Pre-normative research for safety of hydrogen driven vehicles and transport through tunnels and similar confined spaces

Fuel Cells and Hydrogen Joint Undertaking (FCH2 JU)
Grant Agreement Number 826193

Deliverable 6.12
Dissemination Conference

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Version: 220729
Delivery date for internal review: 27th of July 2022
Due date: 31st July 2022
Dissemination level: Public

Clean Hydrogen Partnership

Co-funded by the European Union

Deliverable administration					
Work Package	WP6. Synthesis, outreach and dissemination				
N. and title	D6.12. (D29) Dissemination conference				
Type	Report				
Status	Draft/Working/**Released**	Due	M41	Date	31-07-2022
Comments					

Development and revision			
Version N.	Date	Authors	Description
V1	20220727	M. Martínez	Dissemination Conference
V2	20220729	D. Cirrone	Review
V3	20220729	M. Martínez	Final version

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Acknowledgments

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 826193. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation program, Hydrogen Europe and Hydrogen Europe Research.

Summary

The purpose of this Deliverable is to show the objectives and results of the **Final Dissemination Conference** of the project, held during the month of July in Brussels. As well as to explain its creation process and the digital support channels for its development. All partners have been involved in the preparation of this conference, with FHa leading the communication strategy with the support of the University of Ulster.

Keywords

Dissemination, Communication, Awareness, Hydrogen, HyTunnel-CS, Hydrogen, Safety, website, Conference.

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Nomenclature and abbreviations

CEN-CLC	*Comité Européen de Normalisation- Comité Européen de Normalisation Electrotechnique*
CTIF	*Comité Technique International de prévention et d'extinction du Feu*
D	Deliverable
DCAP	Dissemination, Communication and Awareness Plan
EHSP	European Hydrogen Safety Panel
FCH 2 JU	Fuel Cells and Hydrogen 2 Joint Undertaking
FHa	*Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón*
IFA	International Fire Academy
ISO	International Standardization Organization
JTC	Joint Technical Committee
NEN	Royal Netherlands Standardization Institute
RCS	Regulation, Codes and Standards
SAB	Stakeholders Advisory Board
TC	Technical Committee
VIN	Vehicle Information Number
WHEC	World Hydrogen Energy Conference

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1. The HyTunnel-CS Dissemination Conference

The Dissemination Conference presented the main results of the project that has addressed the investigation of the safety of hydrogen powered vehicles and transport through tunnels and similar confined spaces. The Dissemination Conference took place in Brussels in M41 and it was organised by FHa. It was held on the 14th and 15th of July 2022, jointly with the GA and SAB meeting towards the project end.

The main objectives of the conferences are:

- Presenting results and outcomes of the 3-year-action to the stakeholders, including Hydrogen Europe members, FCH2 JU (now Clean Hydrogen Partnership) officers, European Commission representatives.
- Inviting Mass media communication to reach a wider audience and achieve a great impact.

Along the sessions were presented the following topics:

- Results and advances of the project to the industrial and the academia collaborators and users.
- Feedback sessions to account and follow up the improvement of activities in the rest of the project and future activities.

In order to disseminate all the results of this project, different sessions were organised during the day:

- Closing knowledge gaps, physical phenomena and engineering tools.
- Recommendations to deal with unignited hydrogen releases and jet fires in confined spaces.
- Recommendations to prevent and mitigate hydrogen deflagrations, DDT and detonations in confined spaces.
- Recommendations to prevent hydrogen tank rupture in a fire.
- Quantitative risk assessment.
- Harmonised recommendations on response to hydrogen accidents.
- Recommendations for RCS.

In addition, the day ended with a Q&A session and closing remarks. The programme of the dissemination conference is reported in Appendix I.

1.1 Determination of audiences

Stakeholders or interest groups are, from a broad perspective, any group or individual that may affect or be affected by the achievement of the project's objectives. The audience was open to any hydrogen industry professional interested in the topic. We opened our invitations to the following areas:

Table 1. Audience.

Community, national and regional administration
Beneficiaries and partners of the project
Small Medium enterprises and large companies
Stakeholders Advisory Board
Research and educational centres
Event organizers
Vehicle Safety Companies
Clusters and sectorial organizations related to hydrogen
General and specialized media
Promoters of other related initiatives
Economic and social agents at European level
Tunnel Safety agencies or companies
RCS actors
Firefighter community

2. Strategy

To maximize the impact of the Conference a full 360º Communication Plan has been developed to reach the audience through different channels such us: website, press, and social media networks belonging to the consortium.

