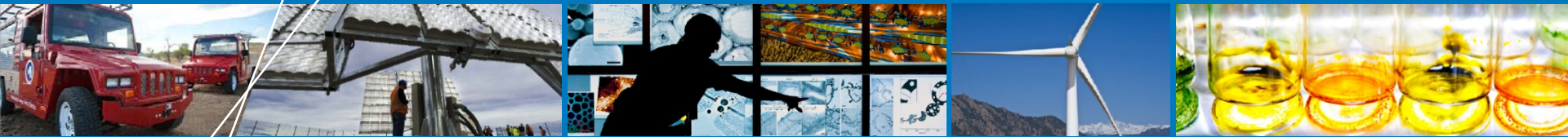


National Codes and Standards Deployment and Outreach



**Carl Rivkin, P.E. (P.I.)
Robert Burgess and William Buttner
National Renewable Energy laboratory
18 June 2014**

Project ID SCS001

This presentation does not contain any proprietary, confidential, or otherwise restricted information.

Overview

Timeline

Project start date: October 1, 2002

Project end date: September 30, 2014

*Project continuation and direction determined annually by DOE

Budget

Funding received in FY13: \$550k

Total funding planned for FY14: \$425k

DOE share: \$425k (\$275k for Hydrogen and Fuel Cell Technologies Deployment Support, \$150k for Codes and Standards Development)

Contractor share: \$0k

Total project value: \$975k

Barriers

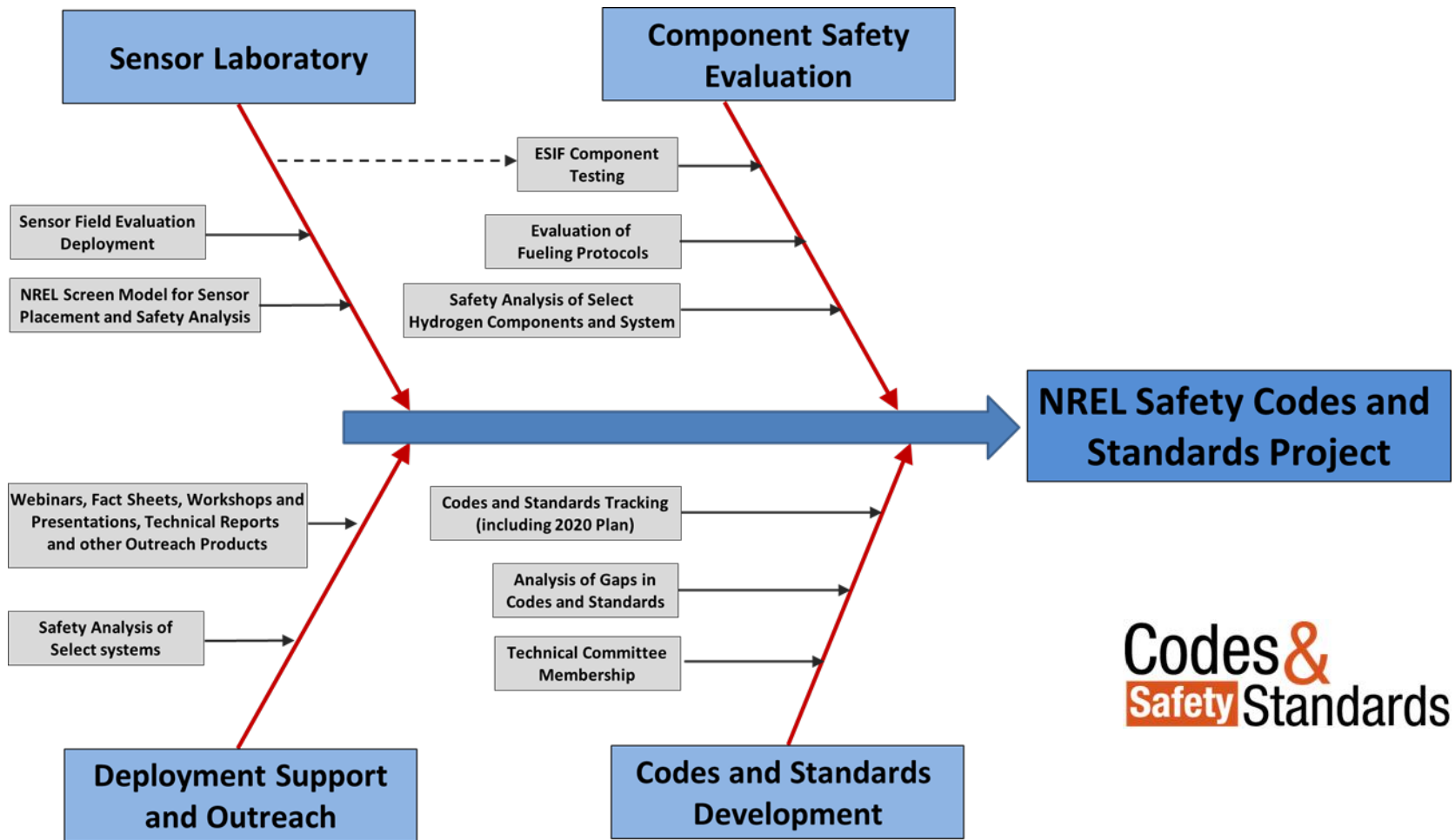
- **G. Insufficient Technical Data to Revise Standards**
 - **F. Enabling National and International Markets Requires Consistent RCS**
 - **A. Safety Data and Information: Limited Access and Availability**
- ## Partners

