NREL
NATIONAL RENEWABLE ENERGY LABORATORY

2011 DOE Fuel Cell Technologies Program Codes and Standards Outreach for Emerging Fuel Cell Technologies

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Overview

TIMELINE

- *Start date*: **October 1, 2007**
- End date**: 10/2011***
- *Project continuation and direction determined annually by DOE

BARRIERS

- ***Consensus*** – Knowledge of codes and standards *(D,E)*
- ***Technology Readiness*** – Jurisdictional issues *(M)*

BUDGET

- Funding received in FY10: **$ 0.5M**
- Funding for FY11: **$ 0.25M**

PARTNERS

- National Codes and Standards Coordinating Committee, CaFCP, CARB, various AHJs
- FreedomCAR and Fuel Partnership C&S Technical Team

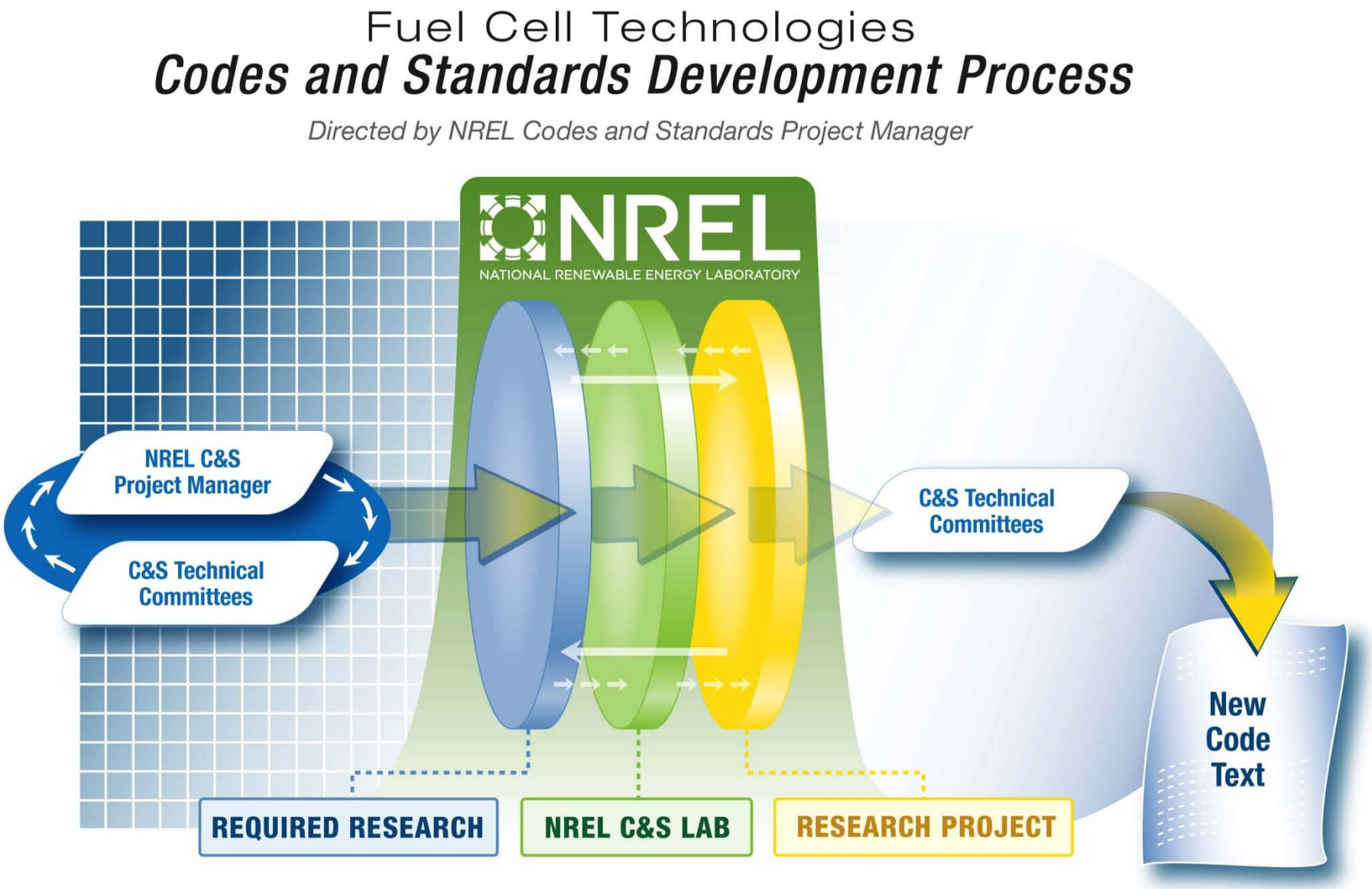
Relevance/Objectives

- Advance hydrogen and fuel cell safety, codes and standards development, and market transformation by distribution of information
- Facilitate the safe deployment of renewable energy technologies
- Overcome barriers to hydrogen and fuel cell technologies, specifically fuel cell powered forklift vehicles and stationary fuel cells used for back up power
- Communicate directly with code user and enforcers
- Provide publicly accessible information on codes and standards

Approach

- Research and Development
  - Use workshops to help define research needs- for example evaluate the impacts of high pressure component failures
- Codes & Standards Coordination
  - Code and Standards workshops to help define codes and standards gaps
  - AHJs, FCHEA, CaFCP, CARB, SDO's, CDO's, Industry
- Support Technology Readiness/Market Transformation
