HYDROGEN
Safety Panel

Hydrogen Safety Panel Strategic Plan

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The Case for Safety

- Safety issues **must** be addressed for successful hydrogen technology development
- Safety issues can be a ‘deal breaker’
- Hydrogen technology proponents and stakeholders cannot begin to individually understand or know how to effectively address all relevant safety issues
- Proponents and stakeholders are on a challenging ‘technology highway’ that is improved when they all collaborate
- A trusted source of information on hydrogen safety can drastically change the ‘view from the road’ and ‘success of the trip’

Responding to Incidents

As the number of fueling stations and vehicles increases, more safety-related events and accidents may occur.

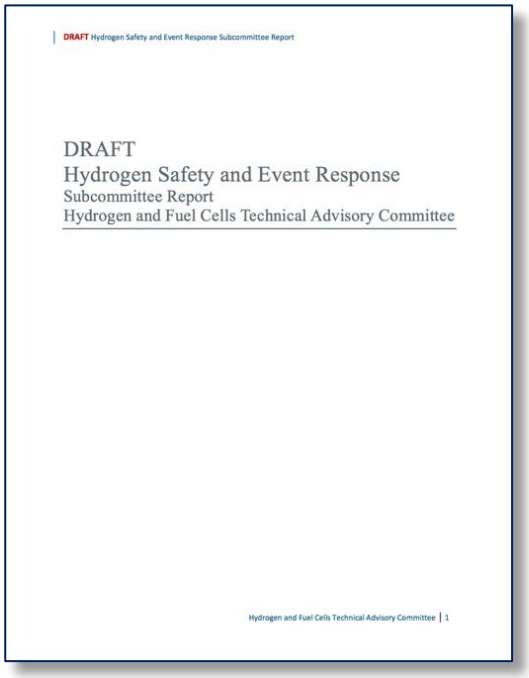
- In the event of an incident, communicating clear and accurate information with authorities, stakeholders, and the public is the foundation of effective decision making and response.

This is distinctly important for hydrogen as it is a new retail fuel for which there is not yet a broad awareness, understanding, and acceptance of its safety.

The Need for a Comprehensive, Consistent, and Coordinated Response to Hydrogen Safety-related Events

A subcommittee of the Hydrogen and Fuel Cell Technical Advisory Committee (HTAC) members worked together beginning in January 2016 to review and assess current resources[1] such as:

- safety plans
- event response plans
- current federal, state, and local requirements
- case studies


DRAFT Hydrogen Safety and Event Response Subcommittee Report

DRAFT
Hydrogen Safety and Event Response
Subcommittee Report
Hydrogen and Fuel Cells Technical Advisory Committee

Hydrogen and Fuel Cells Technical Advisory Committee | 1

The goal was to **identify gaps and recommend actions** to address current and projected needs.

[1] This activity is within HTAC's scope as outlined in its charter to "...review and make recommendations to the Secretary on...the safety, economical, and environmental consequences of technologies for the production, distribution, delivery, storage, or use of hydrogen energy and fuel cells."

Recommendations of the HTAC Task Group for Addressing the Gaps

1. **Maximize the Hydrogen Safety Panel (HSP)**
2. Leverage the Capabilities of Public–Private Partnerships
3. Reopen Hydrogen Stations in a Timely Fashion after a Safety-Related Incident
4. Identify and Support Other Federal and State Agencies

Focusing on the Hydrogen Safety Panel

"Maximize the Role of the Hydrogen Safety Panel"

- *positioning the HSP as a trusted resource on hydrogen safety*
- *ensuring the HSP is visible and accessible*
- *fostering relationships with the hydrogen technology safety community*

Making the Connection

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Utilizing the HSP

The HSP is an expert based resource that can play several potential roles:

- **During project development, through launch, and during ongoing operations:**
  - Provide advice and safety resources
- **After a safety related incident:**
  - Interpret event information and investigate
- **Once an investigation is complete:**
  - Propose facility and operations modifications
  - Conduct site visit to confirm modifications have been implemented and minimize the potential for reoccurrence

Overview of the Hydrogen Safety Panel (HSP)

