



Safety Practices and Lessons Learned: The Work of the Hydrogen Safety Review Panel

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Outline

- ▶ DOE Hydrogen Safety Program Goal
- ▶ Hydrogen Safety Review Panel: Its Role and Work
- ▶ Safety Practices and Lessons Learned
- ▶ Q&A



Hydrogen Safety Program Goal

Develop and implement the practices and procedures that will ensure safety in the operation, handling, and use of hydrogen and hydrogen systems for all U.S. Department of Energy (DOE) projects and to utilize these practices and lessons learned to promote the safe use of hydrogen throughout the emerging hydrogen economy.

Ref: HFCIT Multi-Year Program Plan, February 2005



Hydrogen Safety Review Panel

Don Frikken, Chair	Becht Engineering
Addison Bain	NASA
Harold Beeson	NASA White Sands
David Farese	Air Products and Chemicals
Richard Kallman	City of Santa Fe Springs, CA
Michael Pero	Hydrogen Safety, LLC
Harold Phillippi	ExxonMobil Research and Engineering
Jesse Schneider	DaimlerChrysler
Andrew Sherman	Powdermet Inc.
Rody Stephenson	Motor Vehicle Fire Research Institute
Bob Zalosh	Worcester Polytechnic Institute



Hydrogen Safety Review Panel serves to...

- ▶ provide expertise and guidance to the DOE and assist with identifying technical data gaps, best practices and lessons learned
- ▶ help DOE integrate safety planning into funded projects to ensure that all projects address and incorporate hydrogen safety requirements.



Hydrogen Safety Review Panel accomplishes their work by...

- ▶ discussing best practices and new insights that bear on safety with project teams
- ▶ addressing project-specific safety issues
- ▶ identifying project-specific findings that can have a broader benefit in the DOE program.



Hydrogen Safety Review Panel conducts and evaluates...

- ▶ safety plan reviews
- ▶ telephone interviews
- ▶ safety questionnaires
- ▶ project site visits.



Safety Practices and Lessons Learned

- ▶ Safety Plans
- ▶ Hydrogen Storage/Handling Facilities
- ▶ Equipment Maintenance and Sensor Calibration
- ▶ Management of Change
- ▶ Asphyxiating Gases
- ▶ Hydrides and Other Hydrogen Storage Materials
- ▶ Safety Event Reporting



Safety Plans

“Living” plans require the comprehensive identification and analysis of safety vulnerabilities, effective measures to mitigate risks and ongoing communications to enhance and implement safety practices and lessons learned.



Hydrogen Storage/Handling Facilities

The design and siting of hydrogen systems 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.



Equipment Maintenance and Sensor Calibration

Written procedures and logs for equipment maintenance and calibration of safety-related sensors serve a similar functionality as standard procedures for experiments and operations. Procedures should follow manufacturer recommendations or other accepted standards.



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.

Asphyxiating Gases

Nitrogen asphyxiation 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.



Hydrides and Other Hydrogen Storage Materials

Small quantities of hydrogen-containing materials, which are not well characterized, should be handled with procedures that assume a “worst case” for that class of materials, intermediates or precursors. To ensure integrity, hazard analysis might include calculating the maximum volume of hydrogen that could evolve from an otherwise sealed container.



Safety Event Reporting

A reporting system delivers valuable lessons learned to participants in the DOE Hydrogen Program and others. This system requires information sharing, degrees of confidentiality and a commitment to create higher learning value from incidents and near-misses.

Safety Event Reporting Incidents and Near-Misses

- ▶ An ***incident*** is an event that results in
 - a lost-time accident and/or injury to personnel,
 - damage and/or unplanned downtime for equipment, facilities or property,
 - impact to the public or environment,
 - any hydrogen release that unintentionally ignites or is sufficient to sustain a flame if ignited,
 - any hydrogen release which accumulates above the lower flammability limits within an enclosed space.
- ▶ A ***near-miss*** is an event that under slightly different circumstances could have become an incident.

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