U.S. Department of Energy Hydrogen Program

Safety, Codes and Standards

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2008 DOE Hydrogen Program
Merit Review and Peer Evaluation Meeting

June 9, 2008

Goal and Objectives

SAFETY:

Develop and implement the practices and procedures that will ensure safety in the operation, handling, and use of hydrogen and hydrogen systems for all DOE-funded projects and utilize those practices and lessons learned to promote the safe use of hydrogen.

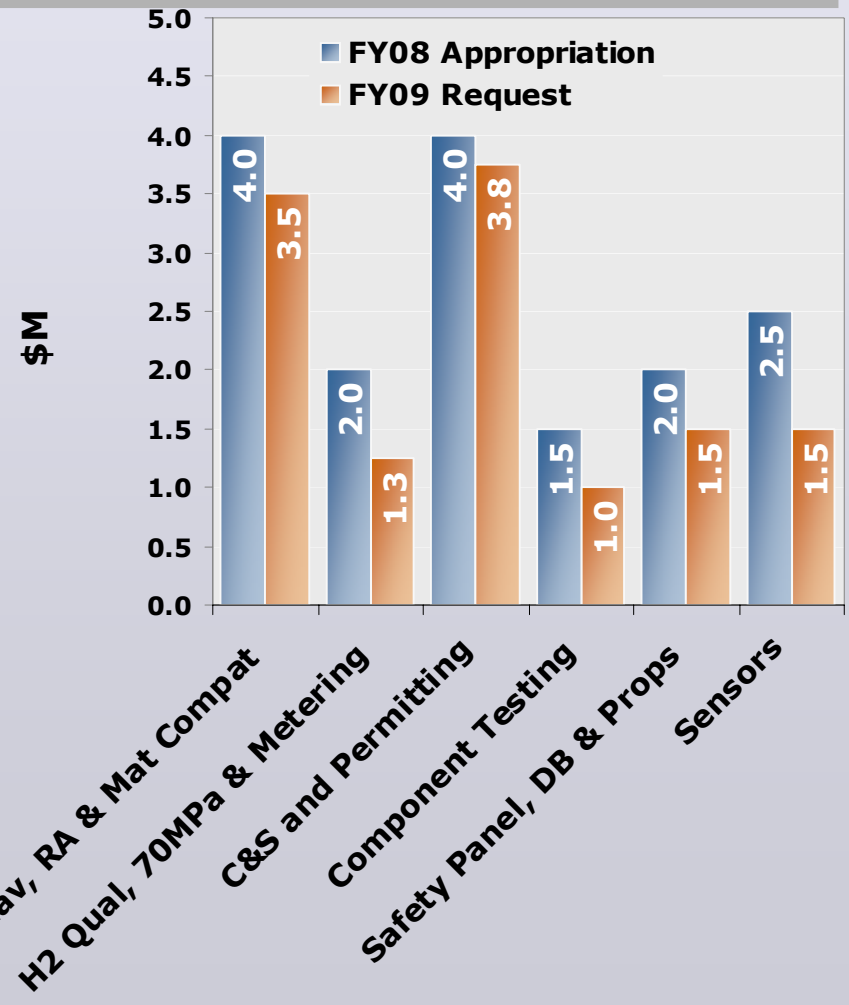
CODES & STANDARDS:

Perform the underlying research to enable codes and standards to be developed for the safe use of hydrogen in all applications. Facilitate the timely development and harmonization of domestic and international codes and standards.