HSP Goal: **Support U.S. energy security by enabling the safe and timely transition to hydrogen and fuel cell technologies**

Objectives

- Provide expertise and recommendations and assist with identifying safety-related technical data gaps, best practices and lessons learned
- Help integrate safety planning into R&D and other funded projects to ensure that all projects address and incorporate hydrogen and related safety practices

Name	Affiliation
Nick Barilo, Manager	Pacific Northwest National Laboratory
Richard Kallman, Chair	City of Santa Fe Springs, CA
Eric Binder	Santa Monica Fire Department
Ken Boyce	UL LLC
David Farese	Air Products and Chemicals
Donald Frikken	Becht Engineering
Livio Gambone	CSA
Aaron Harris	Air Liquide
Chris LaFleur	Sandia National Laboratories
Miguel Maes	NASA-JSC White Sands Test Facility
Steve Mathison	Honda Motor Company
Larry Moulthrop	Proton OnSite (retired)
Glenn Scheffler	GWS Solutions of Tolland
Tom Witte	Witte Engineered Gases
Robert Zalosh	Firexplo

Examples HSP Impact on Infrastructure Rollout

- The HSP provided safety resources for critical support of the 2016 California Energy Commission (CEC) general funding opportunity for construction of 16 new hydrogen fueling stations
- HSP held meetings at over 25% of the locations associated with existing hydrogen fueling stations involving builders, code officials, and other state officials and stakeholders to discuss safety issues and lessons learned from recent station deployments

More Work is Needed to Avoid Repeating Past Mistakes

Fuel Cell Transit Bus Fueling Station Case Study

- Advance training on the unique conditions of hydrogen storage systems for first responders is of critical importance
- There was confusion amongst first responders about the differences between a liquid hydrogen storage system and liquefied natural gas
- The area evacuated was not consistent with the hazard

March 2017 Discussions with Code Officials

- Discussion confirmed the assumption that first responders were not trained on hydrogen safety and response

> Those that fail to learn from history are doomed to repeat it.
>
> -Winston Churchill
> 1874-1965

Four Objectives of the HTAC HSP Recommendation

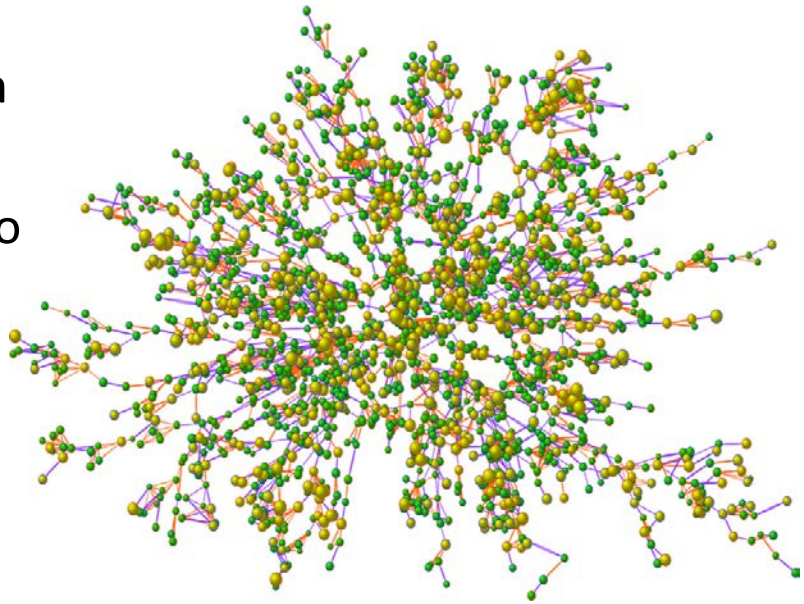
- **Raise awareness** of the HSP and H_2Tools among state/local officials and project developers
- **Establish working relations** with key state and local organizations to enable seamless incident response
- **Identify types of project**s that would benefit from HSP involvement
- **Identify methods** to facilitate outside organizations paying for HSP services

Photo credit: Venessa Miemis via Foter.com / CC BY-NC-SA

HSP is Visible and Accessible

Stakeholders must know about HSP and its availability to:

