

# Hydrogen Safety Training for Researchers

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This presentation does not contain any proprietary or confidential information

**Project ID #  
SCS017**



# Overview

## Timeline

- Start date: **October 2007**
- End date: **Sept. 2012**
- Percent complete: **50%**

## Budget

- Total project funding
  - DOE: **\$400k**
- Funding for FY09:
  - **\$50k**
- Funding for FY10:
  - **\$50k**

## Barriers

- **H. Lack of H<sub>2</sub> knowledge**
- **I. Lack of H<sub>2</sub> training facilities**

## Partners

- **Detailed class peer review in collaboration with Hydrogen Safety Panel and Lab Safety Managers**



## Relevance: Appropriate H<sub>2</sub> safety instruction is key to avoiding accidents



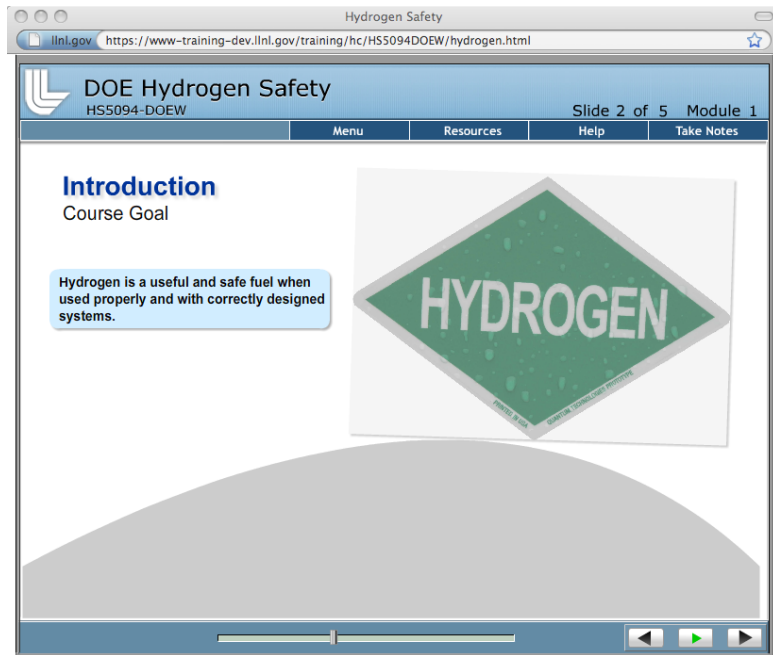
- **Laboratory researchers handling small amount of hydrogen need basic information on pressure, cryogenics, flammability, asphyxiation, and other risks and precautions for using hydrogen**



- **Technical personnel in charge of operations need comprehensive instruction on components, system design, assembly, and leak testing**



# Approach: minimize risk of accidents & maximize productivity through improved knowledge of H<sub>2</sub> properties and procedures



- **Web-based class** (4 hours) developed for laboratory researchers handling hydrogen



- **Hands-on safety class** (3 days) developed for technical personnel in charge of designing, assembling, and testing H<sub>2</sub> systems



# **Accomplishments: we have produced and peer reviewed a web-based hydrogen safety class for researchers**


- **Four hours long**
- **Six modules:**
  - **Introduction**
  - **Hydrogen properties**
  - **Pressure safety**
  - **Cryogenic safety**
  - **Emergency response**
  - **Codes and standards**
- **End of module quizzes (passing grade 85%)**
- **Web address: <https://www-training.llnl.gov/training/hc/HS5094DOEW/index.html#>**



# Class demonstration: pressure safety module

Hydrogen Safety

llnl.gov <https://www-training-dev.llnl.gov/training/hc/HS5094DOEW/hydrogen.html>

