DEVELOPMENT OF A HYDROGEN AND FUEL CELL VEHICLE EMERGENCY RESPONSE NATIONAL TEMPLATE

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ABSTRACT

The California Fuel Cell Partnership (CaFCP) is currently working with key stakeholders, like the US Department of Energy (DOE) and National Fire Protection Association (NFPA), to develop a national template for educating and training first responders about hydrogen fuel cell-powered vehicles (FCV) and hydrogen fueling infrastructure. Currently, there are several existing programs that either have some related FCV/hydrogen material, or have plans to incorporate this in the future. To create a robust national emergency responder (ER) program, the strongest elements from these existing programs are considered for incorporation into the template. Working with the key stakeholders, the national template will be evaluated on a regular basis to ensure accurate and up to date information and resources, and effective teaching techniques for the emergency response community. This paper describes the evaluation process, discusses elements of the template, and reports on the steps and progress to implementation; all in the effort to effectively support the emergency response community as hydrogen infrastructure develops and FCVs are leased or sold.

1.0 INTRODUCTION

Fuel cell electric vehicles, and the necessary hydrogen infrastructure, are entering commercialization in the US, starting in California with key early market communities [1]. Educating first responders about hydrogen properties, safety, operation, and response to vehicles and infrastructure has been conducted by the CaFCP since 2002. Their materials and information are included in programs for the California Office of the State Fire Marshal [2] and the US DOE's Hydrogen Emergency Response Training for First Responders [3]. Recently, emergency responder education for alternative fueled and electric vehicles, including hydrogen, has been developed and delivered by a number of organizations around the country. However, consistency in the content and messaging about hydrogen and fuel cells varies in these programs, and may not be contemporary with the activities in early markets. Reasons for such discrepancies are many; however, in general may be attributed to the amount of hydrogen and fuel cell activities in a given region, and access to industry-vetted information. The primary goal for developing a 'template' is to provide current, factual, relevant information with consistent messaging and for ease of review/updates on an annual or semi-annual basis.

2.0 EVALUATION PROCESS OF EXISTING PROGRAMS

Noted during previous U.S. DOE Annual Merit Review meetings was that similar emergency responder programs for alternative fueled and/or electric and hybrid vehicles, including hydrogen, were funded through the same source. Given the programs in place from the CaFCP and the US DOE, further programs are potentially repeated efforts, at least for the hydrogen and fuel cells portions. The process for development of a template starts with assessing all existing programs for strengths and weaknesses. Knowledge of current programs was obtained in various ways: through first hand experience, attending a course either online or in person, and through discussions with individuals from those programs.

Examples of positive elements in existing ER programs include:

- online, self-paced access to information
- the ability to broadly disseminate information
- smart phone apps allowing for quick access to essential information
- quality illustrations/graphics

Examples of negative elements include:

- excessive length/content
- extraneous information
- lack of quality information (inaccuracies with current activities)
- suggested response techniques inconsistent with vehicle manufacturer recommendations

3.0 DEVELOPMENT OF THE TEMPLATE

A meeting of key stakeholders is planned for the 2013 AMR this May in Washington, D.C. Agenda items for the discussion will encompass:

- overall review of current programs
- evaluate strengths and weaknesses
- an outline of the template
- next steps/milestones:
    - gathering /updating information
    - vetting that information with industry approximate additional meeting dates (in person or by webinar): July, September
    - phone calls/emails: as needed

Once developed, the template must "live" in a central location and be disseminated from that location in various forms, depending on the level of information needed (i.e. awareness vs. operations level). All of the aforementioned items need consensus from the stakeholder group, however a vision will be presented it at the May meeting. See Appendix A for an example outline.

In addition to classroom instruction, the template will include the following, subject to resources and availability:

- static display of vehicles
- opportunity for participants to drive the vehicles
- station tour
- fueling demonstration
- opportunity to 'cut' a car using rescue tools (Auto-extrication events)
- use of a hydrogen flame prop vehicle
    - demonstrate a hydrogen flame; visualize with a thermal imaging camera
    - run rescue drills

3.1 Related projects/programs

A parallel effort to this national ER template is the development of a new document, SAE J2990/1: *Gaseous Hydrogen and Fuel Cell Vehicles First and Second Responder Recommended Practice*. This author is a co-sponsor of that document which, in addition to the existing ER programs, may play a key role in the development of the national ER template. J 2990/1 is a subsequent document to the now published J2990: *Hybrid and EV First and Second Responder Recommended Practice* which had ample input from both the Fire Protection Research Foundation and the NFPA, as well as first responders from around the country. Additionally, the NFPA has online curriculum for emergency response to electric vehicles [4], in which there are plans to include fuel cell vehicles, making it the likely 'home' for the national template described here.

