

# Hydrogen Emergency Response Training for First Responders

**Monte Elmore**

Hydrogen Program Annual Merit Review and Peer Evaluation Meeting  
Washington, DC  
June 18, 2014

# Overview

## Timeline

- ▶ Project start date: October 2004
  - ▶ Project end date: September 2014\*
- \*Project continuation and direction determined annually by DOE

## Barriers\*\*

- A. Safety data and information: limited access and availability
- D. Lack of hydrogen knowledge by authorities having jurisdiction (AHJs)
- E. Lack of hydrogen training materials and facilities for emergency responders

\*\* *Technical Plan – Safety, Codes, and Standards, Section 3.7.5, Multi-Year Research, Development and Demonstration Plan, 2012*

## Budget

- ▶ FY13 DOE Funding: \$ 50K
- ▶ Planned FY14 Funding: \$ 100K
- ▶ Total DOE Project Value: \$2194K

## Partners

- ▶ California Fuel Cell Partnership
- ▶ Nat'l Fire Protection Association
- ▶ Project Lead: PNNL



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# Relevance: Goals and Objectives

## ▶ Long-Term Goal

- Support the successful implementation of hydrogen and fuel cell technologies by providing technically accurate hydrogen safety and emergency response information to first responders

## ▶ Objectives for FY14

- Develop and implement a national hydrogen emergency response education program with downloadable training materials that are adaptable to the specific needs of first responders and training organizations
- Explore mutually beneficial collaborations with other programs and organizations to enhance first responder training content, techniques and delivery



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# Approach

## Introduction to Hydrogen Safety for First Responders

### Introduction to Hydrogen Safety for First Responders

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

COURSE MATERIALS LIBRARY EXIT ▶

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

#### Hydrogen Safety Course Contents



INCREASE YOUR  
**H<sub>2</sub>IQ**  
www.hydrogen.energy.gov

The Course Materials cover the following topics:

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

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.

You can mute the narration by clicking on the mute button in the navigation bar.

Begin the Course ▶

Slide 1 of 1 

<http://hydrogen.pnl.gov/FirstResponders/>

# Approach

## *Hydrogen Emergency Response Training for First Responders*

### ▶ **Classroom Content**

- Hydrogen and Fuel Cell Basics
- Hydrogen Vehicles
- Stationary Facilities
- Emergency Response
- Incident Scenarios

### ▶ **Demonstrations/Hands-on Exercise with FCEV Prop**

- Demonstration of Hydrogen Flame Characteristics
- Student Participation in Rescue Evolutions