  - Permitting workshops, web based information compendium, hydrogen fact sheets, third party safety reviews and site visits
  - NREL technical reports

Codes and Standards Project Approach



Technical Accomplishments

- Conducted the following workshops in FY10:
  - May 25, 2010 San Francisco. CA in collaboration with the CAFCP
  - September 28, 2010 Los Angeles, CA in collaboration with the CAFCP and UCLA School of Engineering
- The following workshops are planned for remainder of FY11:
  - April 19, 2011 Los Angeles, CA in collaboration with the California Fuel Cell Partnership and Southern California Fire Protection Officers Association
  - June 8, 2011 Sensor Workshop Chicago, IL in collaboration with the multiple industry partners and national laboratories
  - July/August Lessons Learned Workshop in collaboration with multiple industry partners
  - September Codes and Standards Workshop East Coast location TBD
- Web based Information Compendium maintained and updated

Technical Accomplishments

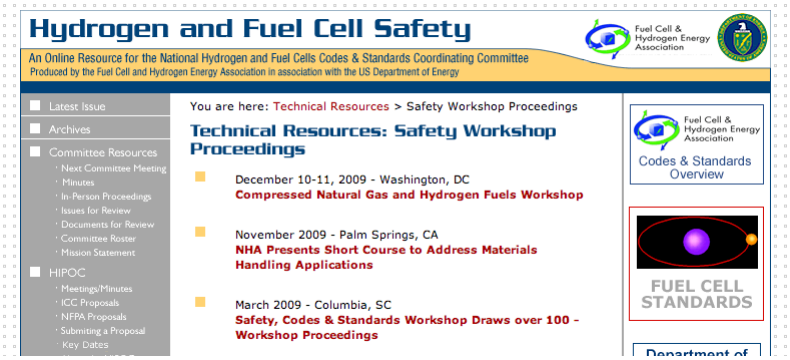
- Identified a key emerging fuel cell technology project for site visit including codes and standards evaluation:
  - Stationary fuel cell for back up power
  - Representative of widely used technology
  - Deployed in wide range of geographic locations
  - Codes and standards requirements relatively well defined

- Began work on a permitting template for hydrogen fueling stations:
  - will contain codes and standards citations for requirements used in many US jurisdictions
  - will contain a basic description and schematic of fueling station
  - will contain information on existing fueling stations

