

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

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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, training sessions, safety reports, and technical presentations
- Inform key stakeholders of the safety, codes and standards requirements for the safe use of hydrogen technologies
- Work with potential infrastructure developers to accelerate the deployment of hydrogen fueling stations and other key infrastructure
- Identify and resolve safety issues associated with hydrogen technologies infrastructure

### Fiscal Year (FY) 2014 Objectives

- Publish a paper on progress and accomplishments in the development of codes and standards
- Support the development of the next edition of National Fire Protection Association (NFPA) 2 Hydrogen Technologies Code by leading the LH2 Task Group and acting as Principal Committee member
- Present webinars on Codes and Standards Progress and Hydrogen Components
- Publish updated National Permit Guide for hydrogen fueling stations

- Present Codes and Standards information at California hydrogen technologies deployments meetings and workshops
- Implement Continuous Codes and Standards Improvement Process by evaluating field data to determine codes and standards development priorities
- Provide in-person training to code officials and project developers in key jurisdictions in California and other locations where infrastructure projects are planned

### Technical Barriers

This project addresses the following technical barriers from the 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 AHJs (authorities having jurisdiction)
- (F) Enabling National and International Markets Requires Consistent RCS
- (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 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 GTR Phase 2. (1Q, 2017)

**FY 2014 Accomplishments**

- NREL provided broad coordination of codes and standards development by:
  - Supporting 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 and making presentations on sensors and codes and standards development activities
  - Acting as liaison between codes and standards development committees to assist in coordination between fire codes and standards development projects
  - Developed a plan for the NFPA Liquefied Hydrogen Task Group to evaluate the setback distances for and safety mitigation measures in NFPA 55 and NFPA 2
- NREL coauthored “Regulations, Codes and Standards for Hydrogen Technologies - A Historical Overview,” a paper that will be drafted by the end of FY 2014
- Developed new Permitting and Codes and Standards training modules for hydrogen technologies deployment
- Presented in-person training sessions for Deployment of Hydrogen Infrastructure in key jurisdictions including Huntington Beach, CA and Culver City, CA



**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.

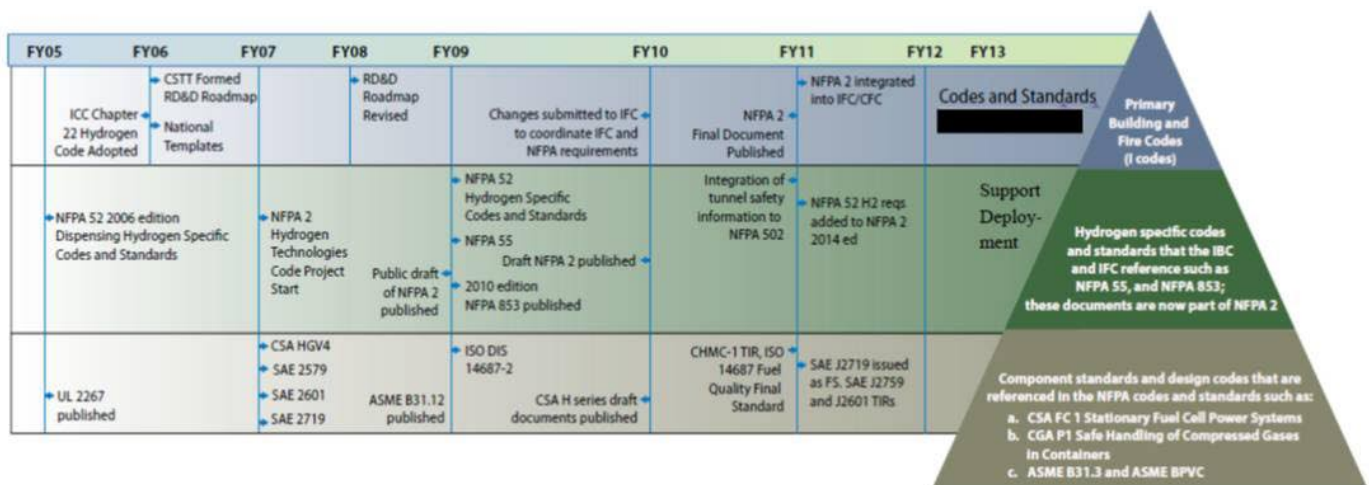
The work under this project has helped develop a national set of codes and standards to safely deploy hydrogen technologies. Additionally, key safety issues have been identified and are in the process of being resolved. Safety, codes and standards information has been distributed to interested parties 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, AHJs, 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 toward developing the key codes and standards required to deploy hydrogen technologies. The reference of NFPA 2 Hydrogen Technologies Code in the International Fire Code and the planned adoption by the State of California of NFPA 2 effectively creates a national hydrogen code. This



