen interaction with relevant SDOs, in particular ISO TC 197, IEC TC 105 (type A liaison, use of technical reports)
   - regional, national and global programmes and activities (demo, PNR, RCS)

2. Widen the scope of safety-RCS activities
   - other transport modes
   - energy applications (H2 storage)
Joint Research Centre (JRC)

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Serving society
Stimulating innovation
Supporting legislation
Back-up
Publication of European standards to be done in accordance with Regulation (EU) No 1025/2012 on European Standardisation

Art. 9: Cooperation with research facilities: JRC shall provide European standardisation organisations with scientific input, to ensure that European standards take into account economic competitiveness and societal needs such as environmental sustainability and safety and security concerns.

JRC Pre-Normative Research Activities:

- Fast filling and permeation of type 4 tanks ✓
- Hydrogen purity requirements for automotive stacks ✓
- Performance characterisation of fuel cells
- Performance characterisation of H2 safety sensors ✓
- CFD modelling of H2 safety issues ✓