Technical Accomplishment—
Codes and Standards Workshops

Workshops held in San Francisco, CA (May 10) & Los Angeles, CA (September 28)

- Held in key locations identified by Industry and Regional trade organizations with invited code officials and project developers
- Provide essential background on hydrogen and fuel cell technologies and electric vehicle deployment and applications
  - Hydrogen fueling stations
  - Hydrogen fuel cells in telecom applications
  - Electric vehicle safety and charging stations
- Provide workshop participants with with basic safety information and an overview of applicable codes and standards



Proceedings from selected workshops on FCHEA website:
http://www.hydrogenandfuelcellsafety.info/resources/workshops.asp

Technical Accomplishment—UCLA, Los Angeles Workshop

- Key workshop objective was providing information on codes and standards to code officials who will be directly involved in project review
- Attendees included key individuals such the
- Workshop conducted in partnership with the California Fuel Cell Partnership and the UCLA School Of Engineering

Technical Accomplishment— UCLA, Los Angeles Workshop Agenda

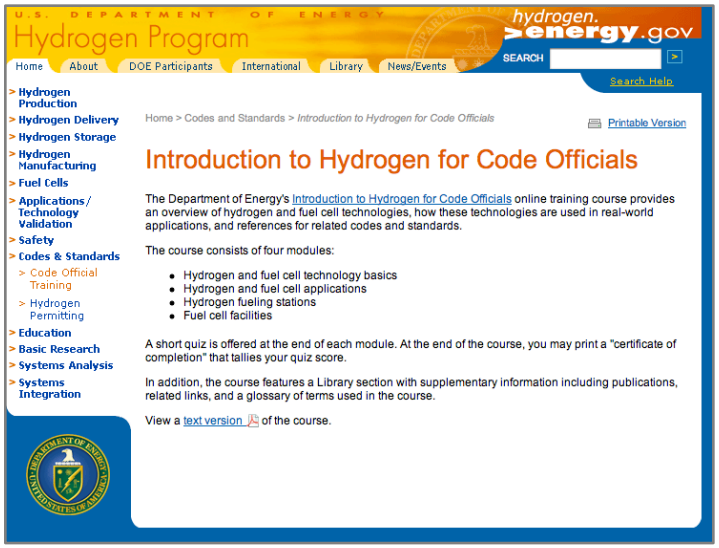
9:00 am – 9:30 am	Registration
9:30 am – 9:45 am	**Welcome Remarks** *Vasilios Manousiouthakis, Director of H.E.R.C.*
9:45 am – 10:00 am	**Workshop Background and Objectives** *Carl Rivkin, NREL*
10:00 am – 10:45 am	**Overview of Renewable Energy Technologies and Alternative Energy Codes and Standards** *Carl Rivkin, NREL*
10:45 am – 11:30 am	**Emergency Response and Safety Systems** *Jennifer Hamilton, California Fuel Cell Partnership*
11:30 am – 12:30 pm	Lunch
12:30 pm – 1:30 pm	**Hydrogen Fueling Stations & Transportation** *Todd Manner, Fielder Group*
1:30 pm – 2:00 pm	**Permitting Website & Education Tools** *Chad Blake, NREL*
2:00pm – 2:45 pm	**Case Studies** *Carl Rivkin, NREL*
2:45pm – 3:00 pm	Break
3:00 pm – 3:45 pm	**Electric Vehicles** *Chad Blake, NREL*
3:45 pm – 4:00 pm	**Permitting Tool & Workshop Wrap-Up** *Carl Rivkin, NREL*

