

Clean Hydrogen JU webinar

“Computational Fluid Dynamics (CFD) for
hydrogen safety analysis”

7 December 2022

EUROPEAN HYDROGEN SAFETY PANEL (EHSP)





- Background

A brief timeline

- In 2006 and 2009 NoE HySafe was suggesting an activity for **sharing lessons learned and hydrogen safety experience across project boundaries** and to **maintain this expertise eventually even beyond program terms**.
- In 2014 the International Association for Hydrogen Safety HySafe proposed the installation of a safety panel to the Executive Director and Governing Board of the FCH JU.
- After several discussions about formal aspects, terms of reference, vision, mission, mandates, etc. the **European Hydrogen Safety Panel was launched by the FCH 2 JU in 2017**






Reflecting the CHP vision

-  **Hydrogen plays a key role in the Energy System constituting a safe and sustainable Energy Carrier.**
-  **Hydrogen is an enabler of the Energy Transition towards a decarbonized system.**

EHSP Role

to provide the CHP

-  independent safety expertise
-  objective information
-  education and training

in different forms for various groups of stakeholders
and support the upscaling of hydrogen energy

Mission, Objectives and Activities

The EHSP assists the Clean Hydrogen Partnership both at programme and at project level in



assuring that hydrogen safety is adequately managed, and



promoting and disseminating a hydrogen safety culture

Current Members

Group of experts in Hydrogen Safety constituted by 15 members



Iñaki Azkarate



Stuart Hawksworth



Thomas Jordan



Georg Wilfried Mair



Marta Maroño



Daniele Melideo



Vladimir Molkov



Ernst-Arndt Reinecke



Pratap Sathiah



Ulrich Schmidtchen



Etienne Studer



Trygve Skjold



Tom Van Esbroeck



Elena Vyazmina



Jennifer Wen



KNOWLEDGE HUB

Activities

Activities are grouped in 4 pillars and organised in Task Forces (TF)

 TF1 Support at Project level



Elena Vyazmina

 TF2 Support at Programme level



Thomas Jordan

 TF3 Data collection and assessment



Jennifer Wen

 TF4 Public Outreach



Trygve Skjold

Outcomes: Safety Planning Guidance Document

SAFETY PLANNING AND MANAGEMENT IN HYDROGEN AND FUEL CELLS PROJECTS - GUIDANCE DOCUMENT



CLEAN HYDROGEN PARTNERSHIP

SAFETY PLANNING AND MANAGEMENT IN HYDROGEN AND FUEL CELLS PROJECTS - GUIDANCE DOCUMENT

XX December 2022

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Safety of Electrolysis

2020



EHSP
European Hydrogen Safety Panel
Workshop on Safety of Electrolysis
18 November 2020

FCH JU Workshop on Safety of Electrolysis
AGENDA

Welcome Remarks	FCH JU
European Hydrogen Safety Panel (EHSP)	EHSP
Session 1: Safety-related events and lessons learnt	
Hydrogen Incidents and Accidents Database (HIAD 2.0) Findings, lessons learnt, recommendations	DO JRC - EC
Case Studies - Ilford and Gangneung in South Korea History, lessons learnt	EHSP
Q&A / Panel discussion - Moderated by the EHSP	
Session 2: Hazards identification for electrolysis	
Set of prototypical hazards, Risk Evaluation and Acceptance Criteria - Overview	EHSP
HYBALANCE project hazards identification approach 1.2 MW, PEMEL, Grid services/transport/industry (DK)	AIR LIQUIDE
GRINHY2.0 project hazards identification approach 700+ kW, SOEL, Steel industry, (DE)	SUNFIRE
H2ME2 project hazards identification approach PEMEL, Hydrogen refuelling station(s)	ITM POWER
PRETZEL project hazards identification approach 25 kW, PEMEL, 100bar Outlet Pressure	WHS/ IGAS ENERGY
Q&A / Panel discussion - Moderated by the EHSP	
Session 3: Safety-related framework in electrolysis	
16:10-16:20 Safety in Regulations, Codes and Standards relevant to electrolysis - Overview	RCS SCG
16:20-16:30 DJEWELS project safety approach 20 MW, AEL, Methanol production plant (NL)	NOURYON
16:30-16:40 REFHYNE project safety approach 10 MW, PEMEL, Refinery (DE)	ITM/ SHELL
16:40-16:50 H2FUTURE project safety approach 6 MW, PEMEL, Steel manufacturing plant (AT)	SIEMENS/ VOESTALPINE
16:50-17:00 DEMO4GRID project safety approach 4 MW, Pressurized AEL, Industrial bakery (AT)	MPREIS WARENVERTRIEBS
17:00-17:10 MULTIPLY project safety approach 2.6 MW, SOEL, Biodiesel refinery (NL)	SUNFIRE
17:10-17:30 Q&A / Panel discussion - Moderated by the EHSP	
17:30 Closing Remarks	FCH 2 JU/ EHSP