- **Regional Fire Departments**
- **California Fuel Cell Partnership**
- **Fuel Cell and Hydrogen Energy Association**
- **Telecommunications Industry Association**
- **Hydrogen industry**
- **Standards development organizations**
- **Project lead: Carl Rivkin**

Relevance

- **Codes and standards development and deployment support**
- **Objectives:**
 - Develop and support the codes and standards required to safely deploy hydrogen technologies
 - Current year—develop outreach tools, conduct training, and address key codes and standards to support the safe deployment of hydrogen technologies
 - Project lifetime—support the development of integrated codes and standards for the safe deployment of hydrogen technologies and provide the outreach required to have these codes and standards used effectively
 - Impact since the 2013 AMR:
 - Analyzed hydrogen fueling systems to establish code and research priorities
 - Published Hydrogen Safety Guide to assist in project development and review

NREL Safety, Codes and Standards Projects



NREL Safety, Codes and Standards work supports hydrogen technologies deployment

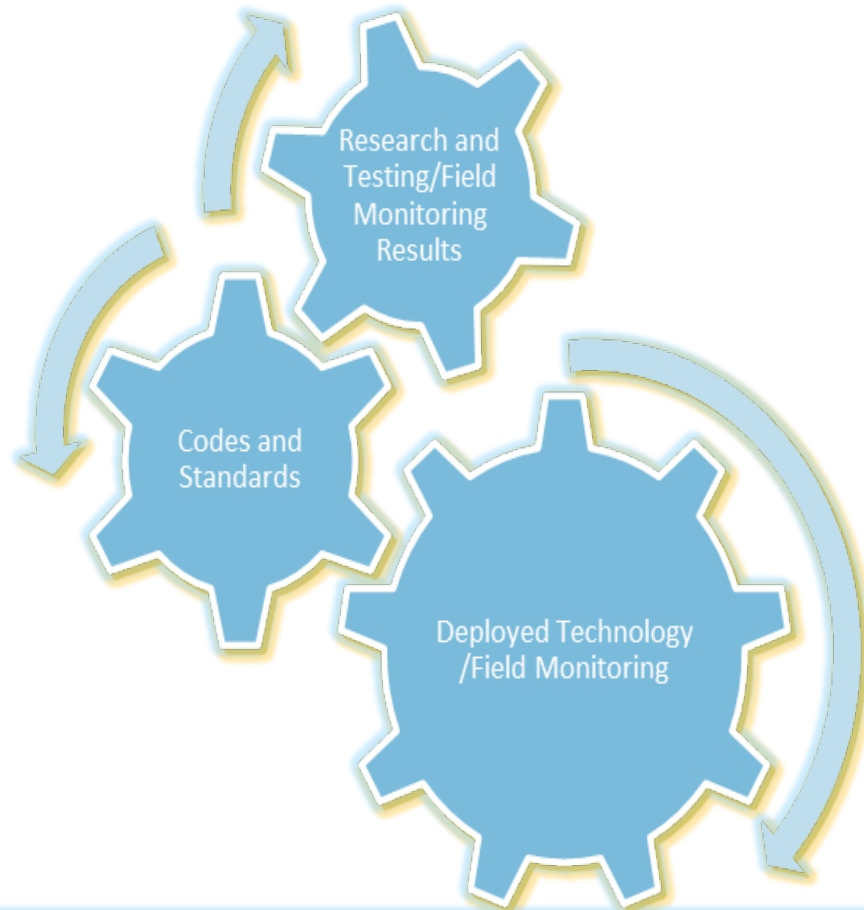
Approach: Continuous Codes and Standards Improvement (CCSI)