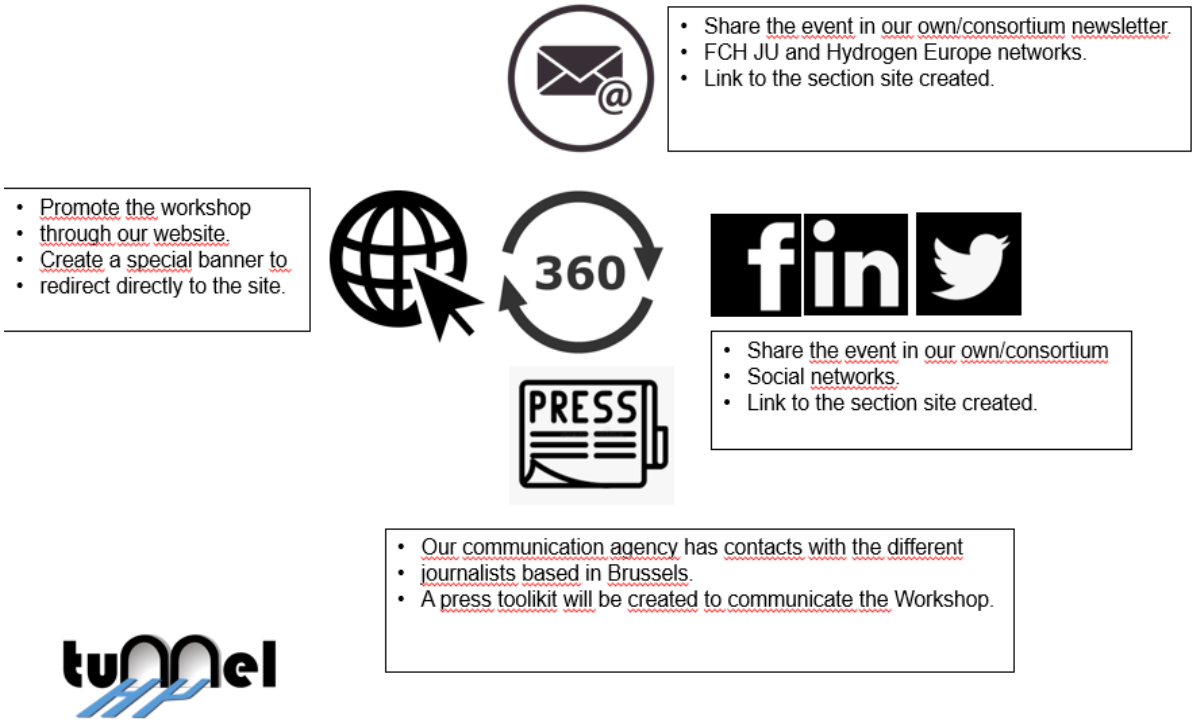

Figure 1. 360º Strategy for communication.

2.1 Registration

To formalize the registration, the EventBrite platform was used to collect information from interested parties through a form. To ensure that we were approaching the right audience, we created the registry with a series of filters to verify that those registered were related to our interests.

This platform generated a link that was shared on the partners' social networks to encourage registration.

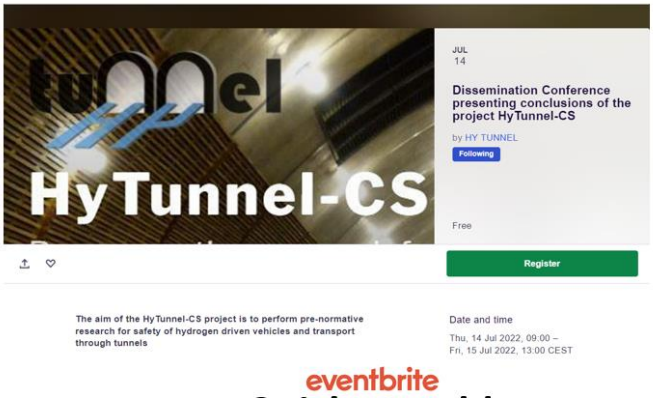

Figure 2. Eventbrite registration platform.

2.2 Editorial Calendar

An editorial calendar was created to disseminate the call for registration, as well as the corresponding reminders in previous months. This calendar involved both the project website, newsletters and partners' own digital channels.

Table 2. Communication timeline.

