

VIII.12 Hydrogen Emergency Response Training for First Responders

Monte R. Elmore
Pacific Northwest National Laboratory (PNNL)
902 Battelle Blvd.
Richland, WA 99352
Phone: (509) 372-6158
Email: monte.elmore@pnnl.gov

DOE Manager
HQ: Antonio Ruiz
Phone: (202) 586-0729
Email: Antonio.Ruiz@ee.doe.gov

Subcontractors:

- Jennifer Hamilton, California Fuel Cell Partnership (CaFCP), Sacramento, CA
- Hanford Fire Department, Richland, WA
- Hazardous Materials Management and Emergency Response (HAMMER) training center, Richland, WA

Project Start Date: October 2004

Project End Date: Project continuation and direction determined annually by DOE

Contribution to Achievement of DOE Hydrogen Safety Milestones

This project will contribute to achievement of the following DOE milestone from the Safety Codes and Standards section of the Fuel Cell Technologies Multi-Year Research, Development and Demonstration Plan:

- Enhance hydrogen safety training props and deliver classroom curriculum for emergency response training. (4Q, 2012)

In addition, the following milestones were met in previous years:

- Milestone 1 (ED): Develop “Awareness-Level” information package for first responders. (4Q, 2006)
- Milestone 3 (ED): Develop “prop-course” using hands-on training devices for first responders. (4Q, 2008)
- Milestone 4 (ED): Update “Awareness-Level” information package for first responders. (4Q, 2009).
- Milestone 21 (SAF): Conduct first hydrogen safety class (non-prop) offered at HAMMER. (3Q, 2005)
- Milestone 22 (SAF): Complete first life-size prop for hands-on training of emergency responders. (1Q, 2008).

Fiscal Year (FY) 2012 Objectives

- Support the successful demonstration and deployment of hydrogen and fuel cell technologies by providing technically accurate hydrogen safety and emergency response information to first responders.
- Provide a one-day first responder training course, “Hydrogen Emergency Response Training for First Responders,” that integrates the use of DOE’s mobile hydrogen fuel cell vehicle (FCV) prop.
- Continue to support the web-based awareness-level course, “Introduction to Hydrogen Safety for First Responders.” www.hydrogen.energy.gov/firstresponders
- Disseminate first responder hydrogen safety educational materials at appropriate fire fighter conferences to raise awareness.

Technical Barriers

This project addresses the following technical barriers from the Safety Codes and Standards section of the Fuel Cell Technologies Multi-Year Research, Development and Demonstration Plan:

- (H) Lack of Hydrogen Knowledge by Authorities Having Jurisdiction (AHJs)
- (I) Lack of Hydrogen Training Materials and Facilities for Emergency Responders

FY 2012 Accomplishments

- **Prop-Based Course:** This operations-level course was presented at two fire training centers in the Los Angeles area of California in the past year. Three consecutive one-day training classes were held at each of the following locations:
 - Los Angeles City Fire Department, Los Angeles, CA (Jan 2012)
 - Los Angeles County Fire Department, San Dimas, CA (Mar 2012)

Approximately 300 first responders from the above sites received this training. Extremely positive feedback from each of the sites continues to reinforce the value of this course to first responder organizations.

- **Awareness-Level Course:** After almost six years, our website continues to receive ~200-300 unique visits per month from almost every state and some foreign countries. The course is registered on the TRAIN (TrainingFinder Realtime Affiliate Network) website for broader dissemination to first responders. TRAIN is a central repository for public health training courses. Almost 30,000 TRAIN users identify themselves as emergency responders.

- **Outreach:** CDs of the awareness-level course were distributed through the DOE Energy Efficiency and Renewable Energy Information Center.



