



DOE Hydrogen Program

# ***Hydrogen Safety Panel***

presented by

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for the

**DOE Hydrogen Program Review**

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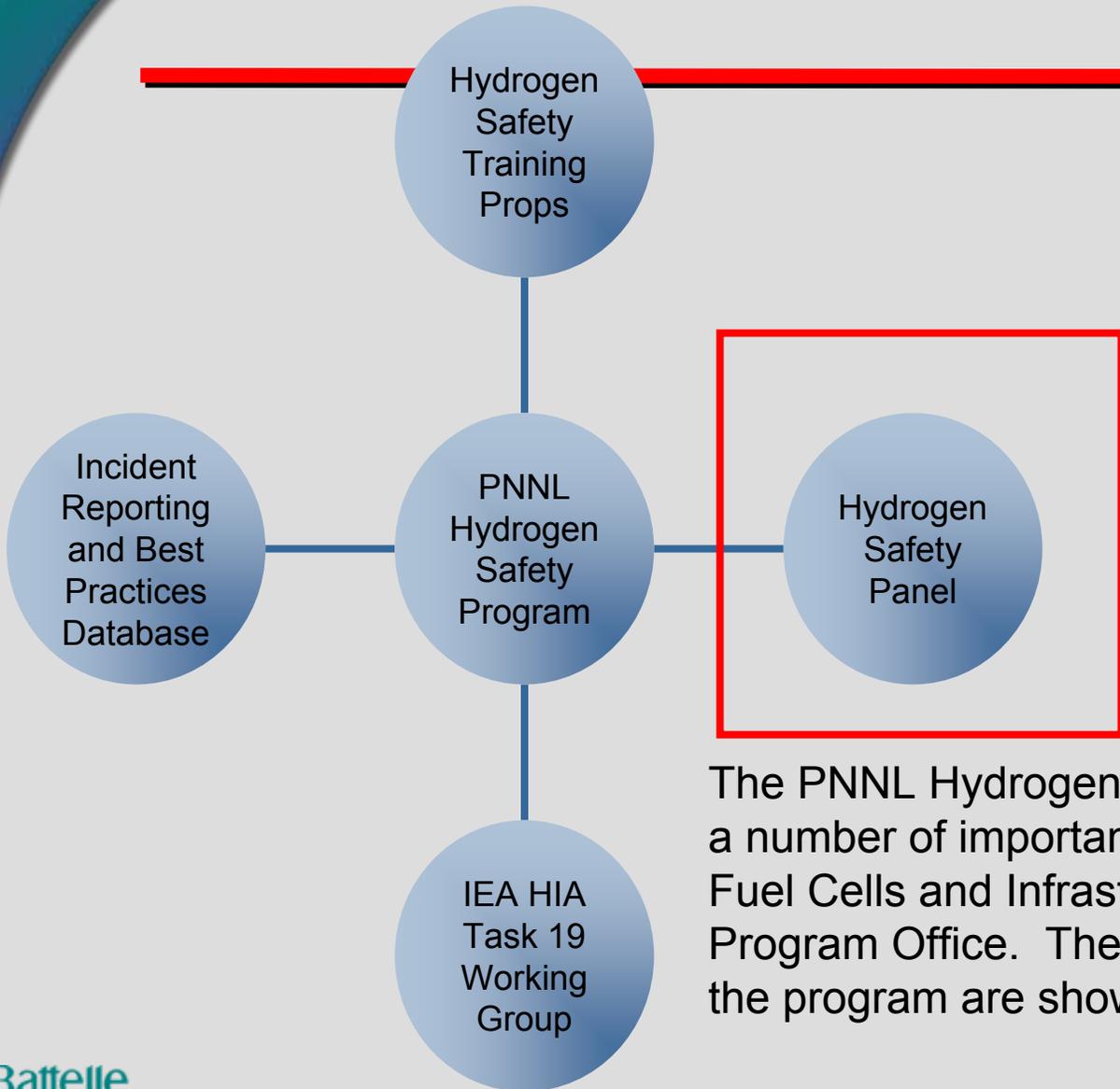
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**Project SA6**

**PNNL-SA-54855**

**Pacific Northwest  
National Laboratory**  
Operated by Battelle for the  
U.S. Department of Energy

# ***PNNL Hydrogen Safety Program***



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

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## Timeline

- First Panel meeting:  
Dec 11, 2003
- Continuing

## Budget

- FY06 = \$450K
- FY07 = \$750K

## Partners

- Energetics, Inc.
- Panel member organizations

## Barriers addressed

- A. Limited historical database
- B. Proprietary data
- C. Validation of historical data
- D. Liability issues
- 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