Safe Storage of Hydrogen

2021



European Hydrogen Safety Panel
Workshop
"Safe Storage of Hydrogen"
18 November 2021

FCH JU Workshop on Safety of Electrolysis
AGENDA

10:30-10:40	H2HAUL project - Heavy-duty vehicles	VDL
10:40-10:50	REVIVE project - Heavy-duty vehicles	ALL ENGINEERING
10:50-11:00	THOR project - CGH2 Tanks	FAURECIA
11:00-11:10	H2TUNNEL-CS project - Safe design of TPRD/ TPRD-free tanks	UNIVERSITY OF ULSTER
11:10-11:40	Q&A / Panel discussion	EHSP
11:40-11:45	Break/ contingency time	

"Safety planning and management in EU hydrogen and fuel cell projects" 22 April 2022



European Hydrogen Safety Panel (EHSP)
Webinar "Safety planning and management in EU hydrogen and fuel cell projects", 22 April 2022

Safety plan implementation, monitoring and reporting

Chapter 3 of "Safety planning and management in EU hydrogen and fuel cells projects - guidance document", EHSP, 21 September 2021.
<https://www.fch.europa.eu/page/european-hydrogen-safety-panel>

Elena Vyazmina, PhD
Member of European Hydrogen Safety Panel (EHSP)



"Computational Fluid Dynamics (CFD) hydrogen safety analysis" 7 December 2022



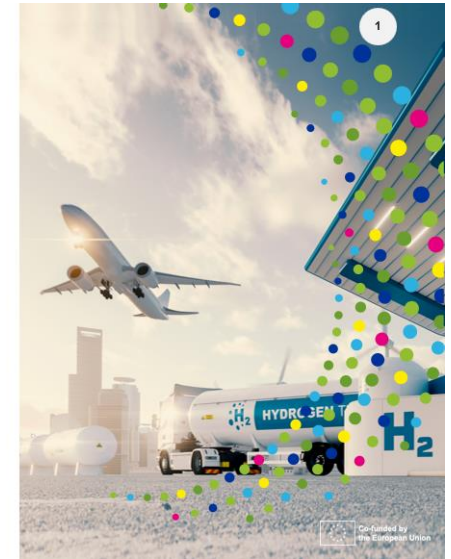
Clean Hydrogen JU webinar

"Computational Fluid Dynamics (CFD) for hydrogen safety analysis"

7 December 2022

**EUROPEAN HYDROGEN
SAFETY PANEL
(EHSP)**

EUROPEAN PARTNERSHIP



Outcomes: Assessment and lessons learnt from HIAD 2.0



FUEL CELLS AND HYDROGEN 2 JOINT UNDERTAKING (FCH 2 JU)

Statistics, lessons learnt and recommendations from the analysis of the Hydrogen Incidents and Accidents Database (HIAD 2.0)

21 September 2021

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Figure 1: Flow chart of the process from data collection to final publishing and dissemination.

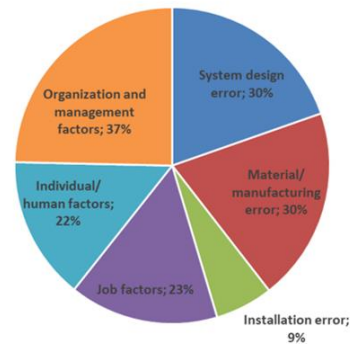


Figure 9: Causes of hydrogen incidents (multiple causes per event considered).

Table 1: HIAD 2.0 events classified by consequence and operation mode

Total number events	Number events by consequence			
	Explosions	Jet fires	Unignited hydrogen release	No hydrogen release
424	238	117	55	14
	Number events by operational mode			
	Normal operation	Outside normal operation	Unclear	
	299	113	12	

Table 2: HIAD 2.0 events classified by industry sector

Sector	Number of events by sector
Chemical/ Petrochemical industry	259
Hydrogen transport and distribution	43
Nuclear power plant	23
Laboratory / R&D	15
Power generation	13
Hydrogen production	10
Aerospace	5
Entertainment	3
Hydrogen-powered vehicle	2
Stationary fuel cell	0
Other/Unknown	
Other	34
Total	461

Finally, Table 3 lists the number of events according to causes. It should be noted that some events had multiple causes.

