

Hydrogen Codes and Standards

2004 DOE Hydrogen, Fuel Cells &
Infrastructure Technologies Program Review

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This presentation does not contain any proprietary or confidential information.

Objectives

- Facilitate the creation and adoption of standards and model building codes for hydrogen systems in commercial, residential, and transportation applications
- Harmonize the technical requirements of international standards and regulations
- Integrate codes and standards activities from R&D to commercialization



Budget

- Funding in FY04
 - Total \$1,725 K
 - Subcontracts \$1,040 K
 - ANSI, ASME, CGA, CSA America, ICC, NFPA, NHA, UL, Vista, Consultants (Brad Bates, Kelvin Hecht, Ron Sims)

Technical Barriers

Codes and Standards

- J. Consensus national agenda on codes and standards
 - A. Limited government influence on model codes
 - B. Competition among standards/code development organizations
 - C, D, E. Large, diverse number of state/local jurisdictions; limited state funds for new codes; training differences for code officials
- H. International competitiveness and national agendas
 - F,G. Limited DOE role in the development of ISO standards and inadequate representation by government and industry at international forums
- P. Current large footprint requirement for hydrogen fueling stations
 - N. Lack of technical data for underground and above ground storage
 - O. Insurance rates tied to current codes and standards

Technical Targets

- Negotiate DOE licenses for critical standards and model codes
- Facilitate adoption of model building codes in three key regions
- Establish comprehensive training program for code officials and fire marshals
- Support and facilitate completion and adoption of ISO standards for hydrogen refueling and storage
- Agree in principle to adopt a global technical regulation for hydrogen fuel cell vehicles under GRPE
- Implement research program to develop defensible standards for hydrogen systems, refueling stations, underground storage, vehicle components

Approach

- Develop unified national agenda
 - National templates
 - accelerate development of priority standards
 - designate lead and supporting SDOs by consensus
 - Provide support to key SDOs
 - Facilitate access to standards through ANSI website
- Coordinate national activities
 - Hydrogen Codes and Standards Coordinating Committee
- Harmonize technical standards and global technical regulations
- Develop comprehensive R&D Plan
 - Fundamental properties of hydrogen
 - Materials compatibility
 - Potential unintended release scenarios
 - Flammable cloud formation and ignition
 - Flame jet characteristics
 - Testing and validation needs

