IX.3 Hydrogen Safety: First Responder Education

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Project Start Date: October 1, 2004
Project End Date: Project continuation and direction determined annually by DOE

Objectives

- 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. (Note: the 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.)
- Develop and disseminate education materials that pertain to hydrogen safety, aimed at the first-responder audience.

Technical Barriers

This project addresses the following technical barriers from the Education section of the Hydrogen, Fuel Cells and Infrastructure Technologies (HFCIT) Program Multi-Year Research, Development and Demonstration Plan:

(A) Lack of Readily Available, Objective, and Technically Accurate Information

(C) Disconnect Between Hydrogen Information and Dissemination Networks

(D) Lack of Educated Trainers and Training Opportunities

Contribution to Achievement of DOE Education Milestones

This project will contribute to achievement of the following DOE Education milestones from the Education section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- **Milestone 1:** Develop Awareness-Level information package for first responders (4Q, 2006)
- **Milestone 3:** Develop Operations-Level information package for first responders. (4Q, 2008)
- **Milestone 4:** Update Awareness-Level information package for first responders (4Q, 2009)
- **Milestone 6:** Update Operations-Level information package for first responders (4Q, 2011)
- **Milestone 7:** Update Awareness-Level information package for first responders (4Q, 2012)
- **Milestone 9:** Update Operations-Level information package for first responders (4Q, 2014)
- **Milestone 10:** Update Awareness-Level information package for first responders (4Q, 2015)

Accomplishments

- PNNL launched a stand-alone, interactive, web-based "Awareness-Level" course - *Introduction to Hydrogen Safety for First Responders* - on January 24, 2007. The web address is: http://hydrogen.energy.gov/firstresponders.html
- In the first 11 weeks (January 24 – April 10), an average of ~240 unique visitors/reviewers per week looked at the course. New visitors continue to come to the site on a daily basis.
- PNNL created alternative versions of the course on CD and in PDF format (hard-copy), which are available for free from the DOE/EERE Information Center.
- PNNL and DOE developed a flyer about the course to promote it at conferences, etc.
- PNNL created "Cliffs Notes" version of the course in the form of a laminated poster that contains critical response information. This will be distributed to firefighters for display in fire stations.
- PNNL and DOE submitted an article to *Firehouse Magazine* (August 2007 publication date).
- HAMMER is scheduled to participate in two major conferences in FY 2007 to demonstrate the course and other information about hydrogen safety (Firehouse Central in Baltimore, and Fire-Rescue International in Orlando, both of which typically have over 15,000 attendees).

Introduction

Hydrogen safety education is a key element of the DOE Hydrogen Safety Program. Safety in all aspects of the future hydrogen economy is a first priority; safety concerns influence all of the DOE hydrogen efforts. Despite the most concerted effort, however, no energy system can be made 100% risk-free. Therefore, for any fuel, a suitably trained emergency response force is also an essential component of a viable infrastructure. The HFCIT has identified training of emergency response personnel as a high priority, not only because these personnel need to understand how to deal with a hydrogen-related emergency situation, but also because firefighters and other emergency workers are influential in their communities and can be a positive force in the introduction of hydrogen and fuel cells into local markets.

This HFCIT project is employing the Occupational Safety and Health Administration (OSHA) and National Fire Protection Association (NFPA) frameworks for hazardous materials emergency response training to develop a tiered hydrogen safety education program for emergency responders. The overall first responder education program will be developed over a number of years, and started with development and distribution of the First Responder Awareness-Level web-based course developed in FY 2006-2007. More advanced courses and materials to facilitate education have been started in FY 2007, and their development will continue in future years. In addition, PNNL will develop and implement plans for outreach to key stakeholder groups, to facilitate delivering the training to a broad audience.

Approach

PNNL works with experts in hydrogen safety (e.g., the PNNL Hydrogen Safety Review Board and national and state groups), as well as experts in first responder training, to develop the hydrogen safety course materials. Draft materials are prepared and undergo considerable review and revision before being released. PNNL (with subcontractor support, as needed) works with DOE to develop plans for making stakeholder groups aware of software-based training opportunities, and to provide "live" training when appropriate.