Table 3: HIAD 2.0 events classified by causes

Cause	Number of events by causes
System design error	126
Material/ manufacturing error	127
Installation error	38
Job factors	98
Individual/ human factors	94
Organization and management factors	158

“Statistics, lessons learned and recommendations from analysis of HIAD 2.0 database” will appear soon in International Journal of Hydrogen Energy

Outcomes: Support at Programme Level

Emergency Crisis Management



Task 2 – Strategic Support

Emergency Crisis Management

Stuart Hawksworth



CLEAN HYDROGEN JOINT UNDERTAKING

DRAFT
Crisis Management Plan
 Version 22 October 2022

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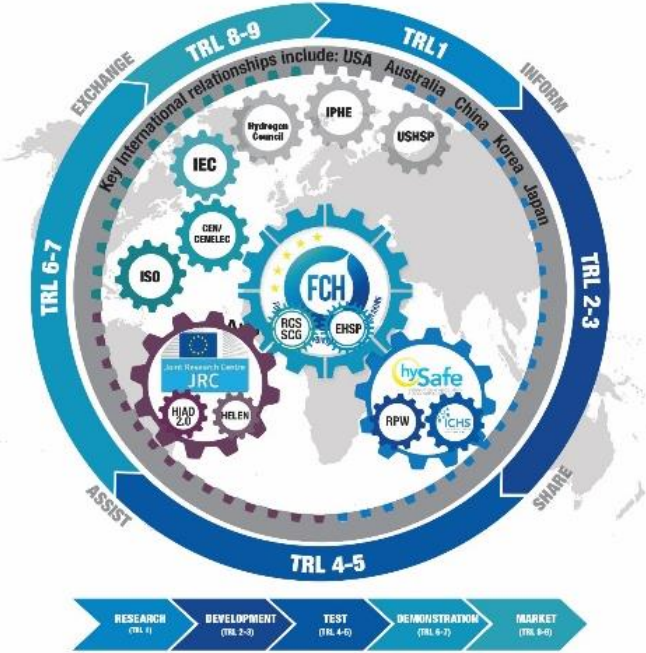
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Outcomes: Support at Programme Level

Collaboration: EHSP-USHSP



ICHS



Hydrogen Safety Forum

Stuart Hawksworth & Chris LaFleur

Representing

European Hydrogen Safety Panel
&
United States Hydrogen Safety Panel

22 June 2021




bySafe The Scottish Government and IA HySafe invite you to the unique

9th INTERNATIONAL CONFERENCE ON HYDROGEN SAFETY 2021

Safe Hydrogen for Net Zero
Edinburgh, 21-24 September 2021

ICHS 2021

bySafe
INTERNATIONAL ASSOCIATION FOR HYDROGEN SAFETY

Scottish Government
Riaghaltas na h-Alba
gov.scot

Registration Open
<https://hysafe.info/ichs2021/>

Outcomes: Public Outreach

Communication Strategy // Website // FAQs // TIM // KEY MESSAGES

Key Messages

- Hydrogen will play an essential role in energy systems as a clean and sustainable energy carrier.
- To bring the benefits of hydrogen to society, hydrogen technologies must be safely developed and used across a variety of applications and sectors.
- Hydrogen systems can be as safe as systems based on conventional energy carriers, provided the specific properties of hydrogen and the hydrogen system are properly addressed.



https://www.timanalytics.eu/TimTechPublic/main.jsp?dataset=s_1622

Presentations at events

- EHEC, Madrid, 18-20 May.
 - ISFEH, Oslo, 22-27 May.
 - IPCEI initiative “Safe H2”, Online, Tuesday 7 June
 - International Workshop on Hydrogen Infrastructure for Transportation, Brussels, 12-13 September 2022
 - IEA TCP Hydrogen Task 43 meeting in Buxton, 17-21 October:
 - General presentation of the EHSP with the focus on TF1
 - Analysis of the past incidents within HIAD 2.0 with a focus on lack of the safety culture
- Crysis management**



https://www.clean-hydrogen.europa.eu/get-involved/european-hydrogen-safety-panel-0_en

Thank you



Get in contact with the EHSP by email at
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