DOE Hydrogen Program

Hydrogen Safety Panel

presented by

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for the

DOE Hydrogen Program Review

June 12, 2008

Project SCS6
PNNL-SA-60080

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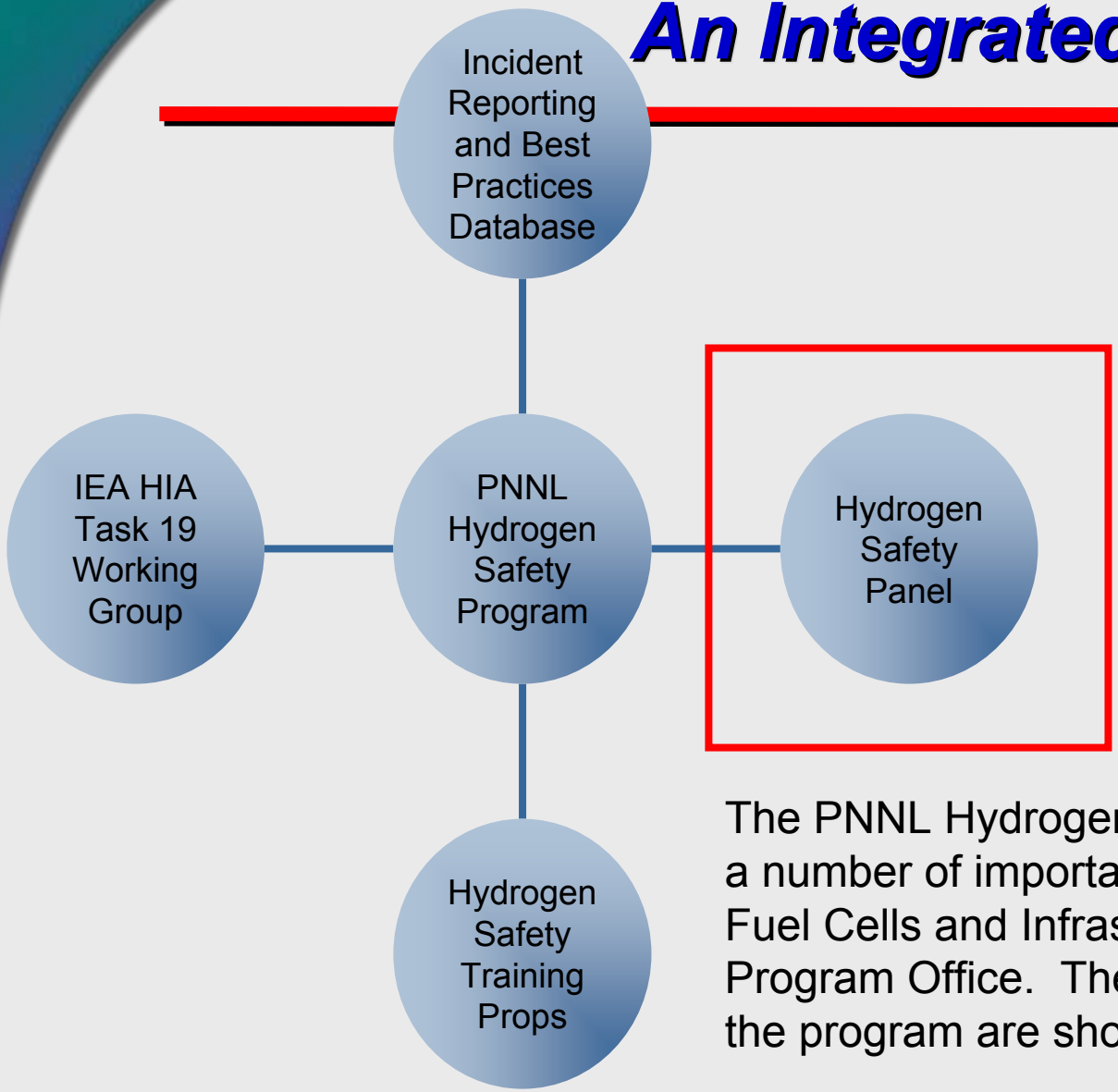
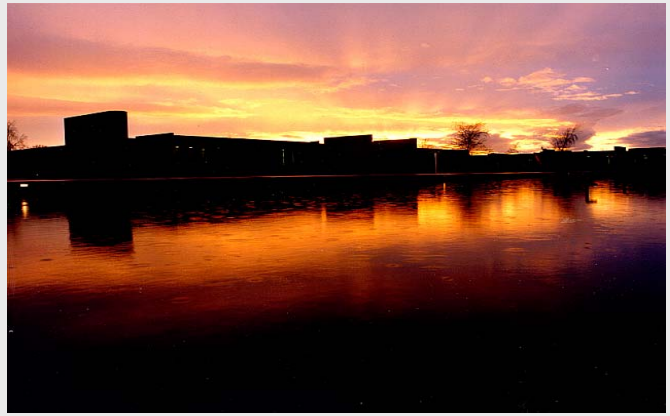
PNNL Hydrogen Safety Program
An Integrated Approach





