Historical Perspectives for Hydrogen Safety, Regulations, Codes and Standards

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A View from the EU

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JRC-IET

ICHS2013

Perspective

European Commission

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

2003 — 2008 — present — 2020

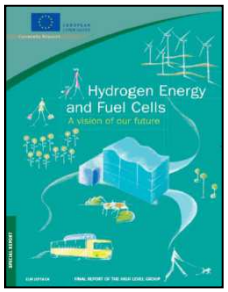
FCH 2 JU, Streamlining of national efforts

New Energy World JU
fuel cells & hydrogen for sustainability

?

Liaisons

ISO IEC



H2

IPHE

Framing EU research, incl. PNR for safety

Interaction of safety community with relevant actors

International cooperation

2009 — present — 2015 — 2020

UNECE

HFCV-SGS launched

HPMV type approval Regulation

HRS: Directive AFI

GTR 13 phase 1

HRS Standards

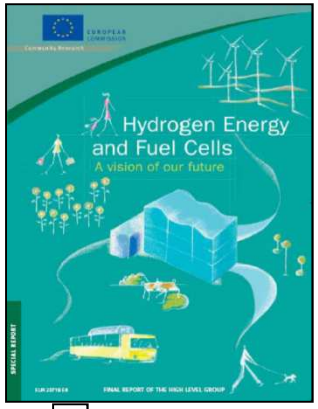
GTR 13 phase 2

2003: Awareness Starts Building

European Commission

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*

HFC ETP → RCS major market enabler → mandate to CEN CENELEC

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

European Commission

EU Philosophy for RCS:

UNECE

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

performance, safety, emissions, sustainability, ...

CE

(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

CEN CENELEC → 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

European Commission

	demos	gaps, needs, roadmaps	PNR	RCS outputs
FP5 1998-2002 transport	CUTE ECTOS	HY SOCIETY FUEVA	EIHP Vehicles, HRS, interfaces	HRS: Guideline for design, installation, operation and maintenance of GHRS to ISO Vehicles (2002): input to • UNECE GTR LH2, CGH2 • EU type approval

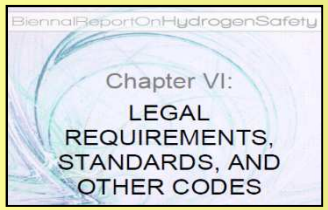
HySafe and JRC

European Commission

facilitating, coordinating, performing, disseminating PNR on H2safety

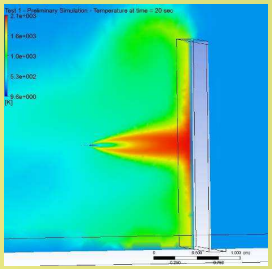
e-Academy on Hydrogen Safety

hydrogen safety handbook



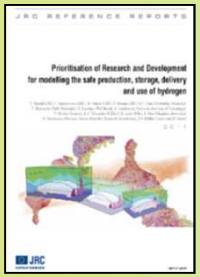
R&D projects InsHyde, HyTunnel

Comparison and validation of CFD simulations



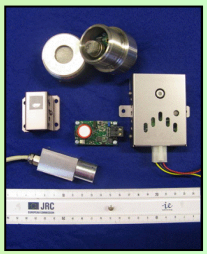
Hydrogen Incidents and Accidents Database (HIAD)

Prioritisation of R&D topics



ICHS conferences

ICHS2013



HySafe

hySafe INTERNATIONAL ASSOCIATION FOR HYDROGEN SAFETY

ISO

JRC EUROPEAN COMMISSION

iet Institute for Energy and Transport

FCH-JU: industry-led

European Commission

New Energy World JU
fuel cells & hydrogen for sustainability

Targeted at market deployment

Structured X-cutting activities

Demos transport

CHIC

H2moves.eu SCANDINAVIA

HIGHVLOCITY

HyTEC

HyLIFT Clean Efficient Power For Materials Handling

Moby Post mobility with hydrogen for postal delivery

shell

FCGEN

DESTA

SWARM

HyTransit

PNR with safety aspects

HyCOMP

Hyindoor

MATHRYCE

H2Sense

FireComp

Hytransfer

SUSANA

Education and Training

HyResponse

HYFACTS

TrainHy

HyProfessionals

Safety knowledge assessment

HyTrust

Demos stationary

sofcom FCH-JU project

fitup

CLEARgen

SOFT-PACT

ene.field

FCpoweredRBS

TOWERPOWER

Demos production & storage

ELYGRID

NEXPEL

DonQuichote

Interaction and international cooperation

European Commission

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UNECE

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Interaction of H2 safety community with relevant actors

Demonstration projects

WaterstofNet

HyER

national H2-mobility programmes

formalised liaisons with

IEC ISO

iet Institute for Energy and Transport

hySafe INTERNATIONAL ASSOCIATION FOR HYDROGEN SAFETY

International cooperation

IPHE RCS, E&T

HYDROGEN IMPLEMENTING AGREEMENT T19, 31

EU-DoE

NOW Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie

workshop

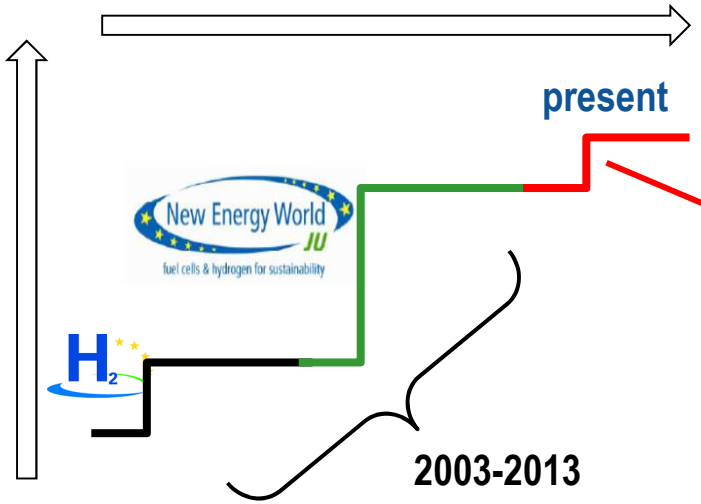
Status and Outlook

Recognised Needs	Addressed at EU level through	EU actors	Outlook transport	Outlook stationary	Outlook H2-chain
Improved understanding of specific hydrogen-related safety issues	prioritised, targeted, collaborative PNR	FCH-JU, JRC, Hysafe, …			
Implementing appropriate safety requirements in legislation, in regulations			DG ENTR DG MOVE		
Establishing harmonised permitting procedures					
Informing/educating/ training	education curricula, training courses, summer schools	FCH-JU, IPHE, ICHS, HySafe, H2FC, …			
Promoting public awareness and acceptance	dedicated projects, demos	FCH-JU, HyER, Waterstofnet, …			

outlook for deployment

- likely adequate
- may fall short
- inadequate

Way Forward



Framing EU research, incl. PNR for safety

Interaction of safety community with relevant actors

International cooperation

(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)

www.jrc.ec.europa.eu

Contact: jrc-info@ec.europa.eu

Serving society
Stimulating innovation
Supporting legislation

Back-up

Scope and Framing of Pre-Normative Research Activities in EC

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* ✓