DOE Hydrogen Program

Hydrogen Safety: First Responder Education

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Project ID: ED-3

Overview

Timeline

- Project start date: 10/2004*
- On-going
- Percent complete, FY07: ~40%

Barriers Addressed

- Lack of Readily Available, Objective, and Technically Accurate Information
- Disconnect Between Hydrogen Information and Dissemination Networks
- Lack of Educated Trainers and Training Opportunities

Budget

- Funding in FY06: $325K
- Funding in FY07: $450K

(100% DOE funded)

* Pre-FY06 funding came from another part of the Safety, Codes and Standards program element.

Partners

- PNNL is working with the Volpentest Hazardous Materials Management and Emergency Response (HAMMER) Training and Education Center on education and outreach

VOLPENTEST HAMMER TRAINING AND EDUCATION CENTER

Objectives

- **Long-term Objective:**

  Support the successful implementation of hydrogen and fuel cell demonstration projects and market transformation by providing technically-accurate and objective information about hydrogen to first responders*

- **Objective for FY07**:

  Develop and disseminate education materials that pertain to hydrogen safety, aimed at the first-responder* audience

*Focus is on first responders (fire, law enforcement, and emergency medical personnel), who must know how to handle potential incidents; their understanding can also facilitate local project approval

Approach in FY07

- Task 1: Awareness-level Course (100% complete)

  Complete (and maintain) a stand-alone, interactive, web-based "awareness-level" course -- "Introduction to Hydrogen Safety for First Responders"

  (This also creates an information set that others can draw from to supplement their ongoing or planned education programs involved in the use of hydrogen and fuel cells)

- Task 2: Awareness-level Outreach (60% complete)

  Conduct outreach activities related to the "Introduction to Hydrogen Safety for First-Responders" course, and disseminate related materials

- Task 3: Prop-based Course (5% complete)

  Begin development of more-advanced course modules based on use of a mobile hydrogen fuel cell vehicle prop (under development in a companion project funded under the Hydrogen Safety, Codes and Standards program element)

Pre-FY07 Accomplishments: Awareness-level Course

- First responder outreach/interviews
- Internal DOE technical review
- Hydrogen Safety Panel review
- Pilot tests of course – given in person at HAMMER
  - August 2005 – industry experts, some first responders
  - April 2006 – first responders at Washington State Hazardous Materials Workshop Conference

August 2005 pilot

April 2006 pilot

Pre-FY07 Accomplishments: Awareness-level Course (cont'd)

Broad review of on-line course (Summer 2006) included more than 100 representatives from the hydrogen and emergency-response communities