The PNNL Hydrogen Safety Program contributes a number of important activities to the Hydrogen, Fuel Cells and Infrastructure Technologies Program Office. The current main elements of the program are shown here.

Overview

Timeline

- First Panel meeting: December 11, 2003
- Continuing

Budget

- FY07 = $850K
- FY08 = $900K

Barriers addressed

E. Variation in standard practice of safety assessments for components and energy systems

F. Safety is not always treated as a continuing process

G. Expense of data collection and maintenance

Partners

- Energetics
- Panel member organizations
- IEA Hydrogen Implementing Agreement

Hydrogen Safety Panel

Don Frikken, Chair	Becht Engineering
Steven Weiner, Program Manager	Pacific Northwest National Laboratory
Addison Bain	NASA (ret)
Harold Beeson	NASA White Sands Test Facility
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
Glenn Scheffler	GWS Solutions of Tolland LLC
Andrew Sherman	Powdermet Inc.
Ian Sutherland	General Motors
Robert Zalosh	Firexplo
Nick Barilo, Technical Support	Pacific Northwest National Laboratory
Ed Skolnik, Technical Support	Energetics

Objectives

- Provide expertise and guidance to DOE and assist with identifying safety-related 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 and related safety practices

What are we trying to achieve?

- DOE and the Hydrogen Safety Panel are trying to achieve safe operation, handling and use of hydrogen and hydrogen systems for all DOE projects. That vision will be achieved when
  - 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.

Hallmarks of Our Approach

- Engage Panel members, OEMs, energy companies, international partners, first responders and other stakeholders in all aspects of our hydrogen safety program
- Focus interactions with projects teams on learning, knowledge sharing and encouragement of thorough, continuous and priority attention to safety…rather than as audit or regulatory exercises

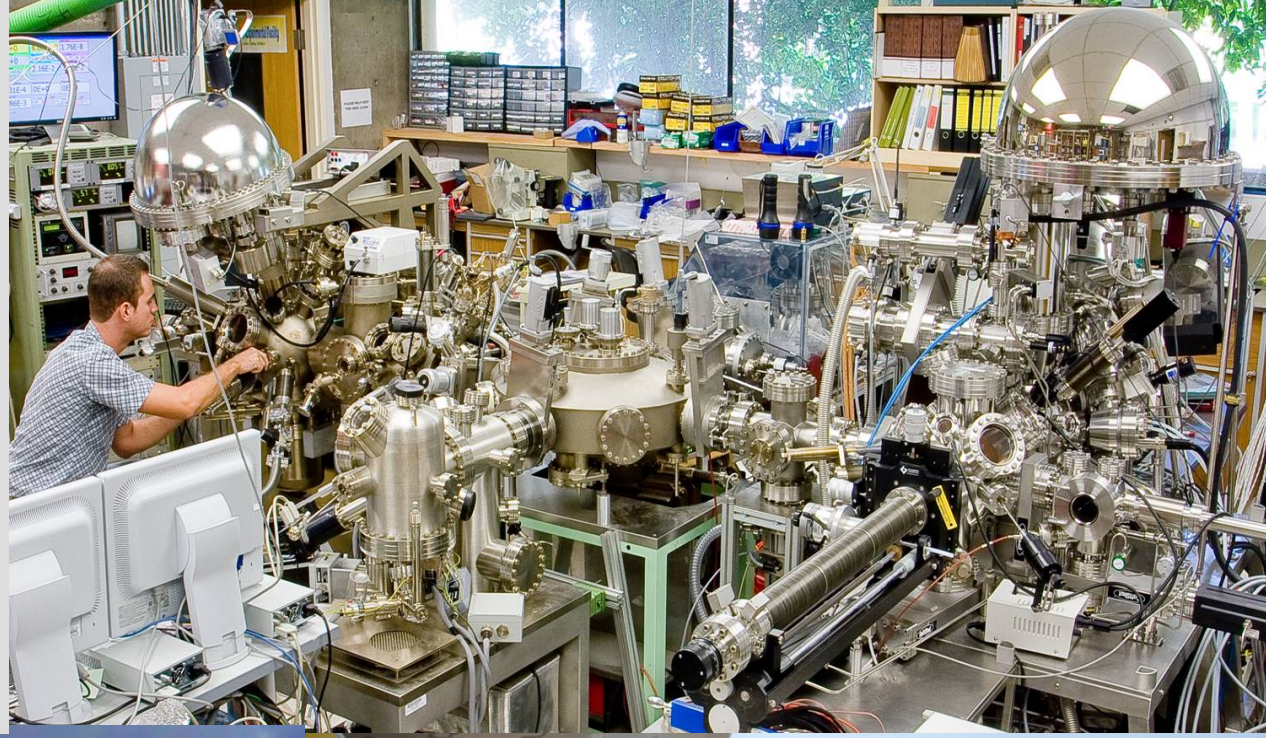
Technical Accomplishments, Progress and Results

