Hydrogen Safety Panel: Shaping Safety Awareness and Practice

Steven C. Weiner and Nick Barilo

presented to

Mary Kay O’Connor Process Safety Center
International Symposium
College Station, TX

October 28, 2008
Outline

- U.S. Department of Energy Hydrogen Program and the Context for Safety
- Hydrogen Safety Panel
  - Safety Planning, Project Safety Reviews, Other Work
  - What Have We Learned?
- Safety Knowledge Tools
  - Incident Reporting and Lessons Learned
  - Hydrogen Safety Best Practices
- Concluding Remarks
- Q&A
The DOE Hydrogen Program is structured to address the wide range of barriers facing hydrogen and fuel cell commercialization.
Goal of the DOE Hydrogen Safety Program

Develop and implement the practices and procedures that will ensure safety in the operation, handling and use of hydrogen and hydrogen systems for all DOE hydrogen projects and utilize these practices and lessons learned to promote the safe use of hydrogen

Ref: Multi-year Research, Development and Demonstration Plan: 2005-2015, October 2007, Section 3.8
http://www1.eere.energy.gov/hydrogenandfuelcells/mypp/
From Laboratory to Demonstration
Hydrogen Safety Panel

- Provide expertise and guidance to DOE and assist with identifying safety-related technical data gaps, best practices and lessons learned
- Integrate safety planning into funded projects for DOE to ensure that all projects address and incorporate hydrogen and related safety practices
# Hydrogen Safety Panel

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization/Position</th>
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<tbody>
<tr>
<td>Richard Kallman, Chair</td>
<td>City of Santa Fe Springs, CA</td>
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<tr>
<td>Steven Weiner, Program Manager</td>
<td>PNNL</td>
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<tr>
<td>Addison Bain</td>
<td>NASA (ret)</td>
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<td>Harold Beeson</td>
<td>NASA White Sands Test Facility</td>
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<td>David Farese</td>
<td>Air Products and Chemicals</td>
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<td>Don Frikken</td>
<td>Becht Engineering</td>
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<td>Michael Pero</td>
<td>Hydrogen Safety, LLC</td>
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<td>Harold Phillippi</td>
<td>ExxonMobil Res and Eng</td>
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<td>Glenn Scheffler</td>
<td>GWS Solutions of Tolland LLC</td>
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<td>Andrew Sherman</td>
<td>Powdermet Inc.</td>
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<td>Ian Sutherland</td>
<td>General Motors</td>
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<td>Robert Zalosh</td>
<td>Firexplo</td>
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<td>Nick Barilo, Technical Support</td>
<td>PNNL</td>
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<tr>
<td>Ed Skolnik, Technical Support</td>
<td>Energetics</td>
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Achieving the Vision …

▶ Safety-related technical data gaps are identified and addressed.

▶ Project teams are aware of relevant issues and best practices that affect safe operation and handling of hydrogen and related systems.

▶ Project teams give sufficient priority to safety in their work.
Conducting safety reviews (site visits and telephone interviews)

Providing tools needed for safety planning

Reviewing project safety plans

Sharing safety knowledge and best practices broadly across the DOE project portfolio

Continuing to present and recognize safety as a priority

Capturing lessons learned from safety events
Hydrogen Safety Panel: The Approach

- Focus on engagement, learning and discussion with project teams rather than on audit or regulatory exercises
- Build on, rather than duplicate, the efforts of other hydrogen-related organizations, partnerships and initiatives
Examples of What We Have Learned…

… from project safety site visits and safety plan reviews for broader benefits

- Hydrogen storage and handling facilities
- Asphyxiating gases
- Management of change
The design and siting of hydrogen systems typically present several options. The safety vulnerability analysis for handling, moving and distributing hydrogen should include the likelihood that increasing quantities of hydrogen will be required for future work in a given facility/location.
Management of Change

Any proposed change to materials, technology, equipment, procedures or facility operation should be reviewed for its effect on the analysis of safety vulnerabilities. This principle applies to hazardous work at the frequently changing laboratory scale.
Nitrogen (and other gas) asphyxiating incidents occur in a variety of facilities including industrial plants, laboratories and medical facilities. The use of enclosed spaces, such as laboratories or glove boxes, requires the assessment of the quantity, storage and flow rate of asphyxiating gases, the adequacy of ventilation and the need for oxygen depletion sensors.
H₂ Safety Best Practices

Welcome!