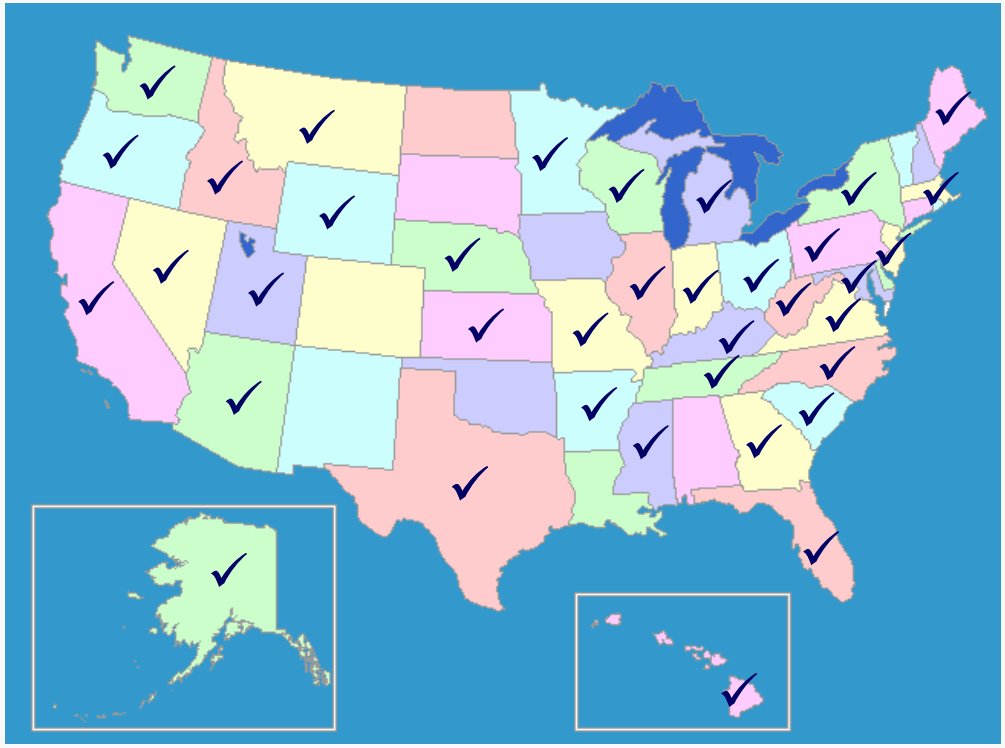
- ✓ Auto companies
- ✓ Energy companies
- ✓ Fuel cell companies
- ✓ FreedomCAR and Fuel Partnership C&S Tech Team
- ✓ National C&S Coordinating Committee
- ✓ Hydrogen/fuel cell trade associations – NHA/USFCC
- ✓ National Laboratories
- ✓ Other Federal agencies – DOT, DHS/USFA
- ✓ Hydrogen-related state organizations/entities – CAFCP, NextEnergy
- ✓ International partners – IPHE, HySafe, JARI, EC
- ✓ Fire protection/prevention membership associations – IAFF, NASFM
- ✓ Individual firefighters and law enforcement personnel and other emergency response experts – Extrication.com
- ✓ College fire science programs
- ✓ Alternative fuel experts
- ✓ Others (universities/nonprofits) involved in education, graphics design

FY07 Accomplishments: Task 1 – Awareness-level Course

- Final version of web-based course (in both Flash and accessible HTML), incorporating comments received, launched on January 24, 2007
  - http://hydrogen.energy.gov/firstresponders.html
- Announcement of course distributed to:
  - Broad review list
  - State firefighter training centers
  - International Association of Fire Fighters
  - International Association of Fire Chiefs
  - Federal Law Enforcement Training Center

Awareness-level Course: Usage and Feedback

The first 11 weeks (Jan 24 – Apr 10) averaged ~240 unique visitors/course reviewers per week



Also UK, Japan, Taiwan, Canada, Sweden, Korea

Who's Taking the Course?

- ✓ Fire prevention/protection community
  - → Firefighters
  - → Fire department education coordinators
  - → Fire marshals
  - → Fire plans examiners/inspectors
- ✓ Law enforcement
- ✓ Industry
- ✓ Universities
- ✓ Military
- ✓ Non-profits

A Sample of Comments Received

Very informative, we all need to see this.
Lt. Gary Brown
Fort Worth Fire Dispatch Office

Good online class!
George J. Fielden Jr., CFI
Deputy Fire Marshal
King of Prussia, PA

Good information. Quick study. Thanks!
Charles J. Gluck
Battalion Chief
Watsonville, CA
Fire Station #1

Great course.
Captain David L. Coble
In Service Coordinator
Fire Educational Services
Fort Worth Fire Dep't

Did this course during my lunch hour and really enjoyed it. Nice slides and well written instructions. Thank you for a pleasant learning experience.
Susan Wulf
Firefighter
South Frontenac Fire Department

Very informative presentation.
Jim Sills
Planning, Building Inspection, and Code Enforcement Dep't
Florence, South Carolina