4.0 DEPLOYMENT OF THE NATIONAL ER TEMPLATE

Both the NFPA and the National Alternative Fuels Training Consortium, out of West Virginia University, have excellent deployment capabilities. In addition to its network of community colleges, the NAFTC is also the lead agency for the US DOE Clean Cities programs. Clean Cities is another tool for disseminating the national ER template through its existing programs. While the NAFTC and Clean Cities programs [5, 6] already include hydrogen and fuel cell information, they are both candidates for thorough review and updating of information and messaging with that of the national template.

As mentioned previously, the NFPA is the ideal 'home' for the template, given their authority and recognition throughout the first responder community for protocols for training and response. Adding to their existing Electric Vehicle program is a natural fit, and aligns with the original plans for including fuel cell vehicles in their curriculum. CaFCP is working with the US DOE on funding to support these efforts.

5.0 CONCLUSION

The early and competent education of our first responders is important to the introduction of a new transportation technology. First responders represent two demographics: the rescuer in a traffic incident and a potential consumer of that technology. It is this author's experience in the seven years of educating first responders that even if there is trepidation initially, after receiving quality industry - vetted information, these men and women are much more comfortable with hydrogen as a fuel and the vehicles using that fuel. It is critical that the information they receive is up to date, accurate, factual and technically correct. A smart phone app, for example, cannot include vehicle disabling or rescue techniques that are not suggested by the automaker themselves. The national template for ER education on hydrogen and fuel cells will aid in eliminating such misinformation, and potentially assist with information about other vehicle technologies, as well.

REFERENCES

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2. California Office of the State Fire Marshal, FSTEP Course, Emergency Response to Alternative Fuel Vehicles (2009) http://osfm.fire.ca.gov/training/pdf/alternativefuelvehicles/Altfuelintroduction.pdf
3. Fassbender, L.L, Hydrogen Emergency Response: Training for First Responders (Training Manual), Pacific Northwest National Laboratory Report No. PNNL-18495.
4. National Fire Protection Association, Electric Vehicle Safety for Emergency Responders Online Course, http://www.evsafetytraining.org/.
5. National Alternative Fuels Training Consortium, Advanced Electric Drive Vehicle Education Program, First Responder Safety Training, http://aedve.info/
6. Clean Cities Learning Program, Advanced Electric Drive Vehicle Education Program http://www.naftc.wvu.edu/cleancitieslearningprogram

Appendix A

The following is an example outline of the in-class portion of the template. It will include, but not be limited to the following:

A. Introduction to hydrogen

   a. Uses of hydrogen
   b. Properties of hydrogen
   c. Hydrogen safety

B. Fuel Cells

   a. How a fuel cell works
   b. FC applications (brief overview)
      i. Stationary
      ii. Industrial truck
      iii. Back up power

C. Fuel Cell Electric Vehicles

   a. How the vehicles work
   b. Comparison of FCEVs to other conventional, alt fuel vehicles, hybrids, & EV's
      i. Air bags and SRS systems
      ii. New materials for frame rails and body panels
      iii. High voltage
      iv. Regenerative breaking
      v. Electric motor
      vi. Compressed gaseous fuel
      vii. Quite operation
   c. Fuel storage system
      i. Tank construction
      ii. Fuel delivery (fuel lines)
      iii. Tank safety testing
   d. Emergency Response to an FCEV
      i. Vehicle ERG's and cut sheets
      ii. Over-arching message: use SOG's/SOP's for response

D. Fueling stations

   a. Elements of a fuel station
   b. Safety features
   c. Station/vehicle interface and how the station dispenses fuel

d. Emergency Response to a fueling station

NOTE: The order of presentation may be rearranged to a certain degree, however starting with uses and properties of hydrogen is recommended to establish a knowledge base and clear up pre-conceived notions/misconceptions about hydrogen. The facilitator should also schedule periodic breaks and encourage discussion and questions throughout.