- Assist with implementing safe projects
- Participate in fact finding and investigation of incidents
- Bring lesson learned from incidents back to inform new projects



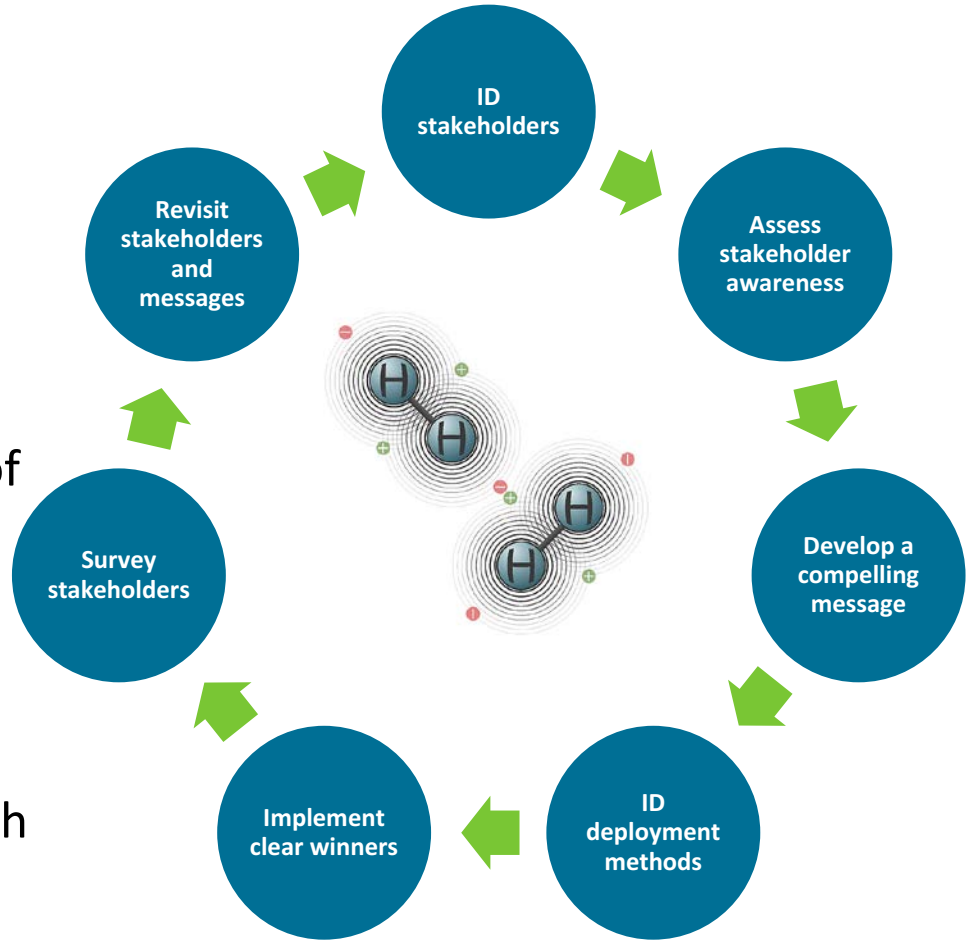
Focus will be on:

- Who the HSP is, what the HSP does, and how to contact the HSP
- Where to find additional safety resources: http://h2tools.org/

HSP as 'The Trusted Source on H2 Safety'

Activities

- Identify hydrogen technology proponents and stakeholders, their safety roles, and challenges
- Develop compelling messages that focus on the importance of each in ensuring hydrogen technology safety
- Show how their value in ensuring hydrogen technology safety can be enhanced through the HSP



Developing Relationships and Partnerships

- Identify national and state level organizations
- Develop a basis for collaboration
- Visit with members of each organization
- Formalize collaborative relationships

National Association of STATE FIRE MARSHALS

ICC INTERNATIONAL CODE COUNCIL

NASEO National Association of State Energy Officials

Cal OES GOVERNOR'S OFFICE OF EMERGENCY SERVICES

Safety is paramount - its the first question we get asked in California when we go into local communities. If anything, we need to figure out how to expand the Safety Panel's reach. The reviews from the Panel have already shown benefit to the state - its a crucial, trusted 3rd party resource. – 2015 DOE AMR Reviewer Comment