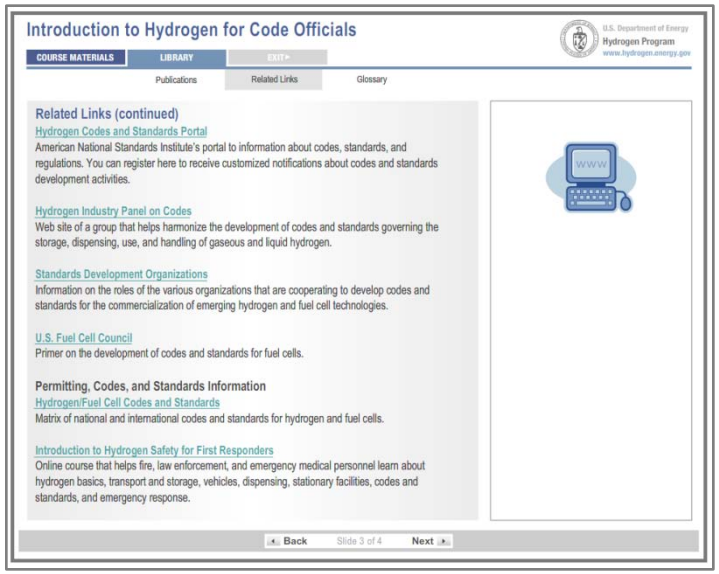
Technical Accomplishment—UCLA, Los Angeles Workshop

- Responses to the workshop.
- 93% of respondents felt workshop met expectations
- 93% respondents felt workshop increased their understanding of hydrogen basics
- 93% of respondents felt workshop provided useful information on safety issues
- 100% of respondents would recommend the workshop to their peers
- 93% of respondents felt workshop permitting tools were valuable

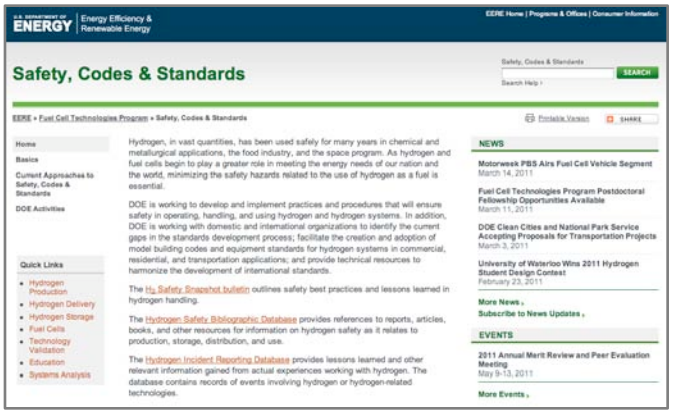
Technical Accomplishment— Code Officials Online Training Course

- Electric vehicle module added to web based Code Officials Training covers:
  - Types of electric vehicles
  - Battery technologies
  - Electric vehicle charging
- Additional deployments efforts will include:
  - Posting course links on key web sites
  - Presenting information on the course at codes and standards workshops
  - Large conferences and other key events
  - Certifying course for Continuing Education Units (CEUs)





