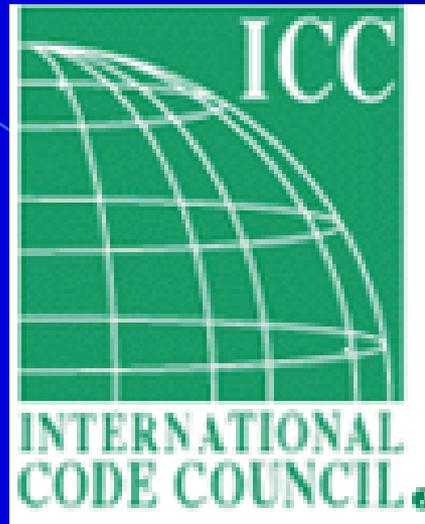


ICC Hydrogen Ad Hoc Committee

“Activities Update”



Setting the Standard for Building Safety™

David Conover, ICC National Programs Liaison
Fuel Cells Summit VII
March 29th, 2003

ICC* Mission

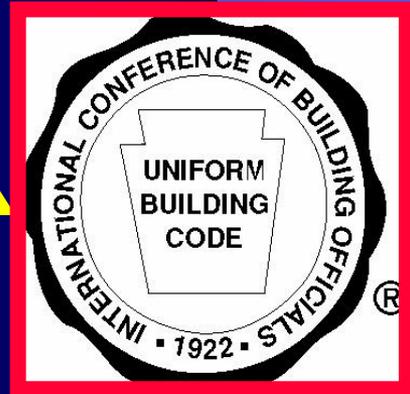
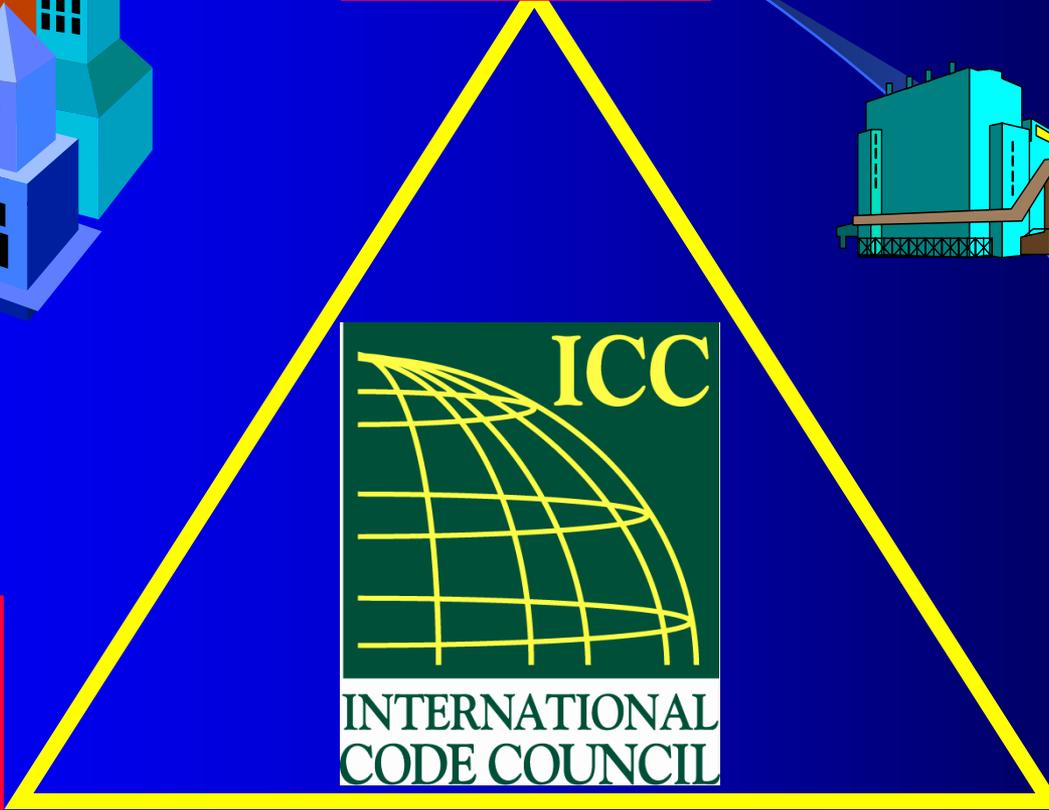
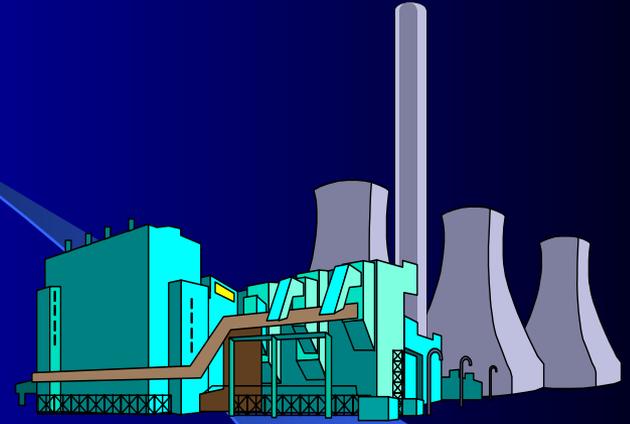