Projects That Could Benefit From HSP Involvement

The Panel's expertise and vast experience makes it uniquely positioned to ensure investments in hydrogen technologies are of high yield

Can support:

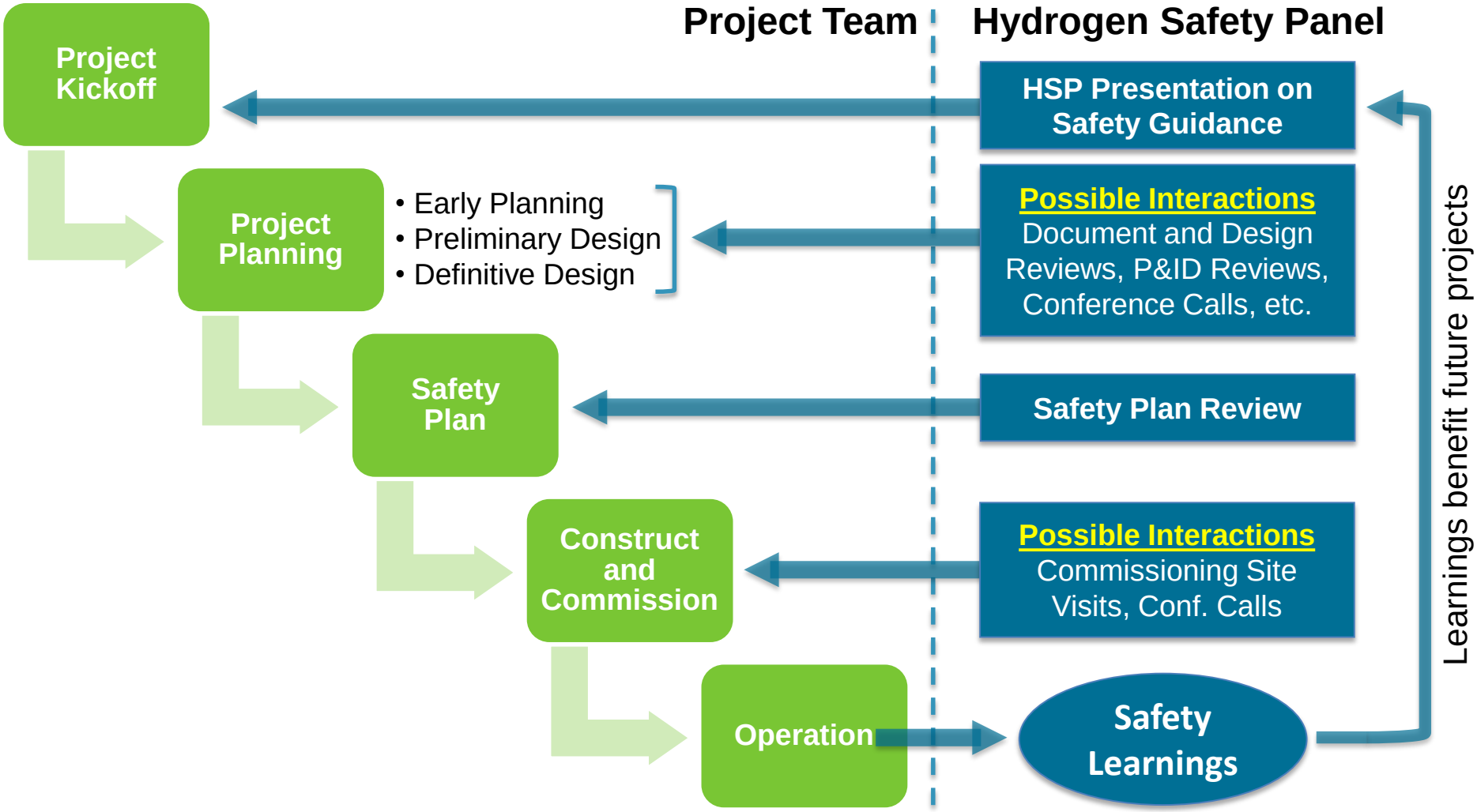
- Federal agencies and agencies that receive federal support
- State and local agencies
- Private industry and commercial installers