Course Overview

Address http://www.ehammertraining.us/energy/hydrogen/controller.cfm Go Links

Introduction to Hydrogen Safety for First Responders

U.S. Department of Energy
Hydrogen Program
www.hydrogen.energy.gov

COURSE MATERIALS | LIBRARY | EXIT ▶

Hydrogen Basics | Transport & Storage | Hydrogen Vehicles | Hydrogen Dispensing | Stationary Facilities | Codes & Standards | Emergency Response | Summary

INCREASE YOUR H2IQ www.hydrogen.energy.gov

The Course Materials cover the following topics:

- Hydrogen Basics
- Transport & Storage
- Hydrogen Vehicles
- Hydrogen Dispensing
- Stationary Facilities
- Codes & Standards
- Emergency Response

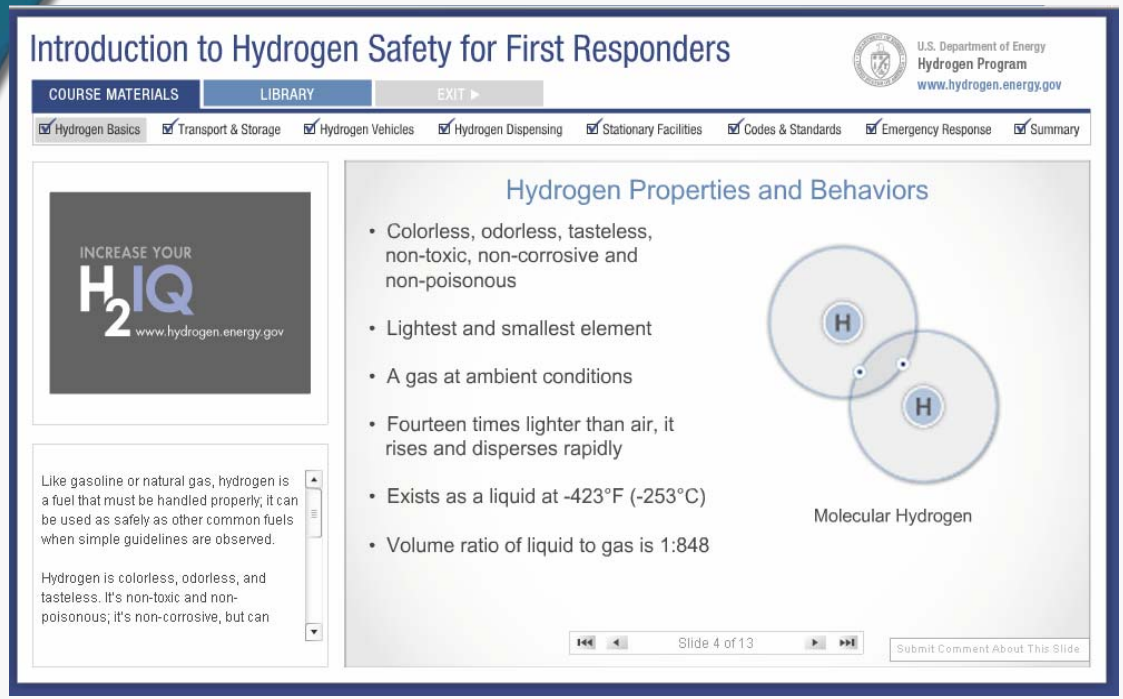
You can view the topic modules in sequence or select them in random order using the top navigation bar.

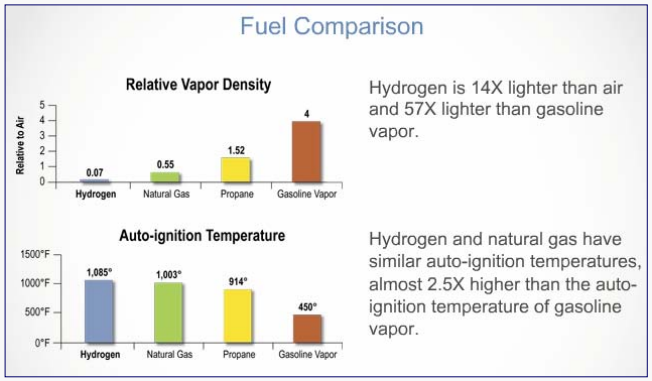
A short quiz follows at the end of the course. User responses will be collected but will not be attributed to you as an individual.

