

Final Action Report

Permitting Hydrogen Fueling Stations and Hydrogen Fuel Cell Backup Power for Wireless Telecommunications Sites Workshop

California State University

**August 25 & 26, 2008
Los Angeles, California**

Prepared by

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Executive Summary

1. Executive Summary

The overall objective of the workshop was to present “case studies” for a selected number of hydrogen motor-fueling station configurations and back-up power for telecommunication sites to an invited group of fire and building code officials that shows how their existing codes and standards, or engineering solutions based on the codes (“alternative methods”), have been or can be applied to permit construction of a hydrogen motor-fueling station in a rigorous but timely manner. Additionally a goal was to have this group develop their own permit processing guide identifying the pathway and application they would take in their jurisdiction and what codes and standards would apply.

To summarize the project:

- The workshop was hosted as a stand alone activity.
- The workshop built on experiences of the previous workshops via teleconference coordination and discussion.
- Building code, fire code and electrical code officials from the Los Angeles County area participated in the workshop.
- An overview of hydrogen and hydrogen safety as compared to other fuel gases was provided.
- Participants were broken down into teams equally divided so to have various expertise on each breakout team.
- Each team was assigned construction plans involving a service station and also plans involving telecommunications sites.
- Upon completion of their work, each team gave a verbal report on the results of their reviews which was followed by comments from any team that used the same plan for their review. General discussion followed.
- Issues were identified and discussed dealing with an understanding of how to apply the codes and standards and existing code language.
- Participants were overwhelmingly positive in their comments and the valuable educational opportunity.

The goals of the project were met. Participants were provided with a better understanding of how to apply the codes and referenced standards to a hydrogen motor-fueling facility permit application and they indicated they had an increased level of comfort with the topic. In addition, feed back from the participants provided guidance on content to include in future workshops along with areas within the existing code language that may need modification to clarify technical requirements.

Workshop Sponsors

National Association of State Fire Marshals

US Department of Energy

National Renewable Energy Laboratory

The California Fuel Cell Partnership

US Fuel Cell Council

General Motors

Plug Power, Inc.

ReliOn, Inc.

Workshop Facilitators

National Association of State Fire Marshals

Project Development

2. Project Development

The success of any project rests on establishing clear goals, assigning responsibilities, setting timelines for completion of assignments, and verifying follow through.

The development phase of the project presents its own challenges through the involvement of agencies and firms with office locations scattered around the country and individuals that are highly mobile on a day to day basis. Face to face meetings during the planning and development phase were limited and alternate means of communications was a necessity.

Project development was accomplished via teleconferences and effective use of electronic communications such as e-mail exchange of messages and documents.

The initial project conference call was held on July 22nd. Representatives of NREL, NASFM, CaFCP and industry discussed the workshop that had recently been completed, and participation for the next workshop to be held in the Los Angeles, California area with dates of August 25 and 26.

The discussion agenda was:

Draft Agenda

Workshop on Permitting Hydrogen Fueling Stations and
Hydrogen Fuel Cell Backup Power for Wireless Telecommunication Sites

California State University
Los Angeles, CA
August 25-26, 2008

August 25 (Monday)

10:30	Registration	
11:00	Welcome	The Governor and Jamie Lee Curtis
11:15	Background, objectives of workshop	Antonio Ruiz, U.S. DOE
11:30	Introductions, agenda, structure of workshop intros)	Jim Narva, NASFM (Go around room
11:45	Get Lunch & Return for working lunch	
12:15	Hydrogen Fuel & Fuel Cells Overview Center	Kathy Haq, National Fuel Cell Research (Melanie to Contact)
12:45	Hydrogen Safety	Carl Baust, (Carl to Contact)