# Hydrogen Safety Panel

Don Frikken, Chair	Becht Engineering
Steven Weiner, Program Mgr.	Pacific Northwest National Laboratory
Nick Barilo, Technical Support	Pacific Northwest National Laboratory
Ed Skolnik, Technical Support	Energetics, Inc.
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
Jesse Schneider	DaimlerChrysler
Andrew Sherman	Powdermet Inc.
R. Rhoads Stephenson	Motor Vehicle Fire Research Institute
Robert Zalosh	Worcester Polytechnic Institute (ret)

# Objectives

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- ▶ 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

# *Approach*

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- ▶ Bringing a cross-section of relevant safety experience to bear on the success of the Hydrogen Program as a whole
- ▶ Focusing safety reviews on engagement, learning and discussion rather than as audit or regulatory exercises
- ▶ Reviewing safety plans to encourage thorough, continuous and priority attention to safety aspects of projects
- ▶ Identifying project-specific findings/learnings and bringing a broader benefit to the Hydrogen Program

# Technical Accomplishments, Progress and Results

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- ▶ Conducted two meetings of the Hydrogen Safety Panel
  - PNNL, Washington, DC, June 27-28, 2006
  - SNL, Livermore, CA, February 27-28, 2007
- ▶ Panel brainstorming, discussion and prioritization of initiatives to address: *What are we trying to achieve?*
  - Safety-related 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.
- ▶ Priorities identified
  - Safety reviews
  - Safety plan guidance and reviews
  - Provide safety information to principal investigators
  - Incident investigations

# ***Technical Accomplishments, Progress and Results (continued)***

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- ▶ Conducted 22 safety reviews (3 to-date in FY07) of production, storage, fuel cells and technology validation projects (March 3, 2004 – first site visit)
- ▶ Reviewed ~50 safety plans since 2006 Annual Merit Review
  - Hydrogen Storage
  - Production and Delivery
  - Fuel Cells

# ***Technical Accomplishments, Progress and Results (continued)***

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- ▶ Directed by DOE to modify operational aspects of the Panel while continuing to meet established Hydrogen Program objectives (July 2006)
  - Established charter for PNNL Hydrogen Safety Panel
  - Revised protocols for conducting safety reviews
  - Established protocol for reviewing reports and meeting information release requirements

# ***Technical Accomplishments, Progress and Results (continued)***

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- ▶ Met with DOE project officers to discuss Panel work and get input on safety planning guidance, status of safety plans and protocol for conducting site visit safety reviews (Jan 2007)
- ▶ Updated a draft of *Safety Planning Guidance for Hydrogen Projects* (April 2007)
  - Incorporates safety planning checklist, discussion, references and the DOE requirement for safety plans

# ***Technical Accomplishments, Progress and Results (continued)***

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- ▶ 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

# ***Technical Accomplishments, Progress and Results (continued)***

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- ▶ Fostered interaction and provided technical guidance for other hydrogen and related projects:
  - Controlled Hydrogen Fleet and Infrastructure Demonstration Program (NREL)
    - Reviewed improved NREL data templates and provided feedback
    - Explored accessing safety event learnings through “H2Incidents.org”
    - Proposed modifications to safety event definitions
  - Reviewed hydrogen fueling station safety documentation for DOE project office
  - Served on safety and technical inspection team for Challenge X competition sponsored by DOE FreedomCAR and Vehicle Technologies Program Office and GM

# Future Work

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## ▶ Remainder of FY2007

- Analyze safety questionnaire responses
- Review project safety plans
- Conduct project safety reviews
  - Telephone interviews
  - Site visits and reporting
- Submit safety guidance document with recommendation to DOE
- Provide guidance and input for the best practices database
- Conduct next Panel meeting (July 17-18, 2007)

## ▶ FY2008

- Utilize DOE and Panel member input for establishing FY2008 work plan
- Review project safety plans; conduct project safety reviews

# Summary

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- ▶ The Panel's contribution to the Hydrogen Program is about raising safety consciousness most directly at the project level.
- ▶ Safety must be treated as a continuing process that is driven at the project level by organizational policies and procedures, culture and priority.
- ▶ Active and continuing project safety reviews provide a resource of safety knowledge and learnings...
  - Being conscious of the need to use safe practices is a necessary first step that must be matched with the knowledge of what encompasses the development and implementation of a good safety plan.
  - Meshing the safety policies, practices and philosophies of partnering organizations into an overall safe project requires particular attention.