Begin the Course ▶

Done Internet

Example Course Module: Hydrogen Basics





Designing Safe Systems - Gaseous Hydrogen

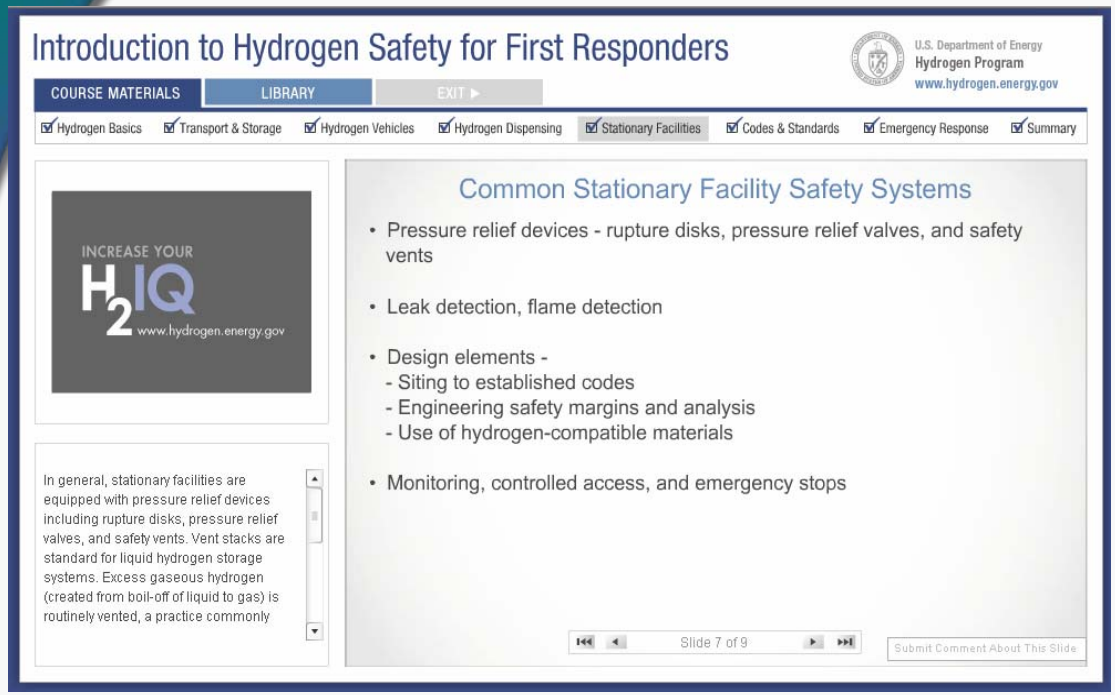
Characteristic	Potential Hazard	Control
• Colorless, odorless, tasteless	• Impossible for human senses to detect	• Detection sensors
• Low viscosity • Very small atom (can be absorbed into materials)	• Leaks • Embrittles certain materials; can result in structural failure	• Leak detection systems • Ventilation • Material selection
• Low volumetric energy density	• Stored at high pressures	• Storage container design • Pressure relief devices

- ✓ Basic properties
- ✓ Comparisons with other fuels
- ✓ Industry designs for safe systems

Example Course Module: Hydrogen Dispensing

- ✓ Refueling demonstration (video)
- ✓ Comparison to refueling with other fuels

Example Course Module: Stationary Facilities



Bulk Storage

- Includes both liquid and gaseous hydrogen storage in cylinders, tubes, and tanks
- Typically located at –
  - Refineries or other hydrogen production sites
  - Fueling facilities
  - Some stationary fuel cell installations
  - Research and development, testing, and manufacturing facilities
- Can be above ground (including on the canopy at a fueling station) and below ground