- **(CCSI) approach:**

- 2000-2013: many key codes and standards developed and promulgated
- 2014: moving forward from this base using CCSI
- Extensive revision or creation of new codes and standards requires input of field data and users concerns
- Early phases of deployment show areas of safety concern (high pressure fueling system components)
- Regular review (at least every 6 months) of NREL technology validation data to identify issues
- Annual site visits to key hydrogen fueling stations provide information on Safety, Codes and Standards issues
- Interviews with code officials and project developers to identify issues with actual code application (for example, requirements that are worded such that they are difficult to enforce and comply with)
- Participation on technical committees to ensure that research and field data are effectively linked to code development

Continuous Codes and Standards Improvement (CCSI)

CCSI Process of feeding deployment information into code development



Approach: Deployment Support

- **Deployment support is critical for the effective use of Codes and Standards and the safe deployment of hydrogen technologies**
- **Two-pronged approach:**
 - Target geographic areas where projects are being deployed to support early successes
 - Create national tools to support deployment that can be used in all jurisdictions
- **Partner with key groups including:**
 - Fire service/building departments that conduct code reviews
 - State programs that support technology deployment such as CaFCP
 - Standards development organization training activities that conduct targeted code training

Accomplishments: National Permit Guide and Tools

Objectives

- Create national permit guide and tools to assist deployment focusing on fueling stations and infrastructure to support hydrogen fuel cell vehicles
- Cover common Regulations, Codes and Standards (RCS)
- Cover permitting processes
- Make product fit the user project developer and code official needs
- Match the product to projects and timeframe for deployment of hydrogen technologies
- Complete Phase I August 2014

Guide Content

The permit process(s)
Generally applicable codes and standards
Station performance
System maintenance
System inspection
Contacts for code official and project developers
<ul style="list-style-type: none">• Note:• NREL published California Template for Permitting Hydrogen Fueling Stations in 2012• This effort is expanded for national deployment of hydrogen infrastructure

Accomplishments: National Permit Guide

Approach

- Work with authorities having jurisdiction (AHJs) and project developers
- Use format that will be effective at communicating with AHJs
- Work with fire service
- Use actual example equipment
- Use schematics, video to document permit process
- Part I complete in FY14
- Part II complete in FY15

Work Products

National Permit Guide document FY2015

Training video/schematics—Part 1: Project Planning and Plans Review

Trace an actual project through all elements of the planning and review process including zoning and public hearings

Training video/schematics—Part 2: Project As Built Inspection

Continue with the same project as it moves through the construction and start-up phases

Accomplishments: Deployment Training

Deployment Training

In-Person Sessions

- Support code officials and project developers
- Cover RCS and basic safety concerns
- Intended to jump start the permitting process
- Geographically focused
- Partner with fire service
- Very focused on information that will smooth permitting process
- 4 FY14 sessions May 19 and 27th
Los Angeles sessions

Contents

- Hydrogen fueling system overview
- Generally applicable codes and standards
- Fueling station performance
- Fueling station inspection
- Fueling station maintenance
- Information resources

Accomplishments: Guide for Fuel Cell Installations for Wireless and Information and Communication Technology (ICT) Infrastructure

- **Telecommunications Industry Association (TIA) is the trade association representing the global information and communications technology (ICT) industry**
- **Published by TIA**
- **Demand for stationary fuel cells is growing**
- **Many opportunities can be more rapidly realized with more information easily accessible**
- **Guide would not create any new requirements but would summarize codes and standards and other key issues associated with deployment**
- **NREL acting as focus group chair**
- **Draft 2014/final 2015**