To promulgate a comprehensive and compatible regulatory system for the built environment through consistent performance-based regulations that are effective, efficient and meet government, industry and public buildings.

*** The ICC, a 50,000-member association dedicated to building safety, develops the codes used to construct residential and commercial buildings, including homes and schools. Through its founders, the ICC has more than 190 years of collective experience developing building safety codes that save lives. The majority of U.S. cities, counties and states that adopt codes choose building and fire safety codes developed by the ICC.**



SBCCI



December 1994 – January 2003

U.S. Situation

Codes and Standards

- Numerous voluntary and public sector standards developers
- Two developers of national model building codes
- Federal, state, and local government adoption and implementation of voluntary sector standards and model codes
- Goal to increase uniformity over time through adoptions

Ad Hoc Hydrogen Committee

- Chartered in August, 2000
- Objectives
 - Review C&S applicable to H₂ in vehicular and portable applications
 - Determine adequacy of coverage in the I-Codes
 - Propose changes, as necessary to the I-Codes
- Effort put forth for 2003 I-Codes
 - Five Open Meetings (DC, Detroit, Portland, Golden, Houston)
 - Two 45-day public comment periods
 - Two public hearings in 2002 (Pittsburgh, Ft. Worth)

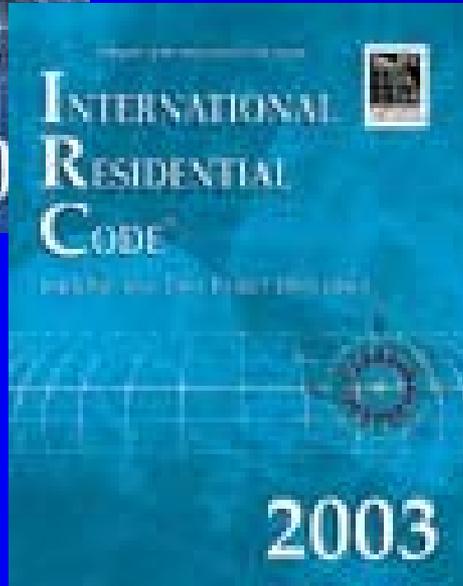
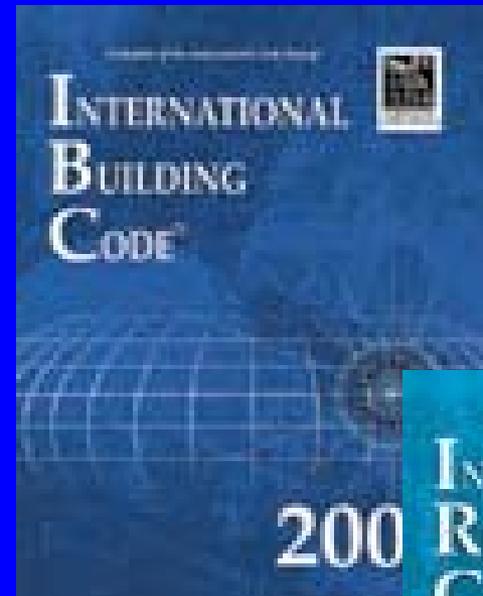
46 States Have Adopted ICC International Codes