Technical Accomplishment

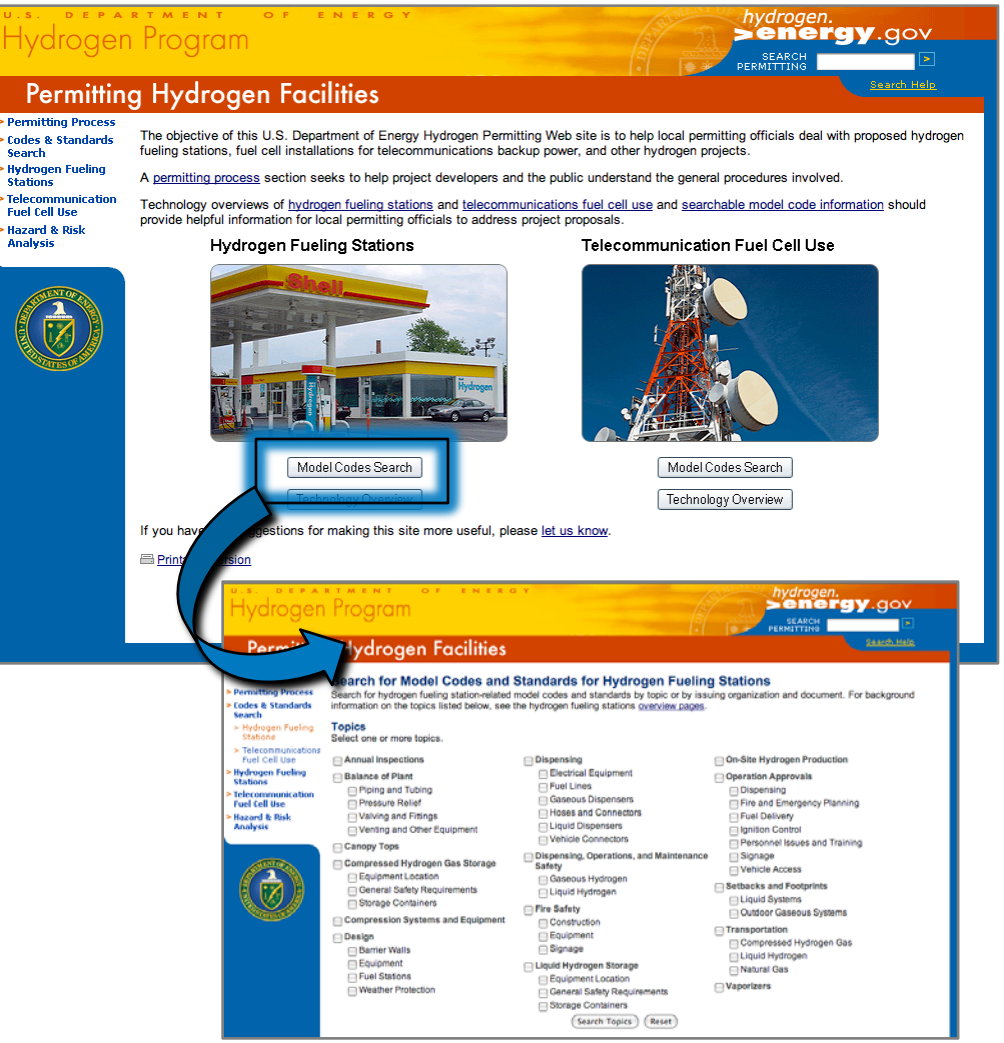


- Information Compendium http://www1.eere.energy.gov/hydrogenandfuelcells/codes/

- The Hydrogen Safety Bibliographic Database provides references to reports, articles, books, and other resources for information on hydrogen safety as it relates to production, storage, distribution, and use.
- A Permitting Hydrogen Facilities Web site identifies model codes and standards to help local permitting officials deal with proposals for hydrogen fueling stations, fuel cell use for telecommunications facilities, and other hydrogen projects.
- The Introduction to Hydrogen for Code Officials Web-based course provides an overview of hydrogen and fuel cell technologies, how these technologies are used in real-world applications, and the codes and standards required for permitting them.

Technical Accomplishment— Codes and Standards Citations for Hydrogen Fueling Stations

http://www.hydrogen.energy.gov/permitting/search_stations.cfm



Search Results for Model Codes and Standards for Hydrogen Fueling Stations

Below are your search results.

ASME B31.3, Process Piping (American Society of Mechanical Engineers, 2006)

- F323.4(5) Specific Material Considerations-Metals
- IX K305 Pipe
- IX K306 Fittings, Bends, and Branch Connections
- IX K307 Valves and Specialty Components

ASME B31.8, Gas Transmission and Distribution Systems (American Society of Mechanical Engineers, 2003)

CGA G-5.4, Standard for Hydrogen Piping Systems at Consumer Locations (Compressed Gas Association, 2005)