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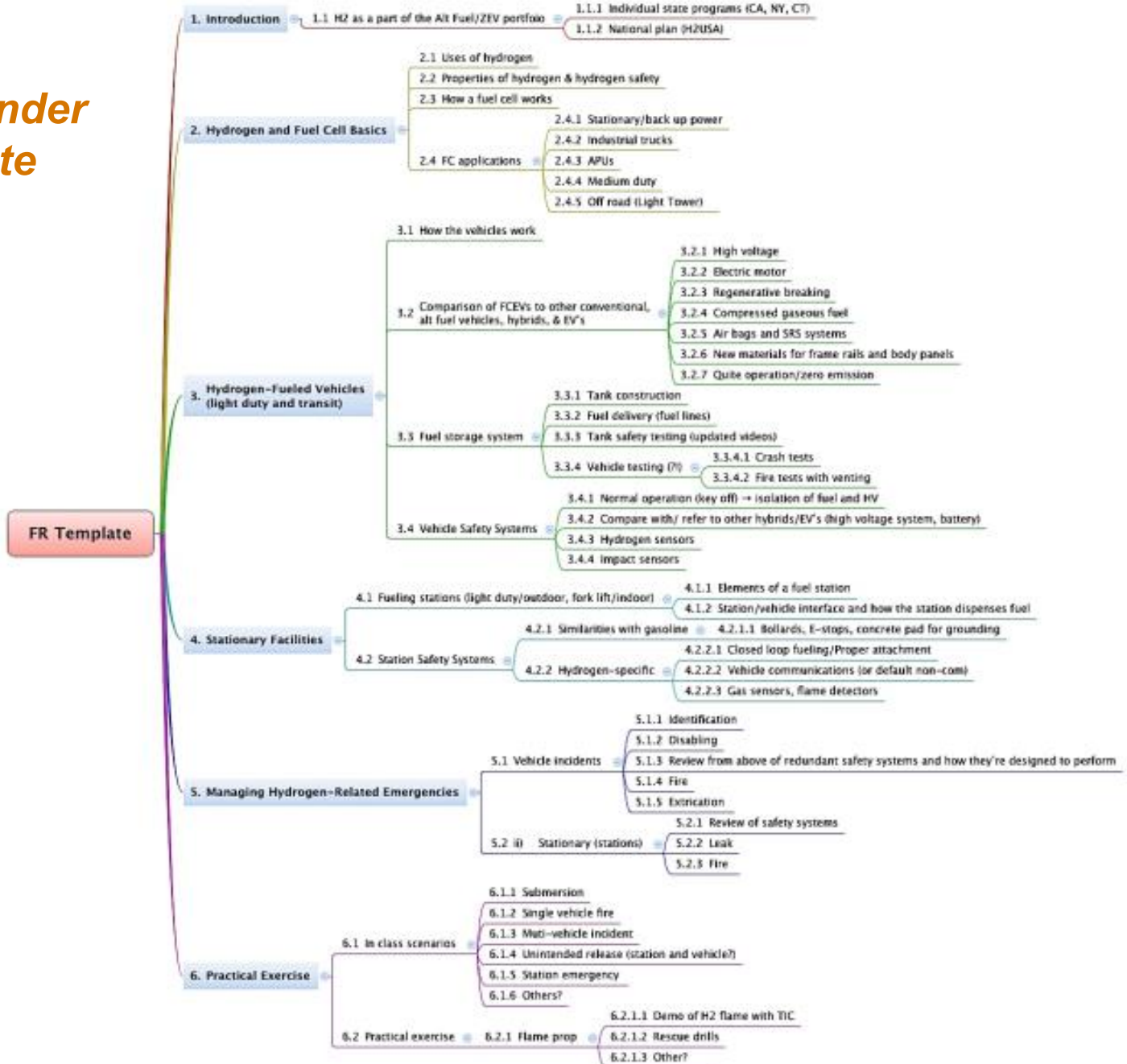
# Approach

## *National Hydrogen Emergency Response Education Program*

- ▶ PNNL serves as content stewards for the national education program
- ▶ Arrange training materials into a multi-level training program appropriate for users with a variety of training perspectives, interests and needs
- ▶ Make these training materials available as downloadable/user-configurable presentations to individuals or organizations seeking information on hydrogen emergency response
- ▶ Utilize the template approach for a consistent source of accurate and current information for use in:
  - Assessing and developing updated/new training content
  - Delivering a variety of training regimens to various audiences
  - Integrating new video and animation tools into the program

# Approach

## The First Responder Training Template



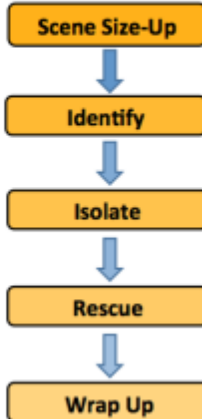
# Approach – The First Responder Template

FR Template

- 1. Introduction
- 2. Hydrogen and Fuel Cell Basics
- 3. Hydrogen-Fueled Vehicles (light duty and transit)
- 4. Stationary Facilities
- 5. Managing Hydrogen-Related Emergencies
  - 5.1 Vehicle incidents
    - 5.1.1 Identification
    - 5.1.2 Disabling
    - 5.1.3 Review from above of redundant safety systems and how they're designed to perform
    - 5.1.4 Fire
    - 5.1.5 Extrication
  - 5.2 ii) Stationary (stations)
    - 5.2.1 Review of safety systems
    - 5.2.2 Leak
    - 5.2.3 Fire
- 6. Practical Exercise