Specific tasks in FY 2007 included the following:

- **Develop and maintain web-based first responder "Awareness-Level" hydrogen safety course.** The *Introduction to Hydrogen Safety* course is designed for first responders who are likely to witness or discover an accidental release of compressed or liquid hydrogen and will initiate an emergency response by notifying other responding authorities of the release, but who would not be expected to take further action beyond this notification. The target audiences in this group include fire fighters, police, emergency medical technicians, and others. The Awareness-Level course consists of a combination of presentation slides with videos and animations for illustrating key points, such as relevant aspects of hydrogen behavior, along with narration to enhance the learning experience. The web-based format lends itself to use with a wide variety of media; in addition to the course being made available over the internet, it is also being distributed on CD and in PDF format (printed hard copy).
- **Awareness-level outreach.** PNNL pursued a number of possible means for spreading word about the *Introduction to Hydrogen Safety* course among its target audiences. These included publication of a short article in a relevant trade publication; attending conferences (with a booth to demonstrate the course, and with demonstration of a prop that shows the difference between a hydrogen and propane flame); and developing print media that summarize and provide information about the course.
- **Begin development of a more detailed prop-based course on hydrogen safety.** While all first responders should understand the fundamentals of hydrogen safety provided in the Awareness-Level course, most emergency personnel in regions with hydrogen demonstrations or emerging hydrogen infrastructure should aspire to a more in-depth level of understanding. An 8-hour course that involves use of a prop (simulating a fuel cell vehicle [FCV]) is being developed to help first responders gain hands-on experience with personal protective equipment, monitoring and detection equipment, and the basic control, containment, and confinement operations associated with a FCV.

Results

The Awareness-Level course was developed and reviewed extensively during FY 2006 and the beginning of FY 2007, culminating in a release of the web-based course in January 2007. Figure 1 provides a screen-shot of the opening page of course, which shows the topics covered in it. For each topic, a separate module in the course provides basic information and sometimes videos or animations to further explain particular points. When the course was posted on the Hydrogen Program web site, e-mail notices were sent to a variety of first responder organizations and mailing lists announcing the course.

Over 200 visitors per week typically access the course materials on the web site. Typical viewers

FIGURE 1. Awareness-Level Course: Screen Shot of Introductory Slide

include the fire prevention/protection community, fire fighters, fire department education coordinators, fire marshals, fire plan examiners/inspectors, code officials, law enforcement officials, and representatives from industry, universities, the military, and non-profit organizations. Figure 2 shows the states with viewers as of April 2007.

Feedback on the course was quite positive. For example, one firefighter sent the following input: "[I] did this course during my lunch hour and really enjoyed it. Nice slides and well written instructions. Thank you for a pleasant learning experience." Many similar complements were received.

An outreach plan was developed to get the word out about the course. Written materials were developed to further promote the course and to summarize key points in the course for the first responder committee. PNNL and DOE wrote an article that appears in the August issue of *Firehouse Magazine*. PNNL's collaborator, HAMMER, signed up to provide a booth and attend several key conferences frequented by the first responder community.

Plans were also laid to develop the more detailed course that involves hands-on training with a simulated FCV.

Conclusions and Future Directions

The launch of the Awareness-Level course aimed at first responders was quite successful, based on the usage recorded and feedback received. The course is fulfilling a need expressed by the first responder community to receive more information about hydrogen and fuel cells, so fire fighters and others will be prepared in the rare event of a hydrogen-related emergency.

In future years, PNNL will update the Awareness-Level course as information about hydrogen safety improves. In addition, an in-depth, hands-on course

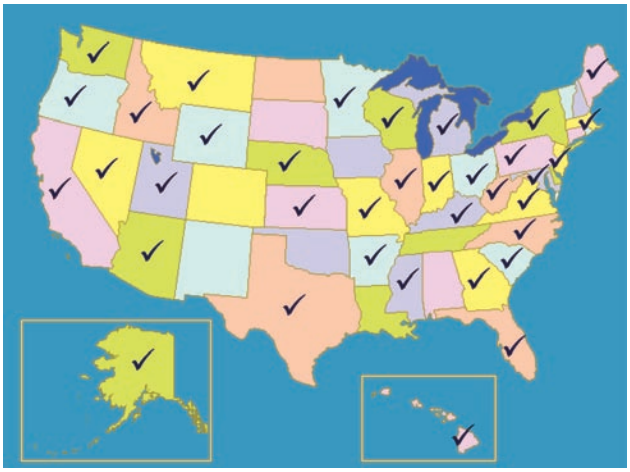

FIGURE 2. Map of States where Users Accessed the Course as of April 2007

that uses a FCV prop is being developed to give the first responder community the second tier of information necessary to make hydrogen emergency response more effective. PNNL will work with DOE to determine what, if any, additional types of educational courses are warranted, and to develop and implement plans to provide education to specific groups including fire fighters, police, emergency medical technicians, and others.

FY 2007 Publications/Presentations

1. Presentation at NHA meeting: Christy Cooper, *Introduction to Hydrogen Safety for First Responders*, NHA Annual Hydrogen Conference, March 20, 2007.

2. Article submitted to Firehouse Magazine: Fassbender, L., Akers, B. and Cooper, C., *Introduction to Hydrogen Safety for First Responders* (August 2007).