Codes Affecting

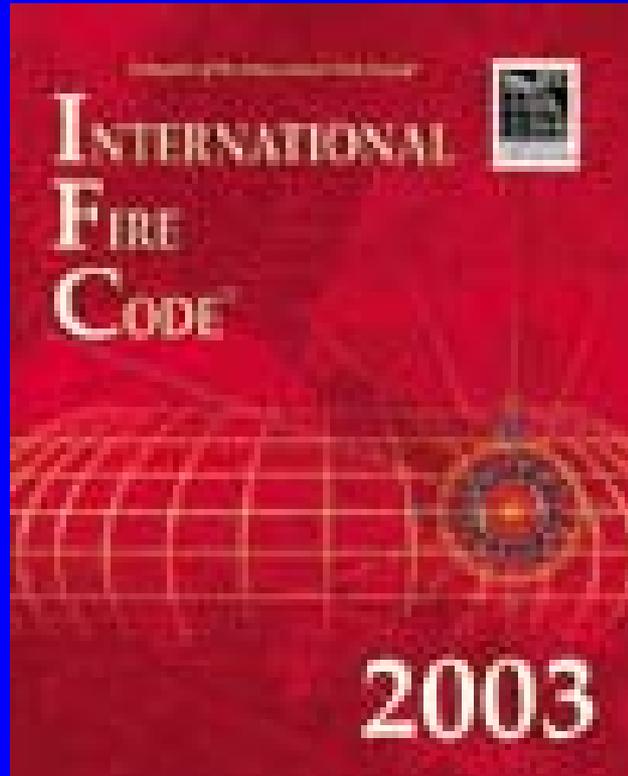
**Coordinated family of
International codes**

Hydrogen Infrastructure in 2003 Building & Residential



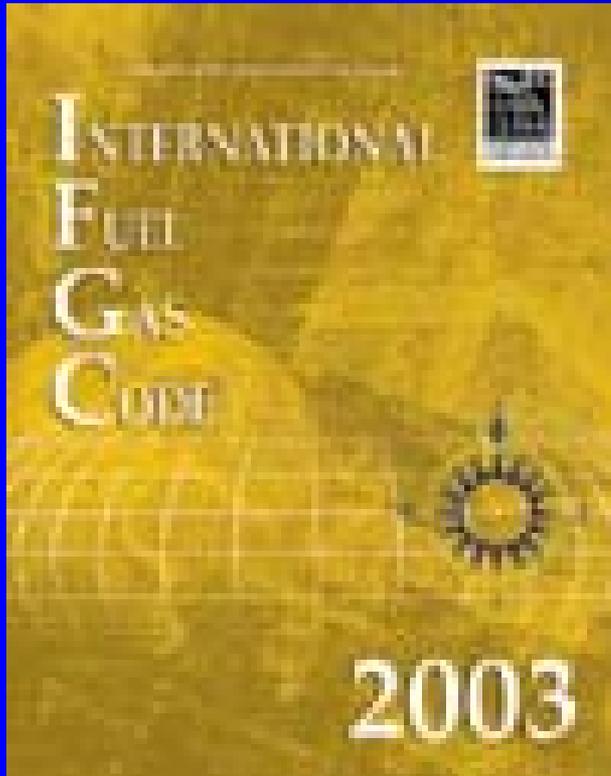
- IBC T302.1.1 Incidental use areas and hydrogen cut-off rooms
- IRC §M1307.4 Hydrogen generating and refueling operations
- IRC §202, Definitions
 - FUEL GAS includes hydrogen gas
- IRC §2401.1
 - Gaseous hydrogen systems are regulated by the IFGC