Budget

FY2009 Budget (Request) = $12.5M

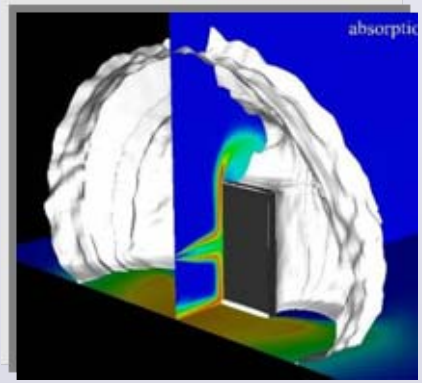
FY2008 Budget (Approp.) = $16.0M

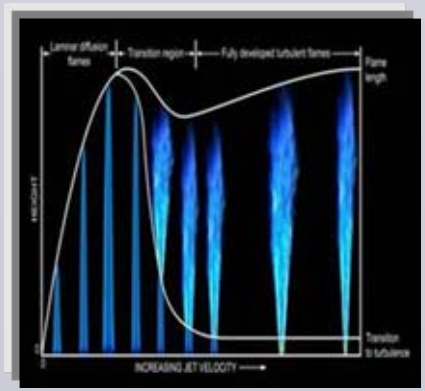


FY2009 Emphasis

- Technically validated performance data needed for new codes and standards
- Web-based tools to facilitate permitting of hydrogen fueling stations and stationary fuel cell installations
- Hydrogen fuel quality testing, measurement, and metering
- Risk assessment and establishment of protocols to identify and mitigate risk
- Global harmonization of hydrogen fuel quality and other key standards
- Dissemination of hydrogen best practices and safety information

Challenges





- Synchronizing codes & standards development and adoption with technology commercialization needs
- Aligning data generation with codes & standards development
- Promoting domestic and international consistency
- Streamlining and standardizing the permitting process for hydrogen facilities
- Facilitating timely adoption of approved codes & standards
- Compiling and disseminating hydrogen safety information

2008 Progress & Accomplishments

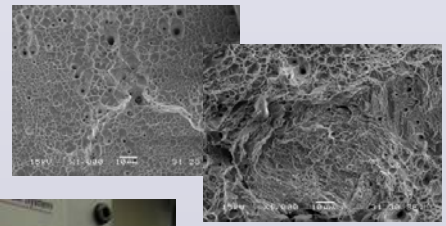
Launched Online Hydrogen Fueling Station Permitting Compendium *February 2008*

- International Fuel Quality Specification (ISO 14687-2) approved by ISO Technical Committee 197, March 1, 2008
  - ISO TS 14687-2 and SAE J2719 harmonized
- Succeeded in the adoption of risk-informed approach for the incorporation of hydrogen provisions in the next cycle of NFPA code development
- Designed, built and tested a fuel cell vehicle prop for first responder training
- Developed an online course for researchers on hydrogen safety
- Released Hydrogen Safety Best Practices Manual, December 2007

Materials Compatibility

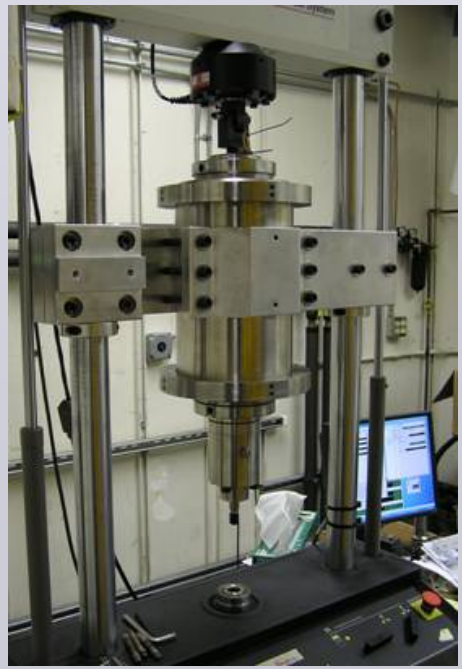
Goals

- Provide Technical Reference for Hydrogen Effects in Materials
- Measure cracking thresholds for static loads in high pressure gas
- Measure cracking thresholds for fatigue loads in high pressure gas



C&S Advocacy

- ASME Project Team on H2 Tanks
  - Section VIII, Div 3, KD-10
  - fracture mechanics in design
  - testing protocols
- ASME Project Team on H2 Piping and Pipelines
  - B31.12
- CSA NGV and HPRD
- SAE, vehicle component materials