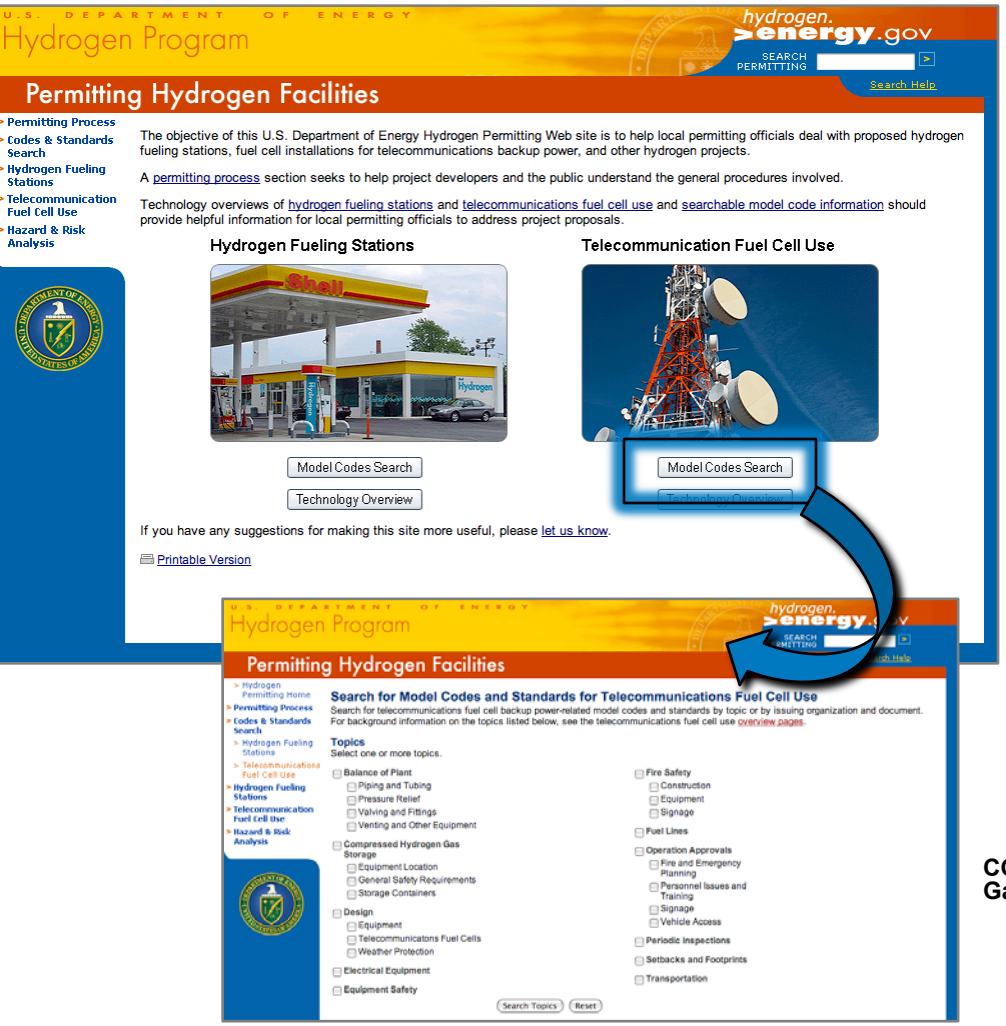
- 3.0 Piping System Criteria
- 3.1 General
- 3.2 Piping Materials
- 3.3.2 Isolation Valves
- 3.3.3 Emergency Isolation Valves
- 3.3.4 Excess Flow Valves
- 3.3.5 Check Valves
- 3.3.7 Gasket and Sealing Materials
- 3.3.8 Additional Requirements
- 5.0 Installation
- 5.1 Piping Installation General
- 5.1 Installation General
- 5.2 Piping Installation Above Ground Installation
- 5.3 Piping Installation Underground Installation
- 7.0 Maintenance and Repair

CGA G-5.5, Hydrogen Vent Systems (Compressed Gas Association, 2004)

- 6.0 Vent System
- 6.2 Sizing
- 6.3 Design
- 6.4 Materials
- 6.5 Components
- 7 Installation
- 9 Maintenance

Technical Accomplishment— Codes and Standards Citations for Stationary Fuel Cells

http://www.hydrogen.energy.gov/permitting/search_stations.cfm



Search Results for Model Codes and Standards for Telecommunications Fuel Cell Use

Below are your search results.