1:15	Emergency Response & Safety Systems	Jennifer Hamilton, CaFCP
1:45	Hydrogen Fueling Stations & Transportation	Bill Elrick, CaFCP & Alex Keros, GM (add planned HFS to discussion)
2:15	Break	
2:30	Hydrogen Fuel Cells for Back-up Power at Wireless Telecommunication Sites	Paul Buehler, Plug Power Mike Maxwell or Mark Cohen, ReliOn
3:15	Permitting Hydrogen Facilities Springs and ICC & NFPA 52 Pathways	Richard Kallman, City of Santa Fe Chair of the DOE Hydrogen Safety Panel
	Introduce Permitting Website	
4:00	Q/A, discussion	NASFM
4:15	Break Breakout Group Assignments Group Discussions & Goal Pathway	Bill Elrick, CaFCP Group Facilitators
5:00	Adjourn	

August 26 (Tuesday)

(NASFM TO COORDINATE)

Breakfast

Breakout session 2

Cal State HFS Site Tour

Breakout session 3

Lunch

Plenary for report outs

Summary, next steps

Jim Narva

Adjourn workshop

Antonio Ruiz

Needs Identified So Far:

4 Laptops with internet access for breakout sessions

1 Laptop with internet, projector, and screen for presentations

As a result of this teleconference the following parameters were identified and discussed.

- The overall objective of the workshop is to present “case studies” for a selected number of HRS and back-up power for telecommunication site configurations to an invited group of fire, building, and electrical code officials that shows how existing codes and standards or engineering solutions based on the latest codes (“alternative methods”) have been or can be applied to permit HRS in a rigorous but timely manner and to have

this group review and develop permitting guides for their jurisdictions. The targeted locals would be from the Los Angeles County area.

- The fire and building code officials will be invited by NASFM. CaFCP will identify those to be invited.
- The case studies can include existing, planned, and “hypothetical” installations. The case studies should demonstrate the logic and concept of the configurations and how safety is built into the design in relation to the existing site improvements.
- At the workshop, teams will be formed to review several case studies each. The teams will be asked to evaluate the application of codes and standards to the examples presented in each case study and to draft a guide that identifies what path an application would take through the approval agencies in their jurisdiction and what codes and standards would be applied. Each team will review more than one type of case study to provide experience with both a HFS and a telecommunications site.
- Two keys issues to address with the workshop is how the codes and standards apply and in which order in their jurisdiction, (which will deal with the logic and design principals); and we also want the participants to become familiar with and apply the DOE/NREL Hydrogen Permitting Website and other resources.

The Workshop

3. The Workshop

The agenda for the workshop was as follows:

Permitting Hydrogen Fueling Stations and Hydrogen Fuel Cell Backup Power for Wireless Telecommunication Sites Workshop

**California State University, Los Angeles, CA
August 25 – 26, 2006**

AGENDA

DAY ONE: MONDAY, AUGUST 25, 2008

- 10:30 a.m. – 11:00 a.m. Registration**
- 11:00 a.m. – 11:15 a.m. Welcome**
Mike Kashuba, Air Resources Board
- 11:15 a.m. – 11:35 a.m. Workshop Background and Objectives**
Antonio Ruiz, US Department of Energy
- 11:35 a.m. – 11:45 a.m. Workshop Structure, Introductions and Agenda**
Jim Narva, NASFM
- 11:45 a.m. – 12:45 a.m. Working Lunch – Hydrogen Fuel and Safety, Fuel Cells Overview**
Anthony Androsky, US Fuel Cell Council
- 12:45 p.m. – 1:15 p.m. Emergency Response and Safety Systems**
Jennifer Hamilton, California Fuel Cell Partnership
- 1:15 p.m. – 2:15 p.m. Hydrogen Fueling Stations and Transportation**
Bill Elrick, California Fuel Cell Partnership; Alex Keros, General Motors, and Carl Baust, OCFA
- 2:15 p.m. – 2:30 p.m. Break**
- 2:30 p.m. – 3:15 p.m. Hydrogen Fuel Cells for Back-up Power at Wireless Telecommunication Sites**
Paul Buehler, Plug Power and Mike Maxwell, ReliOn
- 3:15 p.m. – 4:00 p.m. Permitting Hydrogen Facilities, ICC and NFPA 52 Pathways and Introduction of Permitting Website**
Jim Glew, City of Santa Monica and Ken Kraus, City of Los Angeles Fire Department
- 4:05 p.m. - 4:15 p.m. Break**