COMMUNICATION	CHANNEL	MONTH
ANNOUNCEMENT	WEB, SOCIAL NETWORKS, NEWSLETTER	MARCH
FIRST CALL FOR REGISTRATION	SOCIAL NETWORKS	APRIL
SECOND CALL FOR REGISTRATION	SOCIAL NETWORKS	MAY
LAST CALL FOR REGISTRATION	SOCIAL NETWORKS	JUNE
CALL FOR ONLINE ATTENDANCE	SOCIAL NETWORKS	END OF JUNE

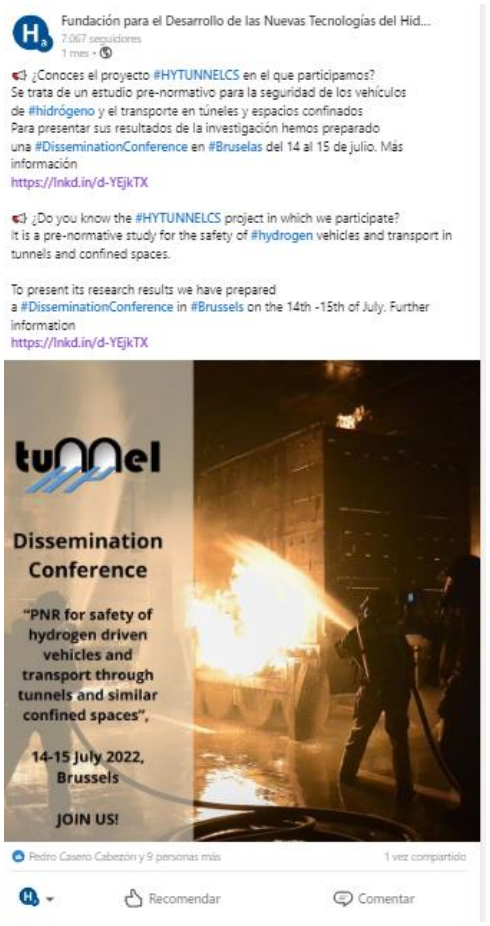

Figure 3. Linkedin post call to register.

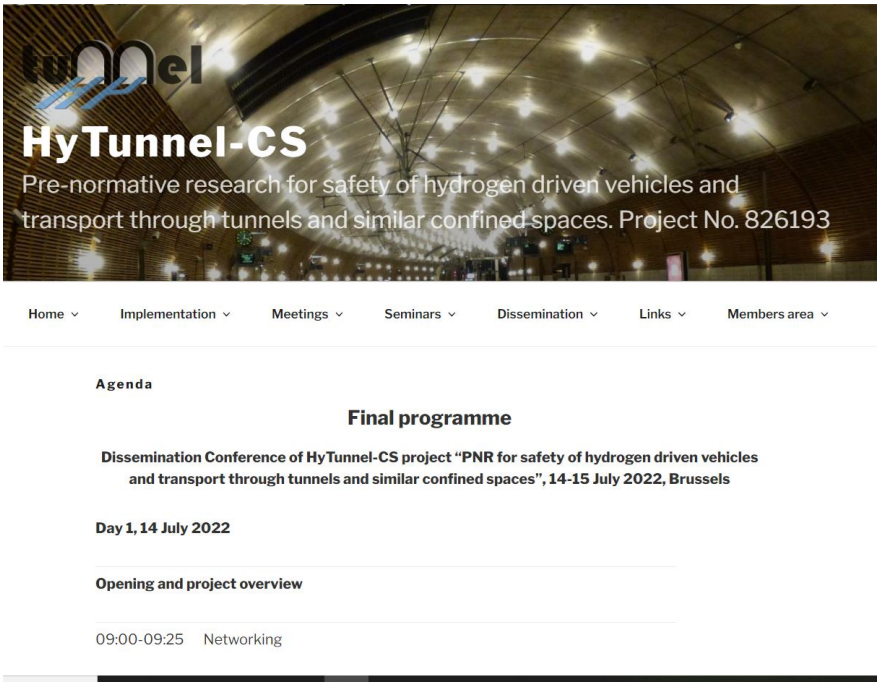

Figure 4. Dissemination Page on HyTunnel-CS website.

2.3 The venue

The Conference was held at THE HOTEL (Bd de Waterloo 38, 1000 Bruxelles). A modern and contemporary hotel in the heart of the city that hosts professional events. Easily accessible from anywhere in the city, airport, train and bus station.