## FOLLOW SOP's for VEHICLE RESPONSE...

...and, pay attention to the unique items for hydrogen-powered fuel cell vehicles





# Approach – three training levels

## National Hydrogen & Fuel Cell Emergency Response Education Program

	Level 1 – Basic Overview	Level 2 - Intermediate	Level 3 – Detailed
<b>1. Introduction – Why First Responder Training for H2 Emergencies?</b>	◇	◇	◇
<b>i) Hydrogen as a part of the Alt Fuel/Zero Emission Vehicle portfolio</b>		◇	◇
<b>1) Individual state programs (CA, NY, CT)</b>			◇
<b>2) National plan (H2USA)</b>			◇
<b>ii) Course Objectives</b>	◇	◇	◇
<b>2. Hydrogen and Fuel Cell Basics</b>	◇	◇	◇
<b>i. Uses of Hydrogen</b>		◇	◇
<b>ii. Vehicles (light duty and transit)</b>		◇	◇

# Accomplishments/Progress

*Introduction to Hydrogen Safety for First Responders*  
(online training)

Our website still averages  
~200 to 300 unique visits per  
month after more than 7  
years from nearly every state  
and some foreign countries

Fiscal Year	Visits
2007	6192
2008	3984
2009	4230
2010	3614
2011	2734
2012	2669
2013	3854
Through 3/2014	1656
Total	29149

# Accomplishments/Progress

## Operations Course Training Locations

Agency	Location	Date	Number Trained
HAMMER	Richland, WA	2009 - 2010	66
Rio Hondo Comm. College	Santa Fe Springs, CA	August 2010	103
Orange Co Fire Authority	Irvine, CA	August 2010	92
Sunnyvale PSD	Sunnyvale, CA	September 2010	110
San Joaquin DLA	Stockton, CA	June 2011	41
Los Angeles City Fire Dept	Los Angeles, CA	January 2012	128
Los Angeles Co Fire Dept	San Dimas, CA	March 2012	170
Honolulu Fire & Fed Fire-HI	Honolulu, HI	February 2013	155
HI Co Fire & Volcanoes NP	Hilo, HI	February 2013	135
<b>Total</b>			<b>1000</b>

# Accomplishments/Progress

## Outreach

- ▶ “Hydrogen and Fuel Cell Vehicles: Educating Emergency Responders,” MR Elmore (PNNL) and JJ Hamilton (CaFCP), 2014 NFPA Conference and Expo, June 10, 2014.
- ▶ Invited to present operations course at 25th Annual “*Continuing Challenge*” HazMat Workshop, Sacramento, CA, September 2014.



# Accomplishments/Progress

## *Hydrogen Emergency Response Training for First Responders*

- ▶ Identified auto industry, USFA, NFPA, national labs and academia partners and discussed draft national ER program. (**December 2013 milestone – complete**)
- ▶ Prepared draft of national ER program and submitted to reviewers. (**March 2014 milestone – complete**)
  - Comments received by mid-May 2014
  - Comments being considered and incorporated
  - Template developed for assessing content and planning forward program
  - Draft to be revised and program submitted as project milestone by end of June 2014
- ▶ Educational presentation at NFPA Conference & Expo June 2014 on the national education program.
- ▶ Partnered with NFPA to supplement their alternative fuel vehicle safety training with information on hydrogen fuel cell vehicles.
  - To be available from NFPA summer 2014

# Accomplishments/Progress

## *International Collaboration*

- ▶ Hosted HyResponse project personnel from AREVA and the French Academy for Fire, Rescue and Civil Protection Officers (ENSOSP) to discuss projects, demonstrate our live-fire FCV burn prop and consider collaborative opportunities, April 21-22, 2014.
- ▶ Discussed collaborative possibilities
  - Animations and videos of accident scenarios for training
  - Incorporating virtual reality tools into U.S.-based training
  - Utilize ENSOSP's International Workshop on Hydrogen Training for First Responders (September 3-4, 2014, Aix-en-Provence, France) for engaging full project team and related stakeholders



# Accomplishments

## *Responses to 2013 Reviewers' Comments*

- ▶ The project was not reviewed last year, so no comment responses are provided.



