VIII.1 Fuel Cell Technologies National Codes and Standards Development and Outreach

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- Compressed Gas Association, Chantilly, VA
- Davidson Code Concepts, Easley, SC
- Fuel Cell and Hydrogen Energy Association, Washington, D.C.
- Kelvin Hecht, Avon, CT
- National Fire Protection Association, Quincy, MA
- SAE International (SAE), Troy, MI

Project Start Date: October 1, 2002
Project End Date: Project continuation and direction determined annually by DOE

Overall Objectives

- Support the deployment of hydrogen technologies for hydrogen fuel cell vehicles and stationary applications
- Make critical safety information readily available through webinars, workshops, safety reports, and technical presentations
- Inform key stakeholders of the safety, codes and standards requirements for the safe use of hydrogen technologies
- Develop sensor technologies to support the safe use of hydrogen technologies
- Identify and resolve safety issues associated with hydrogen technologies infrastructure

Fiscal Year (FY) 2013 Objectives

- Publish NREL Guide to Hydrogen Safety
- Support the development of the next edition of the National Fire Protection Association (NFPA) 2 Hydrogen Technologies Code and SAE J2601 Fueling Protocol
- Present webinars on codes and standards progress and hydrogen fueling protocols
- Update codes and standards citations for the DOE Hydrogen and Fuel Cells website
- Present codes and standards information at California hydrogen technologies deployment meetings and workshops
- Implement 2020 plan for the deployment of hydrogen technologies infrastructure

Technical Barriers

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

(A) Safety Data and Information: Limited Access and Availability

(D) Lack of Hydrogen Knowledge by Authorities Having Jurisdiction

(F) Enabling National and International Markets Requires Consistent Regulations, Codes, and Standards

(G) Insufficient Technical Data to Revise Standards

(H) Insufficient Synchronization of National Codes and Standards

(I) Lack of Consistency in Training of Officials

(K) No Consistent Codification Plan and Process for Synchronization of R&D and Code Development

(L) Usage and Access Restrictions

Contribution to Achievement of DOE Safety, Codes and Standards Milestones

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

- Milestone 4.4: Complete National Codes and Standards Chronological Development Plan. (4Q, 2014)
- Milestone 4.5: Complete fueling station codes and template. (4Q, 2014)
- Milestone 4.6: Completion of standards for critical infrastructure components and systems. (4Q, 2014)

- Milestone 4.7: Complete risk mitigation analysis for advanced transportation infrastructure systems. (1Q, 2015)
- Milestone 4.8: Revision of NFPA 2 to incorporate advanced fueling and storage systems and specific requirements for infrastructure elements such as garages and vehicle maintenance facilities. (3Q, 2016)
- Milestone 4.9: Completion of Global Technical Regulation (GTR) Phase 2. (1Q, 2017)

FY 2013 Accomplishments

- NREL provided broad coordination of codes and standards development by:
  - Supported Codes and Standards Tech Team–develop and maintain the "2020" plan for defining and tracking codes and standards work required for deployment of hydrogen fuel cell vehicles.
  - Managed the National Hydrogen and Fuel Cells Codes and Standards Coordinating Committee. This group has monthly meetings that serve as a forum for the codes and standards development community to share information.
  - Led Hydrogen Sensor Task Group monthly meetings.
  - Acted as liaison between codes and standards development committees to assist in coordination between fire codes and standards development projects.
- NREL worked to have references to NFPA 2 Hydrogen Technologies Code placed in the Fire Codes (The International Fire Code and the Uniform Fire Code) to create a national hydrogen code.
- NREL developed a Hydrogen Safety Handbook that will be published by the end of FY 2013.
- Updated the codes and standards reference material for both stationary fuel cells and infrastructure for fuel cell vehicles that resides on the DOE Hydrogen and Fuel Cells website.
- Published NREL technical report "Regulations, Codes, and Standards (RCS) Template for California Hydrogen Dispensing Stations."
- Published NREL Technical Report Steering Committee Progress Report on Hydrogen Sensor Performance Testing and Evaluation under the memorandum of understanding between NREL, DOE, Joint Research Centre-Institute for Energy and Transport, and the European Commission.