Figure 5. Photo family at the Dissemination Conference.

2.4 The audience

A total of 60 attendees joined the conference face to face, of which 24 were project members and 5 were SAB members. In order for the project's outcomes to reach more professionals, the week before the face-to-face conference took place, a virtual room was set up so that participants could follow the meeting live on the web (see Figure 6). Up to about 230 views of the online event were reached on the first day of the conference. A chat platform was set to receive questions from online attendees.

The professionals joining the face-to-face event came from several key Academic Institutions and Companies such as: University of Birmingham; Vervaeke; Ballard Motive Solutions; Plastic Omnium; AWV; Lombardi Begium; IEI EUROPA Administratrice; SBB AG; Tractebel ENGIE; Universal Press; Hexagon; LIEGE ZONE 2 IILE-SRI; INERIS; Skynet; CNH2; Plastic Omnium; Toyota Motor Europe; BEAMS Department - Electrical Energy; Vebode Consulting; Kiwa Nederland B.V; Protium Green Solutions Ltd; Berufsfeuerwehr Hamburg; ULB; SUEZ/Environment; Infrabel and Tractebel; FOGTEC; Federal Authority;

DNV; University of St. Andrews; Intotech; Tunnel Organisatie Vlaanderen; Ballard Power Systems Europe and University of Antwerp, among others. Overall, it is considered that the conference reached a well widen international and diversified audience.

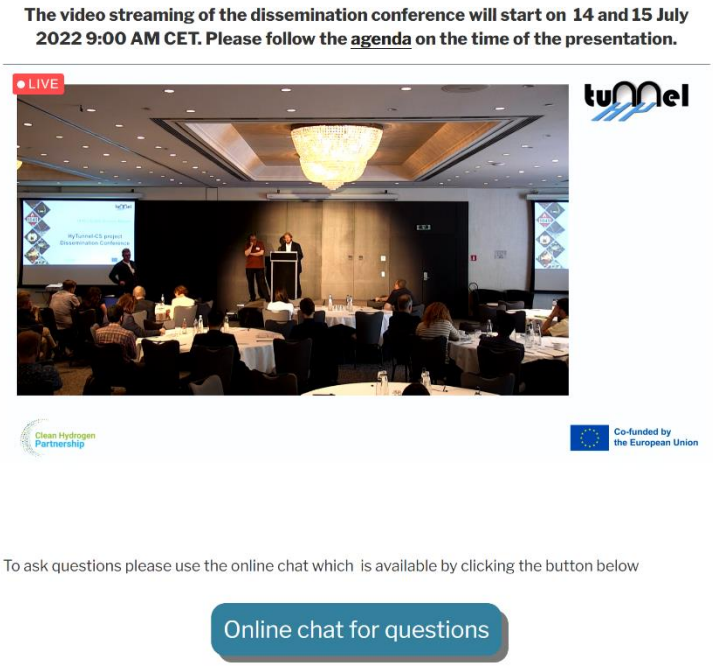

Figure 6. Virtual room for attending online the dissemination conference on HyTunnel-CS website.

3. Conclusions

HyTunnel-CS dissemination conference presented the main outcomes of the pre-normative research performed on the safety of hydrogen driven vehicles and transport through tunnels and similar confined spaces. Presentations gave time for questions, and a time slot at the end of the day was reserved for Q&A sessions. It was generally appreciated the extension and broad spectrum of practical scenarios that were investigated in the project, both in terms of hydrogen applications and of considered enclosed spaces (tunnels, underground car parks, private garage, etc.). Many questions were associated with larger inventories of hydrogen, as could be present in trains and buses. This testifies a clear interest in applications for railway and public transport applications. It was specified during the Q&A session that indeed the project has investigated these scenarios, such as in a CFD/FEM study to assess the effect of a hydrogen jet fire on a tunnel ceiling following release from a bus, numerical study on potential of DDT following the release from a train, experiments on large scale inventories to investigate consequences of releases from trains in a tunnel, etc. However, it was clarified that the main scope of the project is to provide knowledge, validated engineering correlations and numerical tools for hydrogen safety engineering, conclusions and strategies that could be generically applicable. The conference presentations, where consented, will be published online on the project website. It is considered that this is an optimal way to further disseminate the conference outputs and knowledge among stakeholders and people who could not attend entirely the two days programme.