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# Collaborations

- ▶ **California Fuel Cell Partnership**
  - Developing “National Program”
- ▶ **NFPA**
  - NFPA Alt Fuel Vehicle ER Training and DOE Nat’l Program review
- ▶ **Program reviewers**
  - Vehicle and equipment manufacturers
  - Hydrogen suppliers
  - Training organizations
- ▶ **European HyResponse Project**
  - Collaborative activities on first responder training





# Anticipated Future Work (FY2014)

- ▶ Implement the National Hydrogen Emergency Response Education Program
  - Complete development of education program – incorporating review comments
  - Make the materials available through the Safety Knowledge Tools web portal
  - Introduce program to training organizations by various means (webinars, press releases, etc.)



# Future Work

- ▶ Continue providing emergency response training to support successful implementation of fuel cell deployment projects (e.g., Maritime Fuel Cell Generator Project)
- ▶ Advance outreach, education and content initiatives for the National Hydrogen Emergency Response Education Program
- ▶ Further advance the collaboration with the HyResponse project
  - Incorporate virtual reality tools into U.S.-based training
- ▶ Consider other initiatives to address first responder training needs



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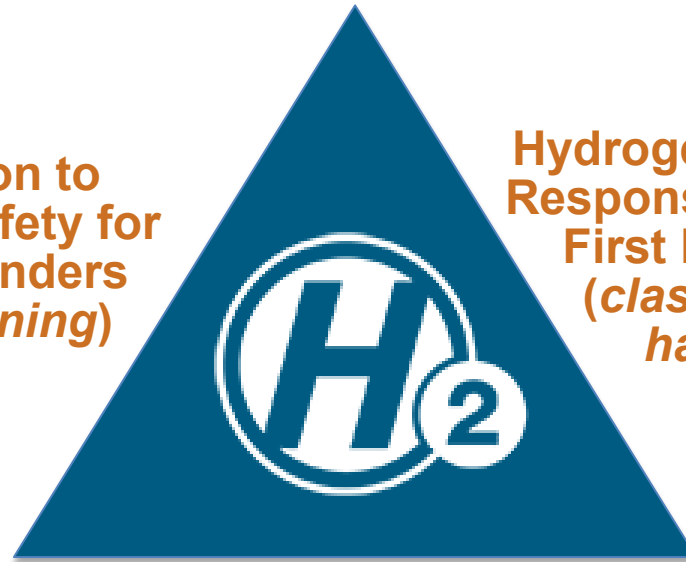
# Summary

- ▶ **Introduction to Hydrogen Safety for First Responders**
  - Available online at: <http://hydrogen.pnl.gov/FirstResponders/>
  - Still being successfully utilized, especially useful for ops course preparation
- ▶ **Hydrogen Emergency Response Training for First Responders**
  - Still available as an instructed classroom course
  - Available FCV burn prop for demonstrations/training evolutions
- ▶ **National Hydrogen Emergency Response Education Program**
  - When finalized hydrogen emergency response training materials will be available to individuals and organizations via the hydrogen safety web portal
- ▶ **Outreach**
  - Attend fire-related conferences (Continuing Challenge HazMat Workshop, Firehouse World) to present ops course, disseminate materials, and identify interest among first responder agencies for training
- ▶ **International Collaborations**
  - Continue work with HyResponse project and other similar programs

# Summary

## *Integrating the Approach to First Responder Training*

**Introduction to  
Hydrogen Safety for  
First Responders**  
*(online training)*



**Hydrogen Emergency  
Response Training for  
First Responders**  
*(classroom and  
hands-on)*

**National Hydrogen  
Emergency Response  
Education Program**



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## *My Thanks To:*

- ▶ U.S. Department of Energy
  - Sunita Satyapal, Director, Fuel Cell Technologies Office
  - Ned Stetson, Will James, and Kym Carey: Safety Codes and Standards Team

*This training program continues to make a positive impact with first responders, and is a vital tool as we see an increase in the number of demonstration, deployment and commercialization projects!*