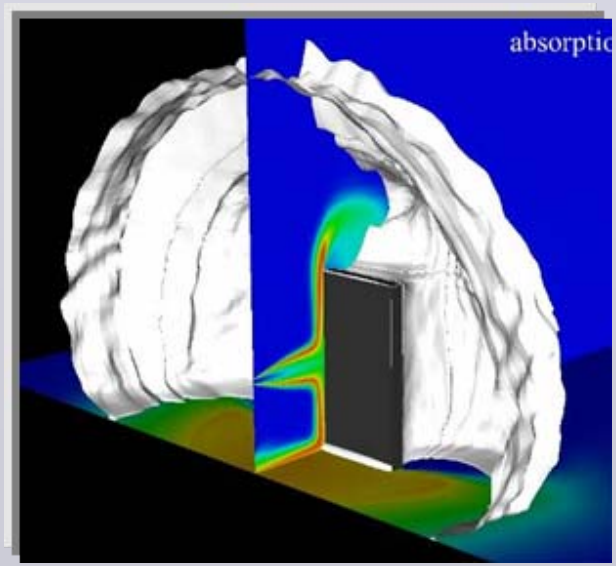
Barrier Wall Design

Goals

- Determine how barrier walls reduce or increase consequences of high-pressure gaseous release hazards using a risk-informed approach
- Develop models for jet flame interaction and over-pressure
- Perform validation experiments

C&S Advocacy

- NFPA 55 and NFPA 2
  - Risk-informed decision making
  - Unintended release characterization
- Hydrogen Industry Panel on Codes
- HYPER Stationary Fuel Cell Permitting
  - WP4 – model validation
  - WP5 – validation experiments