Appendix I. Conference programme

Day 1, 14 July 2022	
Opening and project overview	
09:00-09:25	Conference start and networking
09:05-09:30	Opening and welcome (D. Makarov, UU)
09:30-09:50	Overview of HyTunnel-CS project and structure of recommendations for stakeholders (D. Makarov, UU)
Closing knowledge gaps, physical phenomena and engineering tools	
09:50-10:05	Concrete spalling by hydrogen jet fires (F. Markert, DTU)
10:05-10:20	Effect of tunnel slope on hydrogen dispersion (S. Giannissi, NCSRD)
10:20-10:40	Effect of counter- and co-flow on hydrogen jets: simulations versus experiment (S. Giannissi, NCSRD)
10:40-10:55	Jet fire behaviour in tunnel: effect of TPRD orifice diameter and release direction (G. Bernard-Michel, CEA)
10:55-11:10	*Coffee break*
11:10-11:30	Dimensionless correlation for blast wave decay in a tunnel (V. Shentsov, UU)
11:30-12:00	Deflagration of hydrogen releases in tunnel: large-scale experiments (W. Rattigan, HSE)
12:00-12:20	Correlation for overpressure during ignited spurious hydrogen release (D. Cirrone, UU)
12:20-12:40	Drastic difference between fireball dynamics in the open space and in a tunnel (V. Shentsov, UU)
12:40-13:00	Interaction of water sprays and mist systems with hydrogen fire (J. Grune, KIT)
13:00-14:00	*Lunch*
Recommendations to deal with unignited hydrogen releases and jet fires in confined spaces	
14:00-14:20	Principles of inherently safer design of hydrogen vehicles for use in confined spaces (D. Makarov, UU)
14:20-14:35	Heat release rate, fire resistance rating and contribution of hydrogen released through TPRD to vehicle fire (S. Kashkarov, UU)
14:35-14:55	Garages and maintenance shops: mitigation of pressure peaking phenomenon (A. Gaathaug, USN)
14:55-15:15	Underground parking: requirements to TPRD size and release direction (V. Shentsov, D. Cirrone, UU)
15:15-15:35	CFD and FEM study of hydrogen jet fire effect on tunnel structure (D. Cirrone, UU; F. Markert, DTU)
15:35-15:50	Erosion of tunnel materials by hydrogen jets (S. Bergin, HSE)
15:50-16-05	*Coffee break*
Recommendations to prevent and mitigate hydrogen deflagrations, DDT and detonations in confined spaces	
16:05-16:25	Correlation for flame acceleration and DDT in non-uniform hydrogen-air mixtures in tunnels (M. Kuznetsov, KIT)
16:25-16:45	CFD and FEM study of hydrogen tank rupture on tunnel structure (V. Shentsov, UU; F. Markert, DTU)
16:45-17:05	Blast wave and fireball after hydrogen tank rupture: real tunnel experiments and simulations (G. Bernard-Michel, CEA)
17:05-17:25	Blast wave attenuation by absorbing materials, water sprays and mist systems (J. Grune, KIT)
17:25-17:40	Deflagration propagation through fire extinguishing foam (J. Grune, KIT)
17:40-18:00	Q&A session (V. Molkov, UU)
Day 2, 15 July 2022	
Recommendations to prevent hydrogen tank rupture in a fire	
09:00-09:20	Design of tank-TPRD system to exclude rupture in a fire and the pressure peaking phenomenon (S. Kashkarov, UU)
09:20-09:40	Breakthrough safety technology of explosion free in a fire TPRD-less tank (S. Kashkarov, UU)
Quantitative risk assessment	
09:40-10:05	Quantitative risk assessment methodology for hydrogen vehicles in confined space (P. Russo, URS)
10:05-10:25	QRA of hydrogen vehicles in road tunnels (S. Kashkarov, UU)
10:25-10:45	QRA of hydrogen trains in rail tunnels (P. Russo, URS)
10:45-11:05	QRA of hydrogen vehicles in underground parking (F. Markert, DTU)
11:05-11:20	*Coffee break*
Harmonised recommendations on response to hydrogen accidents	
11:20-11:40	Project findings and their effect on intervention strategies and tactics (C. Brauner, IFA)
11:40-12:00	Interaction of HyTunnel-CS and HyResponder projects (M. Van De Veire, SPFI)
Recommendations for RCS	
12:00-12:25	Recommendations for Regulations, Codes and Standards (J. van den Berg, NEN)
Q&A session and closing remarks	
12:25-12:50	Q&A session (V. Molkov, UU)
12:50-13:00	Closing remarks (D. Makarov, UU)