INTRODUCTION

The fundamental purpose of this work is to support the safe deployment of hydrogen technologies. To achieve this objective codes and standards must be in place to protect public safety and any significant safety issues must be resolved.

The work under this project has helped develop a national set of codes and standards to safely deploy hydrogen technologies. Additionally, key safety issues have been identified and are in the process of being resolved. Safety, codes, and standards information has been distributed to interested parties using a variety of techniques including webinars, NREL technical reports, workshops, in-person presentations, and Web-based products.

APPROACH

The project approach has been to involve as many key stakeholders as possible in codes and standards development and coordination and outreach activities to achieve maximum effectiveness. These stakeholders include industry partners, standards development organizations, research organizations including other national laboratories, authorities having jurisdiction, local government in locations where projects will be deployed, and trade organizations involved in technology development and deployment.

RESULTS

Figure 1 illustrates the progress that has been made towards developing the key codes and standards required to deploy hydrogen technologies. The reference of NFPA 2 in the International Fire Code effectively creates a national hydrogen code. This simplification and coordination of code requirements will make it easier to develop permit application, review and approve applications, and ensure a high level of public safety. This accomplishment helps meet several DOE milestones including 4.4 and 4.8.

NREL published the technical report "Regulations, Codes, and Standards (RCS) Template for California Hydrogen Dispensing Stations" that will help in moving infrastructure deployment forward in California. California appears to be on the leading edge of hydrogen fueling station deployment because of state regulations that mandate the use of zero emission vehicles (hydrogen fuel cell vehicles are classified as zero emission vehicles). This report will help both project developers and code officials write and approve permit applications for hydrogen fueling stations. This work helps meet DOE milestone 4.5.

NREL's ongoing support of standards development has resulted in all of the key codes and standards being promulgated for the deployment of hydrogen technologies. This point is illustrated in the far right column of Figure 1.