4:14 p.m. – 5:00 p.m. **Q/A, Discussion, Breakout Group Assignments, and Breakout Session Goals**
Jim Narva, NASFM, Carl Rivkin, NREL, and Group Facilitators

DAY TWO: TUESDAY, AUGUST 26, 2008

8:00 a.m. – 8:30 a.m. **Continental Breakfast**

8:30 a.m. – 9:45 a.m. **Breakout session**

9:45 a.m. – 10:30 a.m. **California State HFS Site Tour**

10:30 a.m. – Noon **Breakout session**

Noon – 1:00 p.m. **Lunch**

1:00 p.m. – 2:40 p.m. **Plenary Session for Report Outs**
Group Facilitators

2:40 p.m. – 2:50 p.m. **Summary and Next Steps**
Jim Narva, NASFM

3:00 p.m. **Adjourn Workshop**
Carl Rivkin, NREL

The primary goals of the workshop were

- Provide the participants with background on hydrogen such as its chemical properties and uses with comparisons to other flammable gases.
- Provide a hydrogen safety overview and information for emergency responders.
- Familiarize participants with examples of hydrogen motor fueling station projects and telecommunication back up power installations that have been implemented in the United States.
- Familiarize participants with the codes and standards and the processes that have been utilized by local/state officials to permit the projects.
- Provide workshop participants with the opportunity to conduct “Virtual Permittings” of projects that have already been permitted to get a handle on how they would process the permitting, given available information about the projects and available codes and standards.
- Have the participants develop local permitting pathway guides for their use.
- Identify critical issues associated with the permitting process that need to be addressed by the Department of Energy, in order to facilitate the permitting process (i.e., make it efficient, both in terms of time and expense).
- Provide participants with the opportunity to articulate codes and standards gaps or conflicts (if any) that need to be addressed.
- Raise the comfort level of the code official so that when they are presented with an application to construct a hydrogen motor fueling station in their jurisdiction.

An introduction to issues that can develop when applying codes and standards to projects utilizing hydrogen as an energy source, presentations were done on the use of stationary hydrogen fuel cells as a back up power supply at telecommunications equipment sites and on hydrogen as a motor fuel. The presentations were used as an avenue to identify the path a code official should take when applying the California edition of the International Building Codes along with related codes and standards and as an introduction to the properties of hydrogen as compared to other fuel gases commonly in use.

For the breakout sessions the participants were broken down into teams. Each team was assigned a motor fueling station and a telecommunications site review projects. This ensured that there would be sufficient diverse scenarios for the

allotted times and that the participants would be exposed to plans covering both HFS and telecommunication installations.

The resources provided to each team included the following:

A set each of:

- International Code Council I-Codes
 - International Building Code
 - International Fire Code

- National Fire Protection Association
 - NFPA 853 Stationary Hydrogen Fuel Cells
 - NFPA 55 Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks 2006 edition
 - NFPA 70 National Electrical Code
 - NFPA 52 Standard for Motor Vehicle Service Stations

- Online access was provided to the DOE/NREL Hydrogen Permitting Website

Along with:

- A set of Site Layout Plans
- Note Pad Easel, Review Report Forms, Evaluation Forms, Pens and Scales

The Results

4. The Results

The manner in which the teams were selected ensured that individuals had diverse qualifications and were diverse from the standpoint of regional influences on application of codes and standards. The workshop would be the first time they had worked with each other applying the code.

Teams can have a tendency to begin with a slightly disorganized or a shotgun approach to the plans with team's members picking up the different codes and standards and identifying issues to be addressed. It is a fairly common approach to dealing with hydrogen installations because most guidance documents simply list all of the codes and standards that may apply without providing a matrix of the path that should be followed to properly apply the technical requirements of the codes and standards. This approach also occurs because it is not uncommon to have a building code, fire code, mechanical code and/or electrical code official simultaneously reviewing their portions of an application to complete a review process.