Table of Contents

Chapter 1 Scope

Chapter 2 Reference Documents

Chapter 3 Definitions

Chapter 4 Permitting Process

Chapter 5 Generally Applicable Safety Guidance

Chapter 6 System Citing

Chapter 7 System Design

Chapter 8 System Installation

Chapter 9 System Operation

Chapter 10 System Maintenance

Chapter 11 Hydrogen Supply Considerations

Chapter 12 Emergency Response Plan

Annex A Supplementary Information

Annex B Example Systems

Annex C Example Permits

Accomplishments: CCSI

- **Active participation on codes and standards technical committees including identifying research needs and bringing information to committees**
- **NREL supports codes and standards development through active participation in technical committees including:**
 - CSA Fuel Cell Committee
 - SAE Fuel Cell Committee
 - CGA Hydrogen Technology Committee
 - ASME Boiler and Pressure Vessel Committee
 - NFPA Hydrogen Technologies Committee
 - NIST Handbook 44 Committee
 - NFPA Industrial and Medical Gas Committee
 - UL Fuel Cell Committee

Accomplishments: NFPA Bulk Liquefied Hydrogen (LH2) Task Group

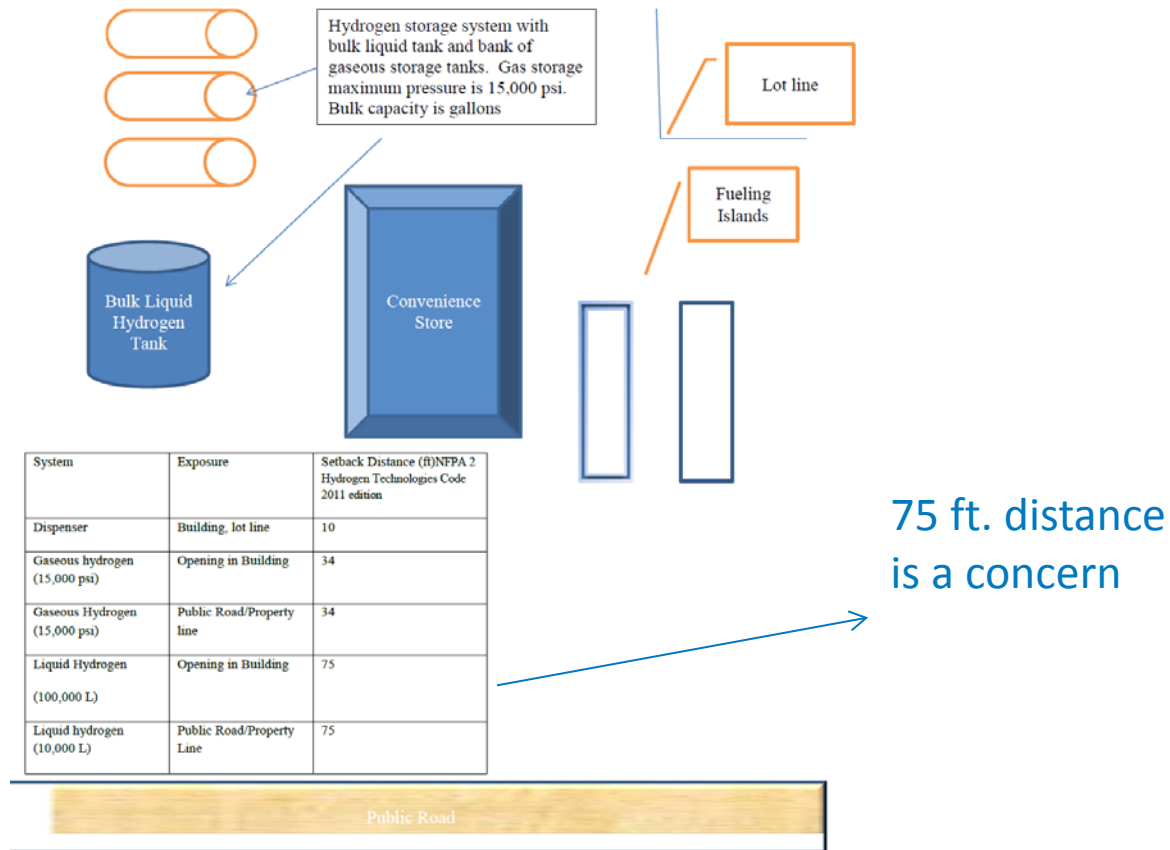
CCSI Issue

- Feedback from multiple sources indicate hydrogen storage setback distances present a potential barrier to deployment