ANSI/CSA America FC 1-2004, Stationary Fuel Cell Power Systems (American National Standards Institute and Canadian Standards Association, 2004)

- 1.2 Power Systems Design
- 1.2 Power Systems Design
- 1.3 General Design Requirements
- 1.3 General Design Requirements
- 1.3.2 Protection from Environmental Conditions
- 1.3.3 Electrical Safety
- 1.3.5 Steam Backflow
- 1.3.6 FC System Purging
- 1.3.7 Safe Handling During Moving
- 1.3.8 Shock and Vibration Protection
- 1.3.9 Requirements for Not-Listed Equipment
- 1.3.11 Temperature Limits
- 1.4 Materials
- 1.4 Materials
- 1.5 General Construction and Assembly
- 1.6 Enclosures and Associated Construction
- 1.6 Enclosures and Associated Construction
- 1.8.1 Metallic Piping
- 1.8.1 Metallic Piping
- 1.9 Drain, Venting and Ventilation Exhaust Systems
- 1.12.1 Manual Valves
- 1.12.2 Automatic Valves
- 1.12.3 Pressure Regulators
- 1.15 Electrical Equipment and Wiring
- 1.18.2 Maintenance Manual
- 1.19.1 Materials for Markings
- 1.19.1 Materials for Markings
- 1.19.2 FC Labeling Requirements
- 1.19.2 FC Labeling Requirements
- 1.19.4 - 1.19.7 Electrical Diagrams
- 1.19.4 - 1.19.7 Electrical Diagrams

CGA P-1, Safe Handling of Compressed Gases in Containers (Compressed Gas Association, 2006)

- 4.1 Transportation Regulating Authorities
- 4.2 Container Regulations
- 4.3 Container Filling Regulations
- 4.4 Regulating Authorities of Employee Safety and Health
- 6.2 Flammable Gases

Technical Accomplishment—
Report on Stationary Fuel Cell Installation

The technical report will include the following elements:

- Project description and background including project funding information if available
- Comprehensive codes and standards evaluation including any issues that might help with compliance at other sites
- Recommendations on any compliance issues
- Recommendations on how the findings could be applied to other projects
- Photographs of the site and equipment (if allowed)

Collaborations

CAFCP

AHJs such as the Southern California Fire Protections Officers

Industry

Milestones

- 7.3.1Codes and Standards workshop plan defined
  - 4 workshops
  - 2 codes and standards workshops, 1 sensor workshop, and 1 lessons learned workshop

- 7.3.2 Identify site for third party safety analysis- stationary fuel cell for backup power

- 7.3.3 identification of permitting template components
  - Publication of NFPA 2 will help organize components
  - Fire code and component standards will be key pieces of the template

Proposed Future Work

- Continue outreach activities such as workshops and safety reviews and site visits
- Workshops will be planned and delivered in close collaboration with local and regional organizations for codes and standards workshops
- Topical workshops, such a sensor workshop, will be held to maximize participation of interested parties
- Continue to extend web based compendium to include information on newly issued codes and standards and new hydrogen and fuel cell applications
- Issue case studies on emerging fuel cell technology projects as NREL technical reports and add links to these reports to the web compendium

Summary

- NREL will continue to support technology readiness of renewable energy technologies through programs such as the workshops for code officials, project developers and other interested parties safety reviews, and the web based information compendium that includes on line training
- Workshops will be focused on geographic areas where there is project activity and desired attendees are code officials, project developers, and other interested parties who will be directly involved in project work
- Look to workshops to help define potential codes and standards issues as well as research and development efforts
- Technical reports documenting site visits will assist code official and project developers