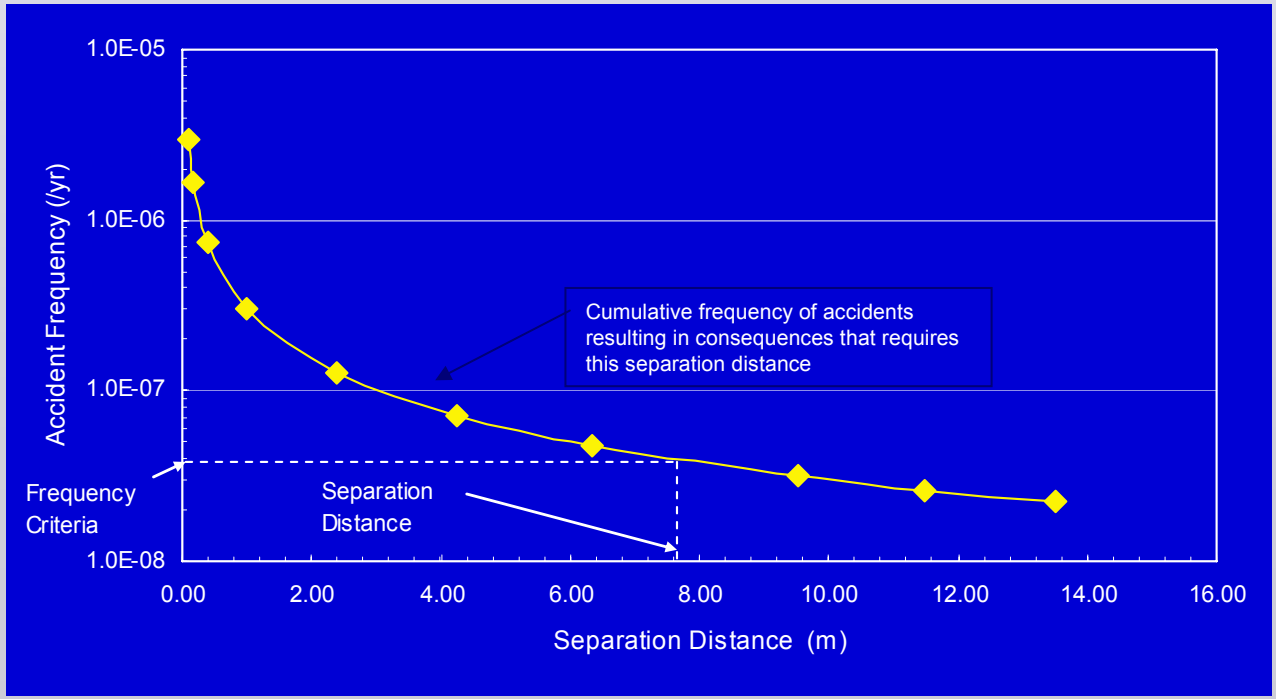
Quantitative Risk Assessment

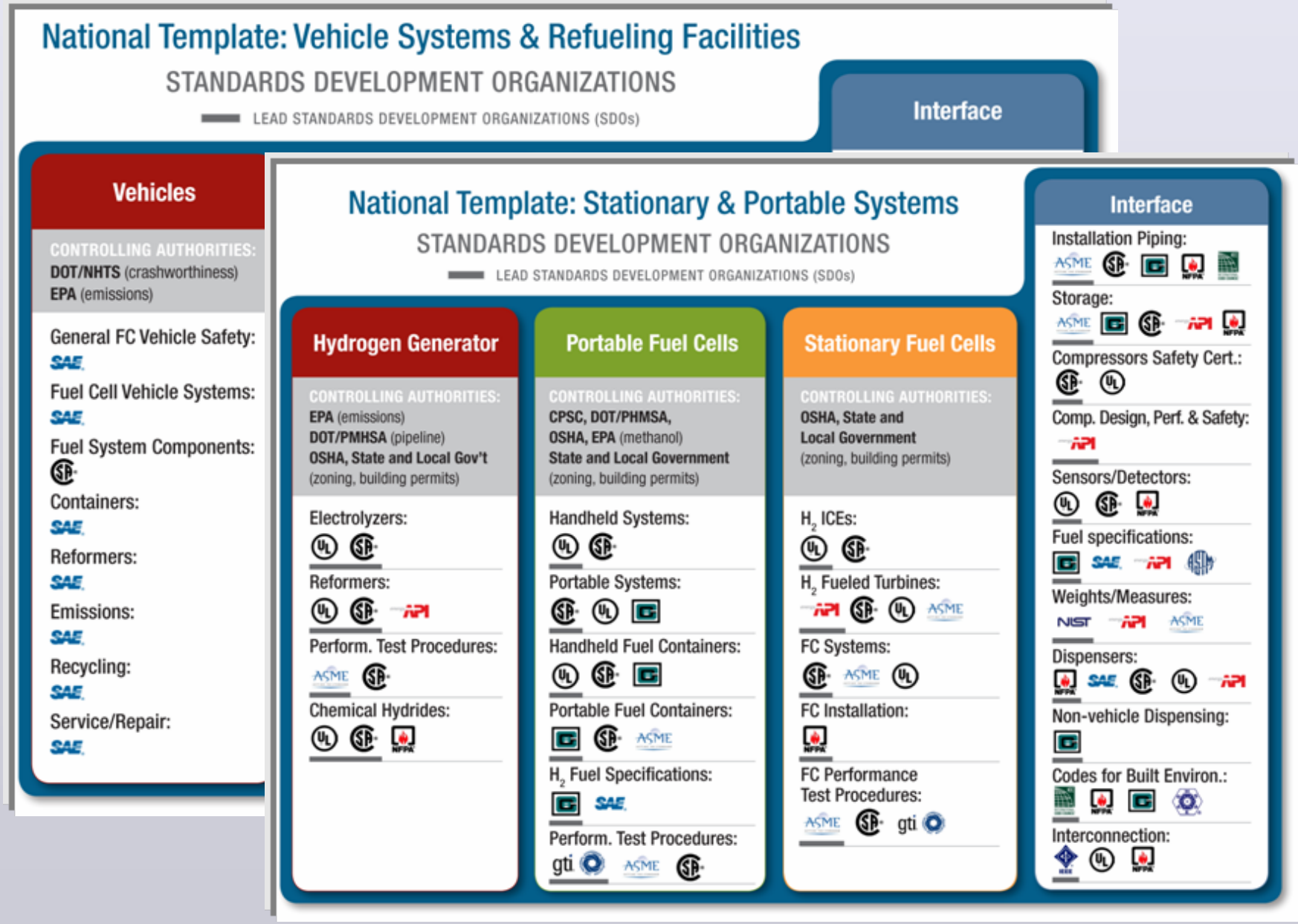
Goals

- Introduce risk-informed decision making into the code development process
- Use quantitative risk assessment techniques to incorporate applied research and establish documented technical bases
- Provide risk-informed permitting tools