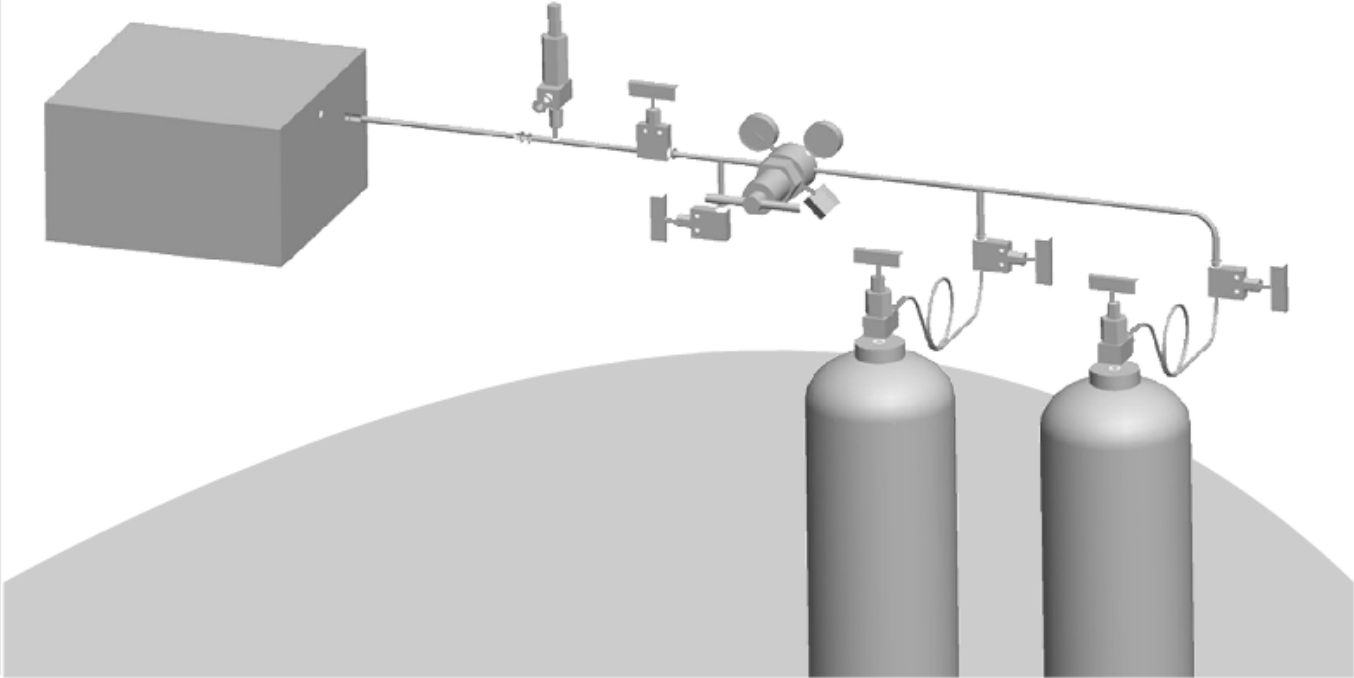
 **DOE Hydrogen Safety**  
HS5094-DOEW

Slide 1 of 58 Module 3

Menu Resources Help Take Notes

## Pressure Safety

### Introduction



Transferring data from www-training-dev.llnl.gov... One active download (3 minutes, 32 seconds remaining)



# We have developed a variety of instructional materials for 3-day hands-on hydrogen safety class



**Working table**



**pressure vessels**



**regulator**



**Relief device**



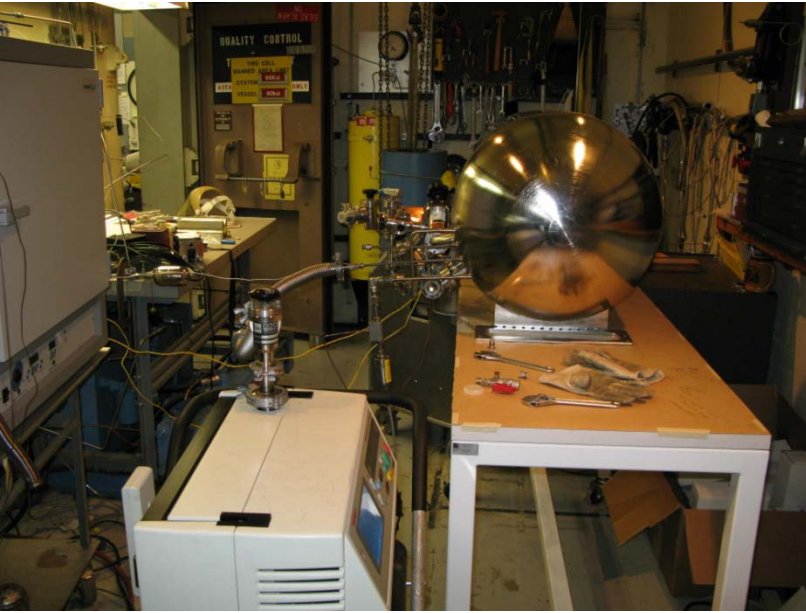
**pressure gauge**



**CGA fitting**



# LLNL's high pressure laboratory is well equipped for teaching and demonstration



- Cells rated for 5.1 pounds of TNT energy equivalent
- Cells rated for flammable gases (hydrogen)
- Pressure rating: 80,000 psi
- Full instrumentation
- Qualified personnel





## Future work: finalize web-based class and complete hands-on class

- ***Start operation of web-based class*** by running web site and keeping track of completions and scores.
- ***Maintain and continuously improve web-based class*** by collecting comments and suggestions and incorporating them into the class
- ***Complete preparation of hands-on class*** by developing student's workbooks, class notes, reference materials, and work tables.
- ***Teach hands-on class.*** We envision 3-day sessions with up to 6 students. Instruction at other institutions possible if appropriate facilities exist



# Collaborations

- **Extensive peer review (two rounds of reviews and 40 pages of comments) conducted by the [Hydrogen Safety Panel](#) and the [Laboratory Safety Managers](#).**
- **We look forward to collaborating with the hydrogen community for continuously improving class materials**



# Summary

- ***We are contributing to safe hydrogen operations*** by developing instructional materials for researchers and operators
- ***Web-based class*** (now complete) addresses the need of laboratory researchers handling small amounts of hydrogen
- ***Hands-on class*** (in process) will present in-depth information for technical personnel tasked with installing and testing hydrogen systems
- ***Participation from the hydrogen community*** will improve the class through suggestions, bug reports, etc.