What is a best practice?
A best practice is a technique or methodology that has repeatedly led to a desired result. Using best practices is a commitment to utilizing available knowledge and technology to achieve success.

What is H₂BestPractices.org?
A website dedicated to hydrogen-related best practices and lessons learned. The website is a collection of resources, including best practices, case studies, and other valuable information for those working in the hydrogen industry.

Welcome to the H₂ Safety Best Practices website!

Purpose of the H₂ Safety Best Practices website:
The purpose of the H₂ Safety Best Practices website is to share the best practices and lessons learned in the field of hydrogen safety. The website includes a variety of resources, including best practices, case studies, and other valuable information for those working in the hydrogen industry.

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What is H2BestPractices.org?

A wealth of knowledge and experience related to safe use and handling of hydrogen exists as a result of an extensive history in a wide variety of industrial and aerospace settings. Hydrogen is gaining increasing attention worldwide as a possible energy storage medium, for later conversion to electricity through fuel cells or for use as a combustion fuel. This focus has introduced many new participants to research, development, demonstration, and deployment of hydrogen technologies (e.g., fuel cell vehicles and stationary fuel cells).

The purpose of the Hydrogen Safety Best Practices online manual is to share the benefits of extensive experience by providing suggestions and recommendations pertaining to the safe handling and use of hydrogen. Best Practices have been compiled from a variety of resources, many of which are in the public domain and can be downloaded directly from the References section. Many others can be obtained via reference links found at various places within the manual.

Best Practices are organized under a number of hierarchical categories in this online manual, beginning with those displayed down the left-hand column. Because of the interdependence of the topical areas, however, individual pages are often accessible via multiple internal links. A web-based electronic document format lends itself well to this type of overlapping content.

Website features

Please notice the mouse-over feature on this website. When a word in the text appears in blue font, you can see its definition by placing your cursor over the word. All the definitions are compiled into a Glossary that can be accessed from the References section of every page. There is also an Acronym list and a Bibliography that can be accessed from every page. When you click on the link to the Bibliography, it will take you to the alphabetized list of references for the particular section from which you accessed it. Please contact us if you notice any definitions, acronyms, or references that should be in these lists but aren’t.

A word about safety

No information resource can provide 100% assurance of safety. Personnel with applicable expertise should always be consulted in designing and implementing any system carrying a potential safety risk.

This online manual is directly linked to a companion website - H2Incidents.org - to provide unambiguous illustration of the importance of following safe practices and procedures when working with and around hydrogen. Like virtually all energy forms, hydrogen can be used safely when proper procedures and engineering techniques are followed, but its use still involves a degree of risk that must be respected. The importance of avoiding complacency and/or haste in the safe conduct and performance of projects involving hydrogen cannot be overstated.
Safety Practices

- Safety Culture
- Safety Planning
- Incident Procedures
- Communications

Design and Operations

- Facility Design Considerations
- Storage and Piping
- Operating Procedures
- Equipment Maintenance
- Laboratory Safety

*Integrating extensive historical experience and learnings from Panel work with other practices*
What is H2Incidents.org?

A unique resource for sharing of safety events and lessons learned gained from actual experiences using and working with hydrogen with the goal of preventing similar incidents in the future.

Pacific Northwest
NATIONAL LABORATORY
Learning Lessons from Safety Events

- Description
- Severity
- Setting
- Equipment
- Characteristics
- Damage and injuries
- Probable cause
- Contributing factors

Lessons Learned and Mitigation Steps
Concluding Remarks

Policies

Plans

Practices
Thank You!

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