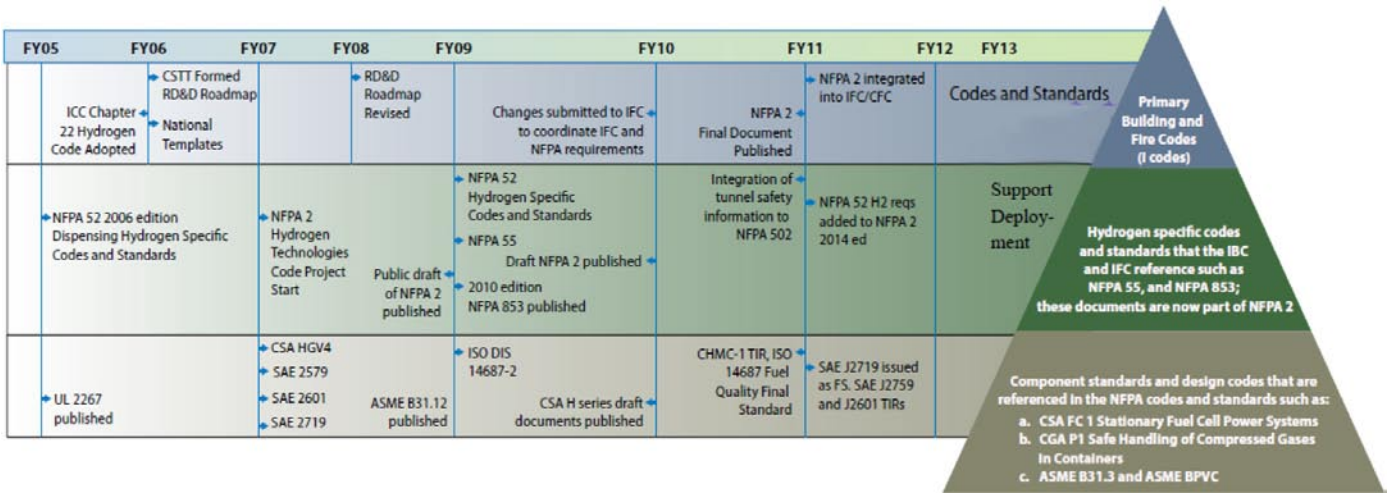

FIGURE 1. Hydrogen Codes and Standards Progress

This effort addresses DOE milestones 4.4, 4.5, 4.6, 4.7, 4.8, and 4.9. The reason this work addresses the GTR is that the SAE J2579 standard that was supported through this coordination work is used as the basis for the GTR.

NREL performed a Process Hazard Analysis on a hydrogen fueling station to help prioritize the risks presented by the construction and operation of a high pressure fueling station. The results of this analysis directly address Milestone 4.7.

NREL prioritized codes and standards development projects through the use of the "2020 Hydrogen Infrastructure Deployment Plan." The plan was developed with the input of the DOE Codes and Standards Technical Team.

CONCLUSIONS AND FUTURE DIRECTIONS

Conclusions

Codes and Standards

- Codes and standards development support will continue at a reduced level through direct support of standards development organizations and participation on or operation of coordination committees.
- Ongoing coordination of the fire codes and key hydrogen codes and standards is a priority.

Outreach

- Deployment support will be focused on infrastructure at locations with project activity and concrete deployment plans, for example jurisdictions in California.
- These goals can only be accomplished through collaborations with key stakeholders at all levels.
- NREL will continue to support deployment of hydrogen and fuel cell technologies through programs such as the technical reports, webinars, safety reviews, and the Web-based information compendium.

Future Directions

Codes and Standards Coordination/Development

- Continue work to coordinate codes and standards on a smaller scale with special focus on taking information from deployment projects back to code development committees.
- Resolve infrastructure codes and standards issues.

Outreach

- Continue to publish NREL technical reports, deliver webinars, and provide Web-based information on key safety issues required to support hydrogen technologies deployment.
- Assist code officials, project developers, and other interested parties in use of new codes and standards and safety information through outreach activities, with special focus on key jurisdictions such as California.
- Work with interested parties to provide information to assist in infrastructure deployment.

FY 2013 PUBLICATIONS/PRESENTATIONS

1. Buttner, W.J.; Burgess, R.; Rivkin, C.; Post, M.B.; Boon-Brett, L.; Black, G.; Harskamp, F.; Moretto, P.(2012). Inter-Laboratory Assessment of Hydrogen Safety Sensors Performance under Anaerobic Conditions.International Journal of Hydrogen Energy. Vol. 37(22), November 2012; pp. 17540-17548; NREL Report No. JA-5600-55065. http://dx.doi.org/10.1016/j.ijhydene.2012.03.165.

2. Buttner, W.; Post, M.; Burgess, R.; Rivkin, C.; Boon-Brett, L.; Palmisano, V.; Bonato, C.; Harskamp, F.(2012). Steering Committee Progress Report on Hydrogen Sensor Performance Testing and Evaluation under the Memorandum of Agreement between NREL, U.S. DOE and JRC-IET, EC. 24 pp.; NREL Report No. MP-5600-57207.

3. Rivkin, C.; Blake, C.; Burgess, R.; Buttner, W.; Post, M. (2012). Regulations, Codes, and Standards (RCS) Template for California Hydrogen Dispensing Stations. 30 pp.; NREL Report No. TP-5600-56223.

4. Rivkin, C; California Unified Program (CUPA) conference Regulations, Codes, and Standards (RCS) for Hydrogen Fueling Stations, February 7, 2013 Anaheim, CA.

5. Rivkin, C; National Hydrogen and Fuel Cell Coordinating Committee (NHFCCC) Meeting webinar, Codes and Standards: Progress to Date and the Path Forward, February 6, 2013.