Overall Timetable

2003

2004

2005

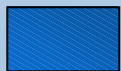
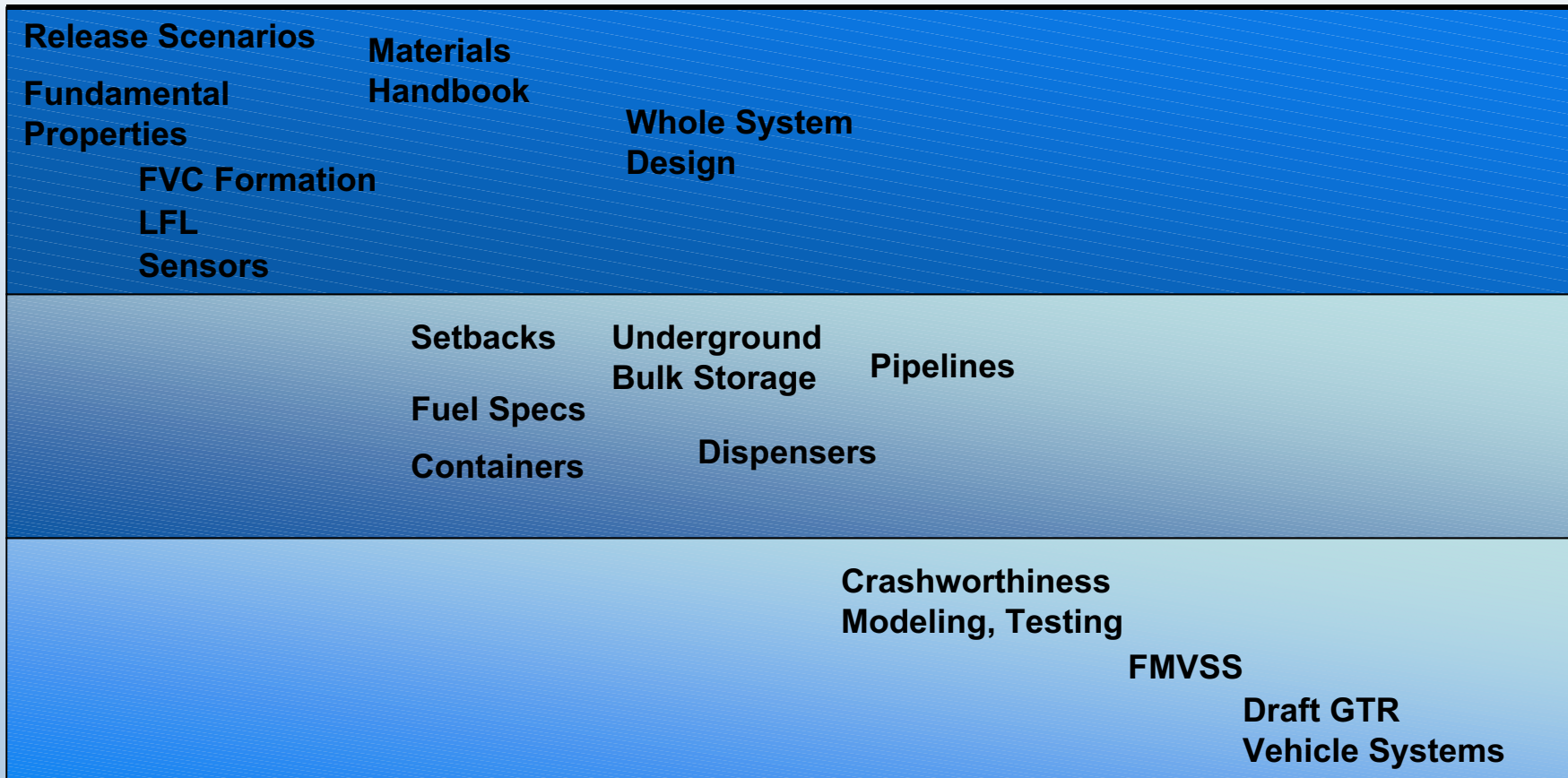
2006

2007

2008

2010

2015



R&D



Codes and Standards



Regulations

Commercialization Decision

Codes/Standards Timetable

2004

2005

2006

Dispensing Systems			
[Hoses HGV 4.2 (CSA) Temperature Compensating Devices HGV 4.3 Breakaway Devices HGV 4.4 Manual/Automatic Valves HGV 4.6/4.7]			
Priority/Sequencing HGV 4.5	Sensors/Detectors(UL)	Piping (ASME)	
Wts/Measures (NIST)	Fuel Purity (CGA/SAE)		
Containers			
On Board Vehicle HGV 2		PRD-1	Metallic
		Portable	Composite
Vehicle Systems			
SAE J2600 Series		Fuel Purity (CGA/SAE)	
Delivery			
		Fuel Purity (CGA/SAE)	Pipelines
Built Environment			
2003 ICC Codes (IBC, IFC, IRC, IMC, IFGC)	{Setbacks, underground LH2 storage, canopy storage, multiple fuels dispensing}		NFPA 5000
		2006 ICC Codes	

Codes/Standards Timetable

2004

2005

2006

Dispensing Systems

[Hoses HGV 4.2 (CSA) Temperature Compensating Devices HGV 4.3 Breakaway Devices HGV 4.4
Priority/Sequencing HGV 4.5 Manual/Automatic Valves HGV 4.6/4.7]

Sensors/Detectors(UL)

Piping (ASME)

Wts/Measures (NIST)

Fuel Purity (CGA/SAE)

Containers

On Board Vehicle HGV 2

PRD-1

Metallic

Portable

Composite

Vehicle Systems

SAE J2600 Series

Fuel Purity (CGA/SAE)