- Provided technical guidance and review for hydrogen incident reporting and hydrogen safety best practices databases and tools
  - H2Incidents.org
  - H2BestPractices.org
- Panel Recommendation to DOE (May 2007): *Potential Fire Suppression Agents for Metal Hydride Fires*
  - Reactivity and fire test program aimed at promising hydrogen storage candidate materials
  - Presented to Codes and Standards Tech Team (July 2007)
  - Paper reviewed by Hydrogen Storage sub-program

Technical Accomplishments, Progress and Results (continued)

- Reviewed 34 safety plans since 2007 Annual Merit Review
  - Hydrogen Storage
  - Production and Delivery
  - Fuel Cells
- Panel examined the role and conduct of telephone interviews and established protocol for such safety reviews
- Conducted 27 safety reviews (5 since 2007 Annual Merit Review) of production, storage, fuel cells and technology validation projects (March 3, 2004 – first site visit)

From Laboratory to Demonstration



Technical Accomplishments, Progress and Results (continued)

- *Safety Planning Guidance for Hydrogen Projects, November 2007* updated by the Panel and adopted by DOE
  - In 2004, *Panel first reviewed Guidance for Safety Aspects of Proposed Hydrogen Projects, Rev 1, July 2003*.
  - This update incorporates safety planning checklist, discussion, references and the DOE requirement for safety plans
  - The document serves a dual purpose
    - A statement of the DOE requirement
    - A resource for project teams preparing safety plans

Technical Accomplishments, Progress and Results (continued)

- Safety questionnaires help to identify project specific findings and learnings that can have broader benefit to the Hydrogen Program
  - 2006 – Incidents and near-misses reported and posted with consent and without attribution on "H2Incidents.org"
  - This year – Identifying the hydrogen hazards: (1) most likely to occur and (2) the potential to result in the worst consequence…and the safety measures in place
    - Used by the Panel in reviewing safety plans
    - Used as one mechanism for follow-up/safety reviews of specific projects

Technical Accomplishments, Progress and Results (continued)

- Conducted two meetings of the Hydrogen Safety Panel
  - PNNL, Washington, DC, June 17-18, 2007
  - NASA White Sands Test Facility, Las Cruces, NM, Dec 11-12, 2007
  - Next meeting: NREL, Golden, CO, June 24-25, 2008

Future Work

- Remainder of FY2008
  - Issue final reports with recommendations for all safety reviews conducted
  - Conduct project safety reviews
    - Telephone interviews
    - Site visits
  - Review project safety plans
  - Provide review for laboratory safety section of H2BestPractices.org
  - Develop safety bulletin concept
  - Propose FY2009 Annual Operating Plan (AOP) to DOE
- FY2009
  - Establish FY2009 work plan
  - Review project safety plans; conduct project safety reviews, etc.

A Summary
For Good Measure…

145 safety plans reviewed
27 safety reviews conducted
9 Panel meetings
5 “alumni” Panel members
4 Annual Merit Reviews
4 “good example” safety plans
4 “white paper” recommendations
3 updates to safety guidance document
1 accident investigation