Liquid hydrogen is stored at Santa Clara Valley Transit Authority (CA), which operates fuel cell buses

Stationary Fuel Cells

- Generate electricity (and heat)
  - Uninterruptible power supply
  - Backup power
  - Power for remote locations
- Some direct-hydrogen units use on-site hydrogen storage
- Others (primarily larger units, >10kW) use natural gas or other fuel and an internal reformer

Fuel cell (left) and hydrogen storage (right) near Albany International Airport

Fuel cells at a municipal wastewater treatment plant in New York City, NY

Hydrogen Fueling Stations

- Typically combine bulk storage with refueling dispenser(s)
- May be designed to fuel cars, buses/large trucks, or forklifts with gaseous hydrogen, liquid hydrogen, or both
- Can be on private or industrial property, or in consumer retail settings, such as multi-fuel stations that provide gasoline and other fuels

This station owned by the Alameda-Contra Costa Transit District (CA) serves cars and buses

Washington, DC Shell fueling station (gasoline, diesel, hydrogen)

- ✓ Overview of bulk storage, stationary fuel cells, refueling stations
- ✓ Common safety systems

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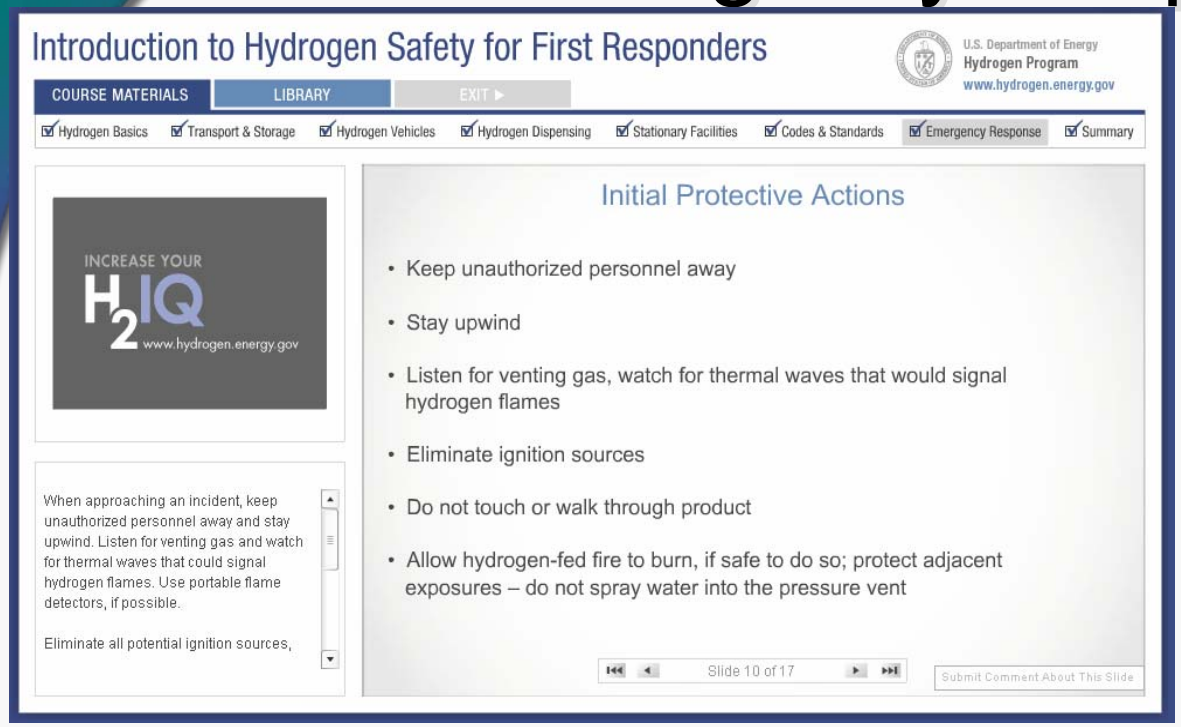
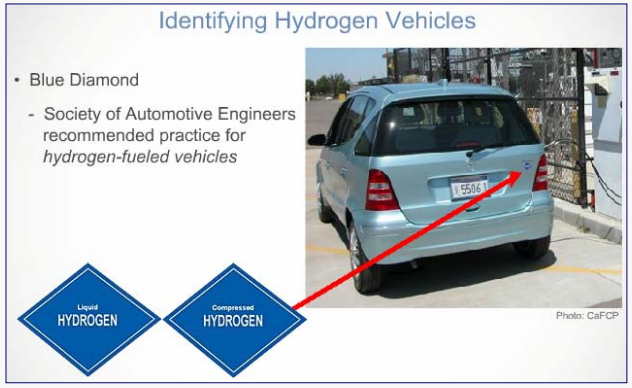
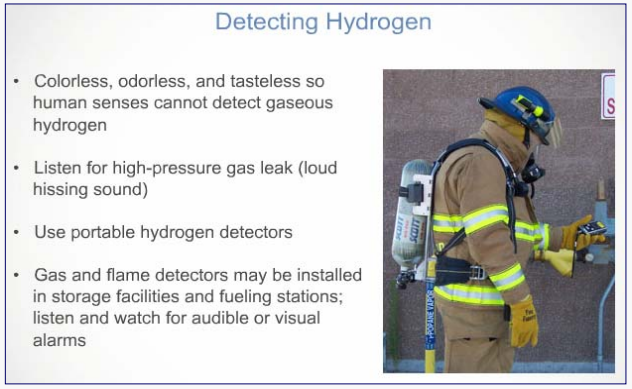
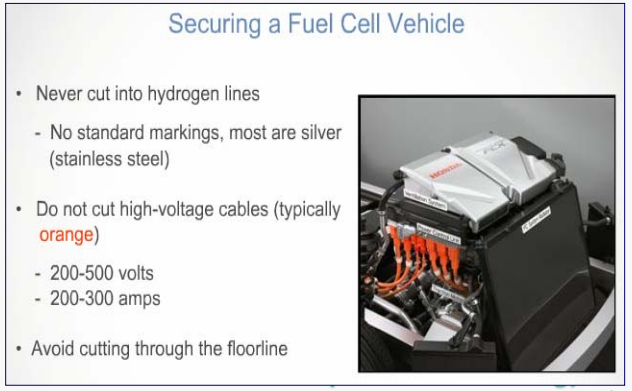
Example Course Module: Emergency Response









- ✓ Recognition and identification of hydrogen equipment
- ✓ Detection of hydrogen releases, flames
- ✓ Initial protective actions
- ✓ Additional information sources