Delivery

Fuel Purity (CGA/SAE)

Pipelines

Built Environment

2003 ICC Codes (IBC, IFC,
IRC, IMC, IFGC)

{Setbacks, underground LH2 storage,
canopy storage, multiple fuels
dispensing}

NFPA 5000

2006 ICC Codes

Technical Accomplishments/Progress

- Negotiate DOE licenses for critical standards and model codes
 - agreement with ANSI to create hydrogen portal on national standards network
 - agreement with key SDO to negotiate posting and downloading hydrogen standards and model codes
- Facilitate adoption of model building codes in three key regions
 - initiated incubator project with ANSI, SDOs, and state code officials in NY, MA, CT, RI
 - additional projects planned for SE and one other region
- Establish comprehensive training program for code officials and fire marshals
 - Handbook for local code officials—How to Permit a Hydrogen Fueling Facility— prepared with ICC, NFPA, and PNNL
- Implement research program to develop defensible standards for hydrogen systems, refueling stations, underground storage, vehicle components
 - Draft DOE Codes and Standards R&D Plan prepared (with SNL, PNNL, LANL)
 - participate in separation distance validation project (ICC, SNL, SRI)
 - Draft C/S R&D Roadmap for FreedomCAR-Fuel Partnership (with SNL, PNNL, LANL)
- Support and facilitate completion and adoption of ISO standards for hydrogen refueling and storage
 - member of ISO/TC197 Working Group to prepare hydrogen fueling facility standard
- Agree in principle to adopt a global technical regulation for hydrogen fuel cell vehicles under GRPE
 - Contract with CGA and CSA to coordinate ISO/TC197 and IEC/TC105

Technical Accomplishments/Progress

- Established national agenda for codes and standards
 - national templates adopted by consensus and being implemented
 - subcontracts negotiated and issued to CGA, CSA America, ICC, NHA, NFPA, UL
 - negotiations in final stage with ANSI and ASME
 - standards for fueling systems, containers (on-board, portable), sensors, fuel cells for hand-held devices, fuel purity under way
 - standards for piping, pipelines, bulk storage, composite containers, transportable containers begun
- Model codes will provide for additional hydrogen applications
 - 2006 edition of International Code Council model codes
 - NFPA 52 and 55 under revision
- R&D Plan to establish scientific basis for technical requirements
 - synchronize codes and standards with R&D
 - workshops on Unintended Release Scenarios and Materials Compatibility (with SNL)
 - fuel purity guidelines/specification workshop (April 26)

Technical Accomplishments/Progress (National Template for Vehicle Systems)

Vehicles

Controlling Authority:
NHTSA (Crashworthiness),
EPA (Emissions)

Fuel Cell Vehicle Systems: SAE
Fuel Delivery Systems: SAE,
Containers: CSA
Reformers: SAE
Emissions: SAE
Recycling SAE
Service/Repair: SAE

Interface

Fuel Specs: SAE
 ASTM, API
Wts/Measures: NIST,
 API, ASME
Fueling/Defueling: SAE
Sensors/Detectors: UL,
 NFPA, SAE, CSA
Connectors: SAE, API,
 CSA
Communications : SAE
 UL, CSA, API, IEEE

Fuel Delivery, Storage

Controlling Authority:
RSPA (Over-road Transport,
 Pipeline Safety)

Composite Containers ASME
 CSA, CGA, NFPA
Pipelines ASME, API, CGA, AGA
Equipment ASME, API, CGA,
 AGA
Fuel Transfer NFPA, API

Fueling, Service

Parking Facility

Controlling Authority: State, Local Govt.
 Zoning, Building Permits

Storage Tanks: ASME, CSA, CGA, NFPA,
 API

Piping ASME, CSA, CGA, NFPA

Dispensers CSA, UL, NFPA,

On-site H2 Production: CSA, UL, CGA, API

Codes for the Built Environment: ICC, NFPA

Lead SDO underlined

Technical Accomplishments/Progress

(National Template for Hydrogen Generators and Stationary and Portable Fuel Cells)