C&S Advocacy

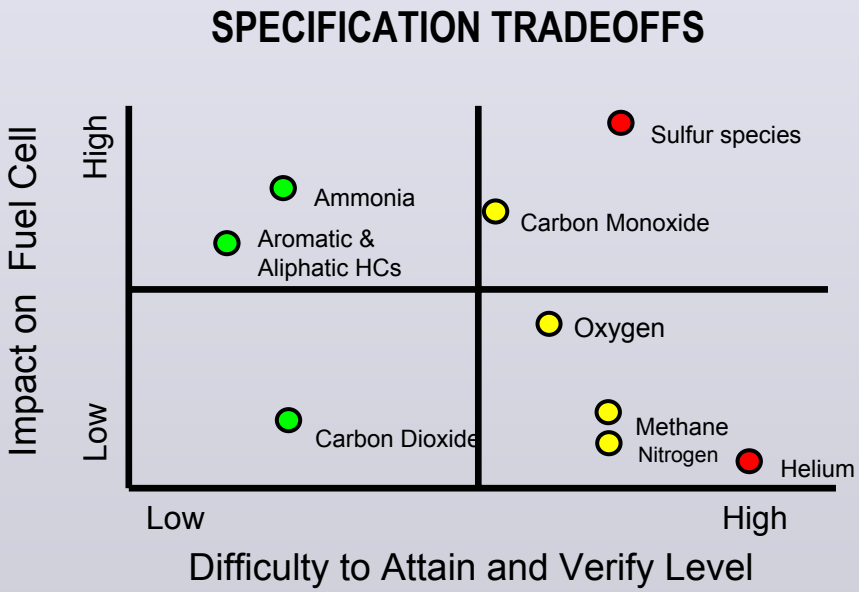
- NFPA 55 and NFPA 2
- Hydrogen Industry Panel on Codes




National Template: Vehicle Systems & Refueling Facilities
STANDARDS DEVELOPMENT ORGANIZATIONS
LEAD STANDARDS DEVELOPMENT ORGANIZATIONS (SDOs)
Interface
Vehicles
CONTROLLING AUTHORITIES:
DOT/NHTS (crashworthiness)
EPA (emissions)
General FC Vehicle Safety:
Fuel Cell Vehicle Systems:
Fuel System Components:
Containers:
Reformers:
Emissions:
Recycling:
Service/Repair:
National Template: Stationary & Portable Systems
STANDARDS DEVELOPMENT ORGANIZATIONS
LEAD STANDARDS DEVELOPMENT ORGANIZATIONS (SDOs)
Hydrogen Generator
CONTROLLING AUTHORITIES:
EPA (emissions)
DOT/PMHSA (pipeline)
OSHA, State and Local Gov't
(zoning, building permits)
Electrolyzers:
Reformers:
Perform. Test Procedures:
Chemical Hydrides:
Portable Fuel Cells
CONTROLLING AUTHORITIES:
CPSC, DOT/PHMSA,
OSHA, EPA (methanol)
State and Local Government
(zoning, building permits)
Handheld Systems:
Portable Systems:
Handheld Fuel Containers:
Portable Fuel Containers:
H2 Fuel Specifications:
Perform. Test Procedures:
Stationary Fuel Cells
CONTROLLING AUTHORITIES:
OSHA, State and
Local Government
(zoning, building permits)
H2 ICEs:
H2 Fueled Turbines:
FC Systems:
FC Installation:
FC Performance
Test Procedures:
Interface
Installation Piping:
Storage:
Compressors Safety Cert.:
Comp. Design, Perf. & Safety:
Sensors/Detectors:
Fuel specifications:
Weights/Measures:
Dispensers:
Non-vehicle Dispensing:
Codes for Built Environ.:
Interconnection:

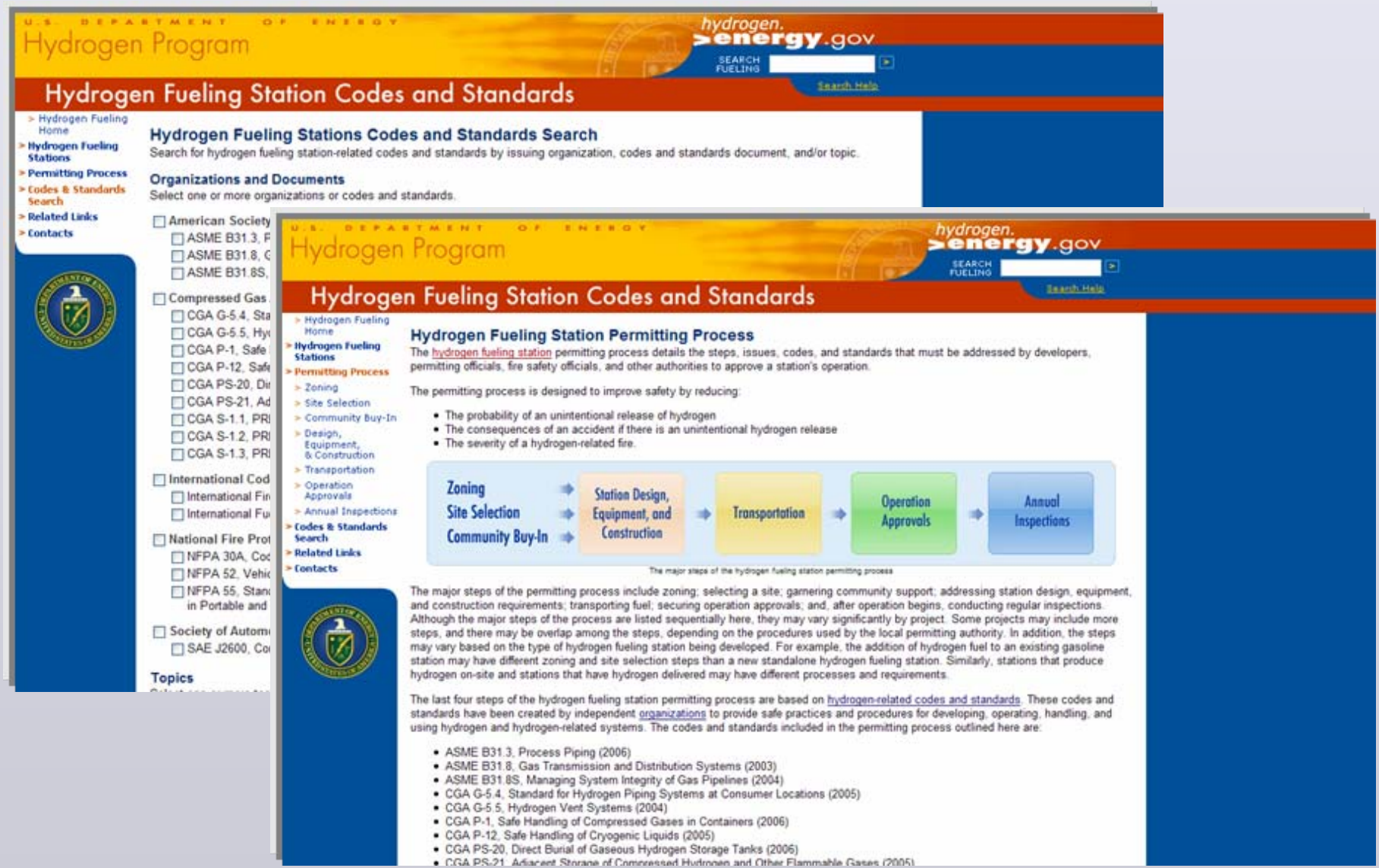
Fuel Quality

- ISO Technical Specification (TS 14687-2) approved and published.
- ISO TS 14687-2 and SAE J2719 are harmonized.
- Test protocol, test matrix, data reporting format adopted:
  - Testing underway at LANL, HNEI, USC, Clemson-SRNL, UConn.
  - Testing coordinated with Japan, Korea, and EU.
- Particulate matter evaluation underway (NREL and industry partners).
- Hydrogen Quality Sampling Apparatus (HQSA) to support ASTM test methods developed and applied.
- Potential canary constituent identified (CO) to simplify testing and analytical monitoring.



Source: Shell Hydrogen

Hydrogen Installation Permitting



Fuel Cell Vehicle Training Prop

Future Plans

- Continue hydrogen installation permitting workshops for fire safety and building code officials
- Evaluate current status of hydrogen leak detection technologies and release competitive solicitation for the development of state-of-the-art hydrogen safety sensors
- Conduct testing and modeling to develop international hydrogen fuel quality standard
- Continue generation of technically validated performance data needed for new and revised codes and standards
- Collect current hydrogen safety records and populate safety databases
- Promote risk-informed approach for developing technically sound (and traceable) codes & standards
- Expand permitting compendium to include stationary fuel cell installations

For More Information

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