Action

- Form NFPA joint (NFPA Industrial and Medical Gas and NFPA Hydrogen Technologies Technical Committee) task group to evaluate current setback distances and control measures that could potentially reduce the setback distances for bulk hydrogen storage systems and modify code
- Develop proposals to 2018/19 editions of NFPA 55 to address these issues

Accomplishments: LH2 Task Group



Schematic of hydrogen station with gaseous and liquefied hydrogen storage

Responses to Previous Year Reviewers' Comments

- **The project team should expand the scope to include the supporting design codes, product standards, and test methods.**
 - Response: NREL does monitor all RCS activities. NREL would welcome the opportunity to expand project activities. This is a relatively small project that can only effectively address a few RCS issues.
- **Researchers should monitor field experience to confirm that the statement that key C&S are in place is really true.**
 - Response: This monitoring has been done and will continue to be done. It is one of the fundamentals of CCSI. It should be noted that CCSI goes beyond the determination of whether C&S are in place by evaluating how effectively C&S are working in actual deployment.
- **The project team should create a Near Term R&D Needs document for C&S and canvas industry members at ASTM/CSA/SAE regarding needs, etc., to determine a roadmap.**
 - Response: This plan, which is a part of the NREL components work, has been created with input from interested parties.

Collaborations

- **Collaborators:**

- H2USA - Market Acceleration Working Group
- Industrial gas and component manufacturing industries
- National laboratories—H2FIRST work with Sandia National Laboratories and hydrogen outreach work with Pacific Northwest National Laboratory
- State hydrogen groups including the California Fuel Cell Partnership, Massachusetts Hydrogen Coalition, and South Carolina Hydrogen and Fuel Cell Alliance
- Code enforcers – outreach training
- Fire departments including Orange County Fire Authority – outreach training
- Universities including the Colorado School of Mines

Collaborations: SDOs

- **Collaborators:**

- Standards development organizations (SDOs) including:
 - CSA Group
 - Compressed Gas Association (CGA)
 - Society of Automotive Engineers (SAE)
 - National Fire Protection Association (NFPA)
 - International Code Council (ICC)
 - Underwriters Laboratories (UL)
 - Global technical regulation for Fuel Cell Vehicles (GTR)
 - American Society of Mechanical Engineers (ASME)
 - American Society for Testing and Materials (ASTM)
 - Telecommunications Industry Association (TIA)
 - International Organization for Standardization Fuel Cell Committee (ISO T/C 197)

Proposed Future Work

- **Phase II of National Permit Guide that will address operations, maintenance, and inspection issues with hydrogen fueling stations**
- **NFPA Hydrogen Storage Task Group—develop proposal for 2018/9 edition of NFPA 55 with primary focus on bulk liquefied hydrogen storage**
- **Continue regional codes and standards workshops—New England workshops likely to be held in Massachusetts and New York**
- **Complete stationary fuel cell deployment guide to be published by the Telecommunications Industry Association**
- **Identify code developments issues using CCSI process**

Remaining Challenges and Barriers

- **Acquiring test data for hydrogen fueling system components and other hydrogen technologies to modify safety requirements as part of the CCSI process**
- **Greater standardization of codes and standards used across the U.S. to create more standardized permit conditions and decrease both permit development and review time**
- **Increased familiarity with codes and standards across the U.S. to decrease permit development time and permit review time**
- **Increased deployment experience across U.S. to increase familiarity with hydrogen technologies and to generate information to improve codes and standards**

Summary

- **NREL will support the development of C&S and the deployment of hydrogen technologies through:**
 - Continuous Codes and Standards Improvement (CSSI) to ensure safety as more information is available with higher levels of deployment
 - Outreach to ensure that required information for hydrogen technologies is available to code officials, project developers, and other interested parties
- **FY 2014 accomplishments in these areas include:**

Summary of FY14 Accomplishments	
CSSI	Formation of NFPA LH2 Task Group
Deployment	National Permit Guide/Tools
Deployment	Codes and Standards Workshops
Deployment	Stationary Fuel Cell Permitting Guide