Controlling Authority:
 OSHA, Emissions – EPA,
 Pipeline: Office of Pipeline
 Safety
 State, Local Government
 Zoning, Building Permits

Electrolyzers: UL, CSA,
Reformers: UL, CSA, API
**Performance Test
 Procedures:** ASME, CSA
Chemical Hydrides: UL,
CSA, NFPA

Installation Piping: ASME, CSA, CGA,
NFPA, ICC
Storage: ASME, CGA, CSA, API, NFPA
Compressors Safety Certification: CSA, UL
Compressor Design, Performance & Safety:
API,
Sensors/Detectors: UL, CSA, NFPA
Fuel specifications: CGA, SAE, API, ASTM
Weights/Measures: NIST, API, ASME,
NCWM
Dispensers: CSA, UL, NFPA, SAE, API
Non-vehicle Dispensing: CGA
Codes for the Built Environment: ASHRAE,
ICC, NFPA, CGA
Interconnection: IEEE , UL, NFPA

Interface

Controlling Authority:
 OSHA,
 State, Local Government
 Zoning, Building Permits

H2 ICEs: CSA, UL
H2 Fueled Turbines: CSA,
UL, ASME, API
H2-O2 Steam Generators:
CSA, ASME, UL, NFPA
**Performance Test
 Procedures:** ASME, CSA,
NHA-GTI

**Hydrogen
 Generator**

Controlling Authority: CPSC, DOT RSPA, OSHA, EPA
 (Methanol),
 State, Local Govt. (Zoning, Building Permits)

Handheld Systems: UL, CSA
Portable Systems: CSA, UL, CGA,
Handheld Fuel Containers: CSA, UL, CGA
Portable Fuel Containers: CGA, CSA, ASME,
H2 Fuel Specifications: CGA, SAE,
Performance Test Procedures: ASME, CSA, NHA-GTI

**Stationary
 Fuel Cells**

**Portable
 Fuel Cells**

Leads will change
 depending on type of
 environment.

Technical Accomplishments/Progress

Codes and Standards R&D Roadmap Engineering for Hydrogen Systems

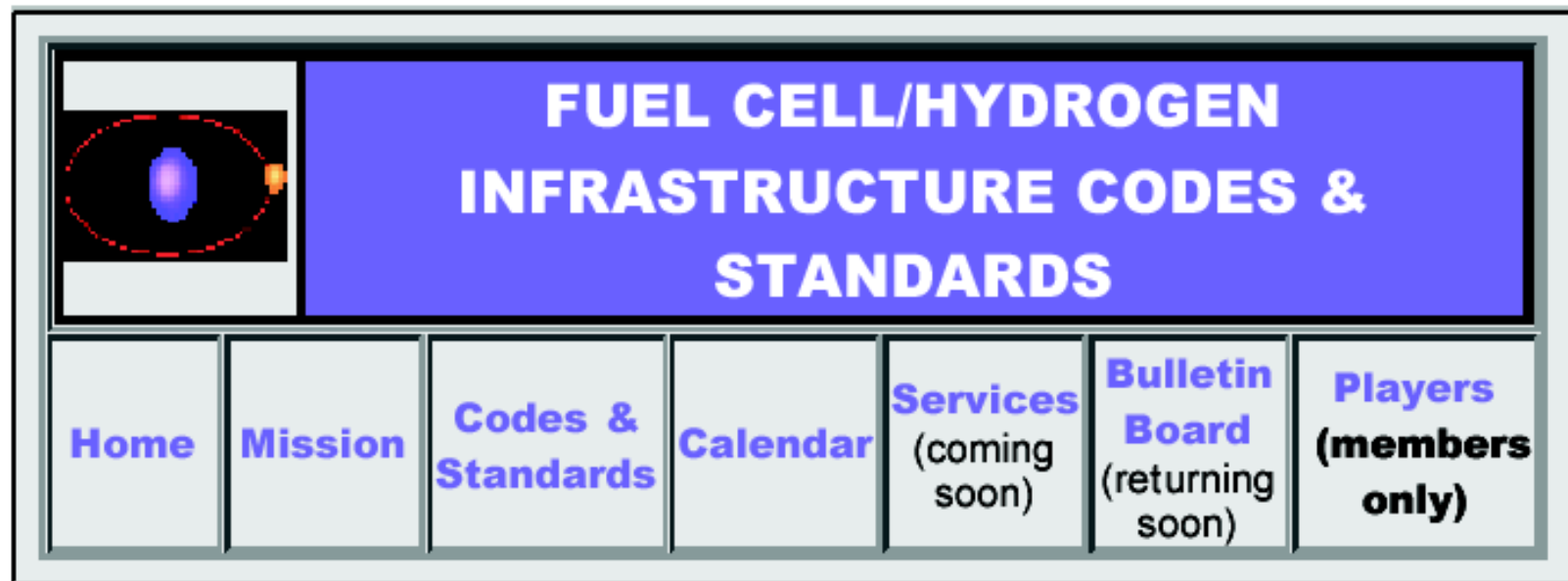
- Basic
 - Combustion/Flammability
 - Physical and Chemical
- Material Properties and Compatibility
 - Technical Reference
 - Crack Growth
 - Fatigue
- Designing for Safety
 - Release Scenarios
 - Control Options
 - Cost/Benefit Analysis
 - Sensors/Odorants/Tracers
 - Modeling