Types of Activities:

- Review designs and supporting documentation
- Participation in or review of risk assessments
- Site reviews

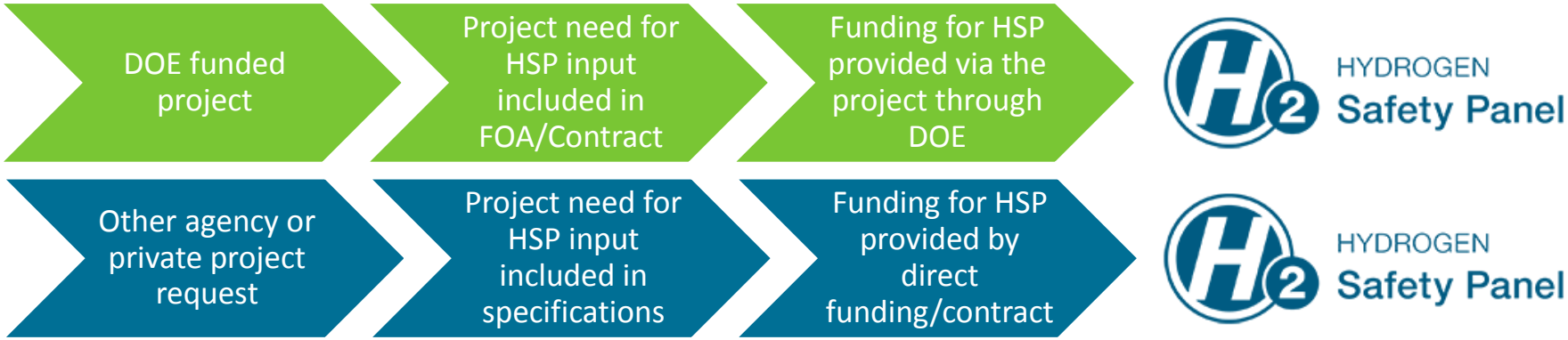
"I cannot emphasize enough how vital & timely the HSP involvement was during this [H-Prize] competition – appropriately informing our product safety architecture, and enabling us to galvanize our appliance design." **Darryl Pollica, IVYS Energy Solutions**

Optimal HSP Project Interaction



Resourcing the HSP

Accessing the HSP



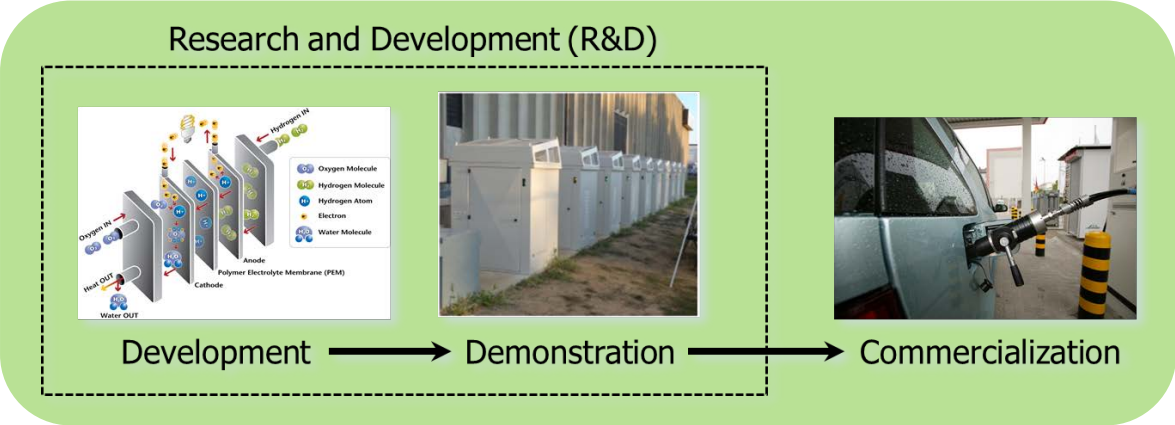
- The HSP is a unique resource that can provide significant benefit to hydrogen projects (having learnings from 460+ reviews covering a wide range of R&D and demonstration activities)
- A project-funded model for DOE R&D will enable an appropriate support that is a "justifiable benefit" (bringing learnings to new activities)
- Mechanisms are in place to facilitate non-DOE utilization of the HSP (e.g., CEC)
- Continued need to identify project and funding opportunities in other federal agencies and private industry