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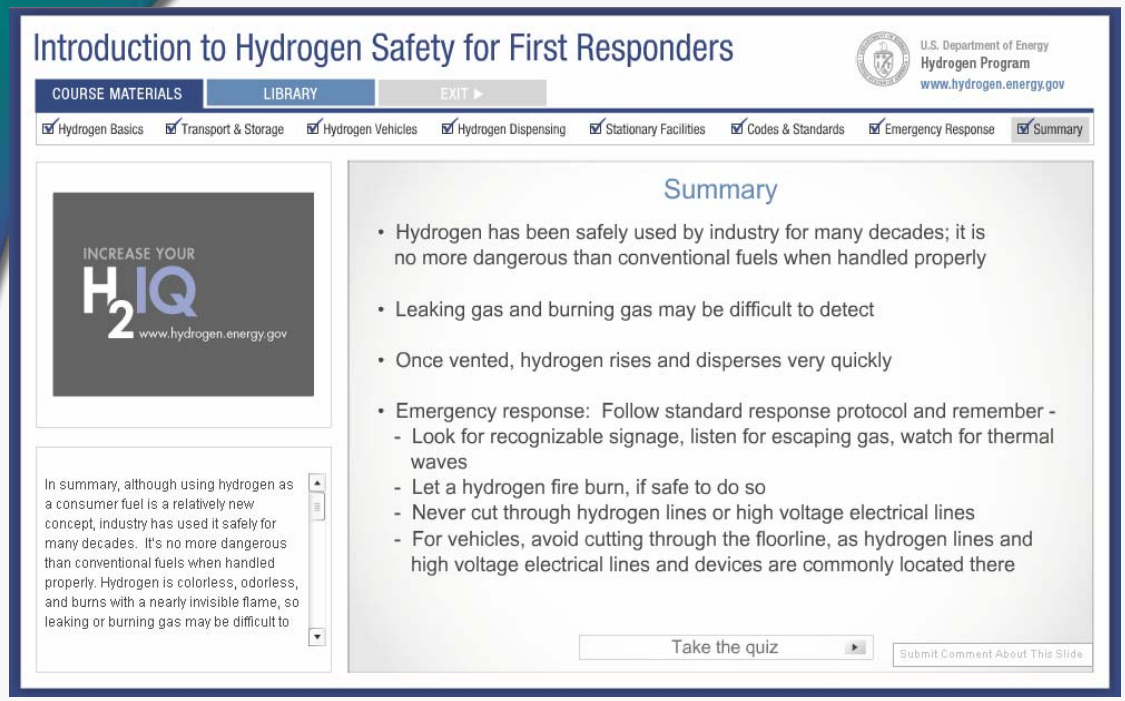
Summary & Quiz



- ✓ Most important "need-to-know" information in summary
- ✓ 13-question quiz tests knowledge/reinforces learning

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Accomplishments: Task 2 – Awareness-level Outreach

- Outreach plan completed
- Full version of course on CD and PDF (hard-copy) version available for free from DOE/EERE Information Center
  - 877-EERE-INF/877-337-3463
- Flyer produced to promote course at conferences, etc.
- Article submitted to *Firehouse Magazine*
- Three major first-responder conference events planned to demonstrate the course (Baltimore, Atlanta, and Orlando)
- "Cliffs Notes" version – laminated poster with critical response information for distribution to firefighters for display in fire stations
- Web-cast of course (500-1000 viewers at a time) in the planning stage

Accomplishments: Task 3 – Prop-based Course

- ✓ In early stages of development
- ✓ Some materials gathered for use in preparing course
- ✓ Discussions initiated with partners interested in endorsing and conducting the course

Prop Under Development

- Designed to realistically and safely simulate an actual emergency response event
- Mobile for on-site use (transported by trailer)
- Scenarios will demonstrate:
  - Safe approach to a fuel cell vehicle
  - Extinguishment of a compartment fire
- Will include typical FCV components (e.g. high-pressure H_2 lines)
  - Extrication techniques
  - Hydrogen venting during a compartment fire

Future Work

- Continue to address comments and to field questions on the Awareness-level course
- Complete planned outreach activities for Awareness-level course (publications, conferences, webcast)
- Complete planning and begin development of prop-based course (will continue into FY08)
- Conduct prop-based course in appropriate forums in the latter part of FY08

Project Summary

- Relevance – Education of first responders is a critical element of introducing hydrogen and fuel cell technology
- Approach – Develop and disseminate education materials that pertain to hydrogen safety, aimed at the first-responder audience
- Accomplishments – Web-based awareness-level course completed; very well-received. Outreach plan complete and a wide range of activities underway. Prop-based course planning has begun.
- Future work – Continue to maintain, refine, and disseminate Awareness-level course. Work with appropriate organizations to develop prop-based course.