Introduction

Safety in all aspects of a future hydrogen infrastructure is a top priority, and safety concerns influence all DOE hydrogen and fuel cell projects. Despite the most concerted effort, however, no energy system can be made 100% risk-free. Therefore, for any fuel and energy system, a suitably trained emergency response force is an essential component of a viable infrastructure. The Fuel Cell Technologies Program has identified training of emergency response personnel as a high priority, not only because these personnel need to understand how to respond to a hydrogen incident, but also because firefighters and other emergency responders are influential in their communities and can be a positive force in the introduction of hydrogen and fuel cells into local markets.

This project employs the Occupational Safety and Health Administration and National Fire Protection Association frameworks for hazardous materials emergency response training to provide a tiered hydrogen safety education program for emergency responders. The effort started with development and distribution of the awareness-level web-based course in FY 2006-2007. A more advanced course and materials to facilitate education were developed in FY 2008-2009, complementing the design, construction, and operation of a fuel cell vehicle prop (developed under PNNL's Hydrogen Safety project). The overall first-responder education project will continue to be updated. In addition, PNNL has implemented outreach efforts to key stakeholder groups to facilitate delivery of the training to a broad audience.

Approach

PNNL works with subject matter experts in hydrogen safety and first responder training to develop hydrogen safety course materials. Draft materials undergo considerable review and revision before being released. The PNNL team works with DOE to make stakeholder groups aware of training opportunities and to provide “live” training when appropriate. The web-based awareness-level course is available “online” or on CDs and provides the student with a basic understanding of hydrogen properties, uses, and appropriate emergency response actions. The prop-based course, a more advanced operations-level course, was initially presented at the HAMMER training facility in Richland, WA. Subsequently, the mobile prop has enabled the course to be delivered at several offsite fire training

centers (in California during 2010-12) in order to reach larger audiences in areas where hydrogen and fuel cell technologies are being deployed.

Results

Prop-based course: The focus of the curriculum is on teaching first responders what is the same and what is different about hydrogen and FCVs as compared to conventional fuels and vehicles. Course evaluation forms are distributed and feedback obtained at each class to help us improve the course content and delivery. Based on feedback from all the training sessions held this past year (January and March 2012), we conclude that following the training, first responders are more familiar with the properties and behavior of hydrogen, and are prepared to operate in a safe and effective manner if a hydrogen incident should occur in their jurisdiction.

The FCV prop has been integrated into the “Hydrogen Emergency Response Training for First Responders” course. The prop demonstrates potential conditions that could be encountered during the control and suppression of a FCV fire.

Conclusions and Future Directions

The introductory web-based course has been highly 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 they will be prepared in the rare event of a hydrogen incident. The in-depth prop-based course builds on that success and is very useful in giving first responders a hands-on experience with simulated FCV incidents that integrates well with classroom training. PNNL will continue to update both courses as needed to reflect current applications and markets for hydrogen and fuel cells.

There is an identified need for the prop course curriculum to achieve a better balance between the vehicles (including industrial lift trucks) and stationary facilities modules, through the development of some type of prop for stationary applications of fuel cells. An interactive video training tool of virtual hydrogen incident scenarios and responses to simulate both outdoor fueling of passenger FCVs and indoor fueling of hydrogen forklifts could address that need. We propose to develop a virtual model by first demonstrating the concept with a simplified model, and subsequently adding additional features and capabilities.

The prop course will be offered at additional first responder training facilities in FY 2013. As additional hydrogen fueling stations are commissioned and more FCVs appear on the road, more first responder organizations are inquiring about this training. As with the previous training classes, the prop will be transported to each site for about a week. Multiple classes will be offered at each site. In future

years, the prop will be transported to other locations across the country for use in delivery of this course at training centers in areas that have emerging deployments of hydrogen and fuel cell technologies. PNNL will also work with DOE and other stakeholders to determine what, if any, additional types of educational courses and materials are warranted, and to develop and implement plans to provide education to specific groups.

FY 2012 Publications/Presentations

1. Elmore, M.R., Fassbender, L.L., Hamilton, J.J., and Weiner, S.C. "Hydrogen Emergency Response Training for First Responders." International Journal of Hydrogen Energy. (Manuscript submitted December 2011).