Support for Other Report Recommendations

2. Leverage Public–Private Partnerships
   - Expand tiger teams to include hydrogen – **a subgroup of HSP could function as a tiger team if it were formalized within the Clean Cities process or other opportunities**.
3. Reopen Hydrogen Stations in a Timely Fashion after a Safety-Related Incident
   - Develop a guidebook on incident recovery that the HSP can use during outreach and initial engagement with project developers and state and local officials – **the HSP can help develop and deliver the guidebook**.
   - Develop virtual training courses that demonstrate what first responders can expect during a hydrogen leak or fire at a fueling station – **other parts of the PNNL H_2 safety program are well positioned to do this**.
4. Identify and Support Other Federal and State Agencies
   - **A formal outreach plan has been drafted by PNNL. Additionally, activities in California and work with the Federal Energy Management Program are examples of how this might work moving forward.**

The Need for HSP to Continue Support of R&D Activities

HSP expertise and shared learnings can benefit all these activities



The purpose of R&D is to develop new products, and the approaches used there don't necessarily translate to safe or code compliant configurations for commercial deployment.

Some potential reasons why:

- Manufacturers generally use design engineers rather than safety engineers to design products. This can result in a product that performs well but may not comply with the safety, health or environmental standards or requirements[1].
- Designers and stakeholders may not have the experience to recognize and address specific safety issues.

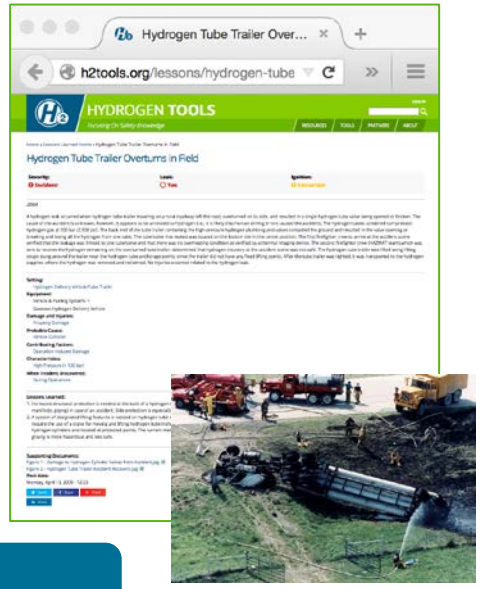
Safety issues can be a barrier – but need not be if managed effectively starting early in R&D. If unsafe practices are overlooked during the R&D phase, they may be a barrier towards acceptance and result in negatively impacting its deployment.

1 American Council of Independent Laboratories, The Value of Third Party Certification, Washington, DC, April 11, 2002.

Key Resource – Hydrogen Tools Portal

User Groups

- AHJ/code officials
- First responders
- Operations and maintenance
- Project proponents
- Research and development



Training for First Responders, Code Officials and Researchers

User Group Networking

Compatibility of Materials

Codes and Standards Tools

Properties, Calculators & Bibliographic Database

HSP

Lessons Learned and Best Safety Practices

H_2Tools Portal

QRA Tools (coming soon)

Summary

- As the number of fueling stations and vehicles increases, more safety-related events and accidents may occur
- Safety issues and incidents can impact the interests of hydrogen proponents/stakeholders and their realization of the benefits associated with its use
  - *Impacts can affect one proponent or stakeholder, or the entire industry*
- The availability and communication of safety-related information is critical to ensuring that the impacts from any incidents are minimized
- Who lends support to assuring the safe deployment of hydrogen technologies?

Photo credit: Foter.com

The HSP is valued as a trusted resource – they understand the technology and safety issues, they have been and should continue to be invaluable resource for safety planning and recovering from incident.

For additional information…

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OR VISIT:

http://h2tools.org

for more Hydrogen Safety related news and the latest resources