However, because this workshop involved each official developing their own permitting guide the team members coalesced and agreed that the codes and standards needed to be applied in an orderly manner starting with the land use approval process then the building code and followed by the fire code. The fuel gas code and referenced standards would be applied subsequent to these two documents. This process was helped by the availability of the "Michigan Guide Boilerplate" document and the California version of the I-Code Path matrix that visual depicts the path through the various codes.

The structured approach ultimately applied by the separate teams wherein sections of the building code were noted with a path to a reference led all of the teams to identify loop backs wherein the code language pointed to another code section, only to find the referenced code section pointed back to the starting point. Some of these issues were pointed out in the introductory presentations.

Ultimately the teams did an excellent job of reviewing the assigned plans in a collaborative manner. Only minimal guidance was provided by the workshop facilitators. Reporting of results was thorough and well documented by all four teams, although none of the teams came out of the exercise with a customized code "pathway" for their jurisdiction.

Each team's final analysis and presentation included explanations on how they made their decisions, why they made the decisions they did, and what path took them to the next section of the code or to a referenced standard.

At the end of the workshop each participant was asked to complete an evaluation form. The evaluation asked the participants to rank their responses to four questions concerning expectations, increase in comfort level, increased

understanding and whether or not they would recommend others to attend a similar workshop. In addition they were asked to share what they liked or disliked about the workshop and to provide recommendations for improvements.

The rankings provided by the participants were overwhelmingly positive and all those that commented responded that they would recommend participation in similar workshops to their peers.

Summary

5. Summary

The workshop was a success both from the standpoint of providing code officials with an understanding of how to apply the various codes and standards to an application to build a hydrogen motor-fuel station or a back up power installation for a telecommunications site, and in having the codes and standards methodically applied to a project in a manner that identified areas of concern that needed to be addressed. For code officials to feel comfortable dealing with these types of applications they need to believe they have an adequate knowledge of the issues involved and they need to be assured that the existing codes and standards adequately address safety in an effective manner.

This workshop gave a different assignment to the code officials present, i.e., they were asked to develop a permitting guide for their own jurisdiction that identified the agencies an application needed to be approved by, the order that application would move through those agencies and what codes and standards would be applied in that process. The purpose was to provide the participants with a tool to take back to their jurisdictions and apply should an application be made for the use of hydrogen as a fuel in their jurisdiction.

For the workshop to have been the success it was, all involved in the preparation had to perform their functions in an effective and timely manner. The management of the invitations, travel and accommodations for those attending, and scheduling of the facility for meeting rooms and refreshments are as important as the information gathering, material preparation and presentation of the workshop itself.

A failure of any one component, whether it was the lack of a room, missing or inaccurate piece of information, or the functioning of the workshop itself affects the experience of the participant and their assessment of the workshop as a whole.

When a team is assembled and contracted to develop and present a workshop it must include an agency or organization that has a proven track record organizing an event that includes travel, accommodations and leasing of conference space. When the participants arrive for the workshop everything must be organized and ready to go. Technical assistance must be available before and during the activity to address any audio visual equipment issues that come up.

The team must include firms, individuals or agencies familiar with the targeted topic to provide valid information and resources for use in the workshop. To be effective the information must be current, technically accurate and in a form that allows it to be understood and have a professional appearance.

And the team must include experienced educational presenters to develop the material and present or facilitate the workshop. Many otherwise well prepared

presentations have failed when the presenter did not have the ability to communicate effectively with the audience.

The code officials that were invited to attend this workshop were all experienced in their field of endeavor. All are knowledgeable about codes and standards. Because of their backgrounds they were a challenging audience; one that requires a high content level and a high level of accuracy. They have the ability to immediately pick up on flaws, incorrect information or if a presenter is not being entirely open with their information.

Because the participants had such a high level of knowledge and experience, their positive response to the workshop and the information provided documents the quality and value of the workshop for the purpose of educating code officials on the topic of hydrogen motor-fuel stations and the safe use of hydrogen in general.

Appendices A-H