**FIGURE 1.** Progress in Codes and Standards Development

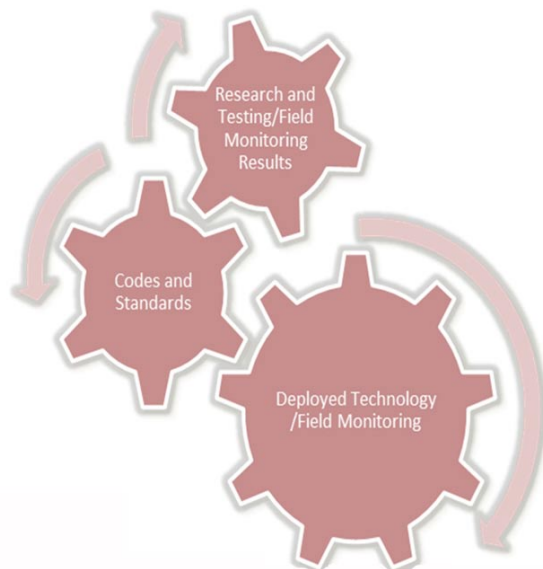
simplification and coordination of code requirements will make it easier to develop permit applications, review and approve applications, and ensure a high level of public safety. This accomplishment helps meet several DOE milestones including 4.4 and 4.8.

The next step in this codes and standards development process after the promulgation of the baseline set of codes and standards is monitoring the field performance of these documents, determining where modifications are required, and supporting the implementation of those modifications. This helps DOE meet milestone 4.5.

This modification process is illustrated in Figure 2. The process consists of evaluating field deployment of hydrogen technologies through use of NREL data and site visits, determining whether there are issues with codes and standards based on this information, and developing modified codes and standards requirements to resolve these issues. This process also integrates NREL laboratory research activities involving hydrogen technologies safety by using this research to address codes and standards issues.

NREL developed updated codes and standards training modules and provided in-person training for code officials and project developers in key jurisdictions. This work will be ongoing as deployment of infrastructure increases.

NREL supported the work of H2USA by participating as a member of the Market Acceleration Working Group. This participation included developing a generic slide presentation that will be used when introducing hydrogen technologies to organizations that may play a role in the support and development of hydrogen infrastructure.



**FIGURE 2.** Continuous Codes and Standards Improvement

NREL will support testing required to develop Federal Motor Vehicle Safety Standards required to implement the Global Technical Regulation in the United States. This supports DOE milestone 4.9.

NREL has acted as Task Group Leader for a LH2 task group that will develop new requirements for bulk liquefied hydrogen and associated safety mitigation measures for the next edition of NFPA 55. The supports DOE Milestone 4.9.

## CONCLUSIONS AND FUTURE DIRECTIONS

### Conclusions

#### Codes and Standards

- Codes and standards development support will continue through direct support of standards development organizations by NREL staff participation on or operation of coordination committees
- Ongoing coordination of the fire and building codes and key hydrogen codes and standards is a priority
- Field deployment information will help set codes and standards development priorities

#### 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 technical reports, webinars, safety reviews, and the Web-based information compendium
- NREL will work with H2USA to support the efforts of key organizations involved in infrastructure deployment

#### Future Directions

##### Codes and Standards Coordination/Continuous Codes and Standards Improvement

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 such as hydrogen setback distances in NFPA codes
- Continue coordination between National Fire Codes and International Code Council codes
- Support efforts to adopt NFPA 2 Hydrogen Technologies Codes (and other key codes) such as the work done by

the California Fire Marshal's Office to adopt NFPA 2 earlier than adoption of the IFC would dictate

### 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
- Provide in-person codes and standards training in key locations such as California and other zero-emission vehicle states
- Work with H2USA to support infrastructure development

### FY 2014 PUBLICATIONS/PRESENTATIONS

1. Deployment of Hydrogen Infrastructure May 19, 2014 Huntington Beach, CA
2. Deployment of Hydrogen Infrastructure May 27, 2014 Culver City, CA
3. Regulations, Codes and Standards (RCS) for Hydrogen Technologies- A Historical Overview projected September 2014.