BOTH

Interactions and Collaborations

- DOE H₂ Codes/Standards Coordinating Committee (HFCIT Program)
 - BP, Ballard Power Systems, ChevronTexaco, Exxon-Mobil, H2Source, Plug Power, Shell H2, Stuart Energy, UTCFC; GTI, IHIG, NHA, USFCC, NGVC, FreedomCAR-H2 Fuel Partnership C/S Tech Team
 - ANSI, API, ASME, ASTM, CGA, CSA, ICC, NFPA, IEEE, SAE, UL
 - DOT, NIST
 - LANL, NREL, PNNL, SNL
 - Coordinate and manage national templates for DOE
 - Open to all interested parties
 - Contact Russ Hewett (russell_hewett@nrel.gov)

New Website for Hydrogen/Fuel Cells Codes and Standards



www.fuelcellstandards.com

(will be linked to DOE HFCIT website: <http://www.eere.energy.gov/hydrogenandfuelcells/>)

Responses to Previous Year Reviewers' Comments

- Comment: Needs additional people (critical mass)
 - one additional person on team; plans to add several more staff postponed due to budget cut in C&S program
- Comment: Should use as much as possible to use web tools and additional ones for information dissemination
 - new website launched; ANSI hydrogen portal under negotiation
- Comment: Get some additional social/technical links into program
 - incubator project with ANSI launched; member of new FreedomCAR Hydrogen Fuel Partnership C&S Tech Team; draft R&D Roadmap prepared
- Comment: Engage Weaver/Hollywood for some sense of the demo - what's good and bad
 - training and education through ICC, NFPA, ANSI

Future Work

- Remainder of FY2004
 - Draft standards for hydrogen fueling systems
 - Dispensing systems
 - Hoses
 - Temperature compensation
 - Break-away devices
 - Priority-sequencing
 - Manual/automatic valves
 - Draft standard for hydrogen containers
 - HGV-2
 - PRD-1
 - Coordinate codes and standards development and R&D Roadmap with DOE fleet demonstration project
 - Consensus “mini-template” for fuel purity guidelines/specifications based on workshop
 - Hydrogen portal on ANSI’s NSSN
 - NE regional meeting of code officials
 - Present paper at WHEC-15
- FY2005
 - Technical reports for bulk (composite) storage containers, piping, pipelines
 - Draft standard for hydrogen sensors/detectors
 - Draft standards for stationary reformers, electrolyzers
 - Revised ICC and NFPA model codes for the built environment