Hydrogen Infrastructure in 2003 Fire Code



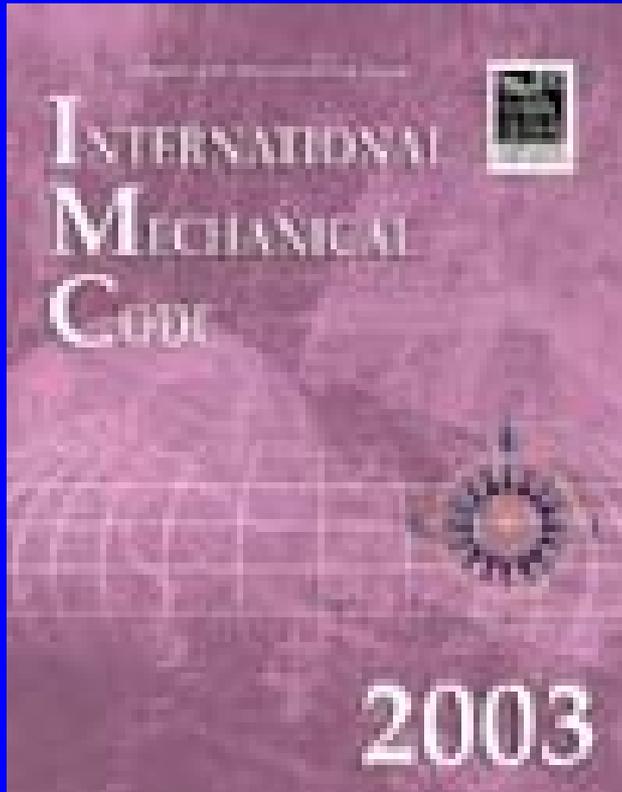
- §2209 Hydrogen motor fuel-dispensing and generation facilities
- T2209.3.1 Separation distances
- §2211.8 Defueling of hydrogen from motor vehicle fuel storage containers
- Ch. 32 Cryogenic Fluids
- Ch. 35 Flammable Gases

Hydrogen Infrastructure in 2003 Fuel Gas Code



- §101.2.1 Gaseous hydrogen
- §202, Definitions
 - FUEL GAS
 - STATIONARY FC Power Plant
 - PORTABLE FC APPLIANCE
- §633 Fuel Cells installed in acc. with
 - ANSI Z21.83 and NFPA 853
- Ch. 7 Gaseous Hydrogen Systems
 - General requirements
 - Piping, use and handling
 - Testing of piping; Location
 - Operation and maintenance

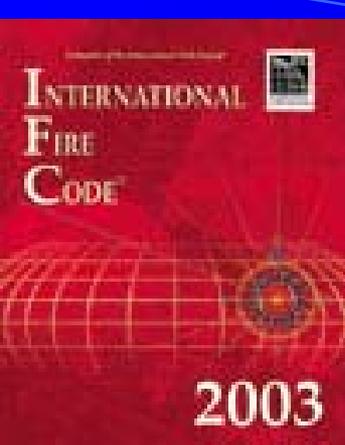
Hydrogen Infrastructure in 2003 Mechanical Code



- §202, Definitions
 - FUEL GAS
 - STATIONARY FC Power Plant
 - PORTABLE FC APPLIANCE
- §304.4 Hydrogen generating and refueling operations
- §924 Fuel Cells in accordance w/
 - ANSI Z21.83 and NFPA 853

AHC Activities Sustained for 2003-04 Code Cycle

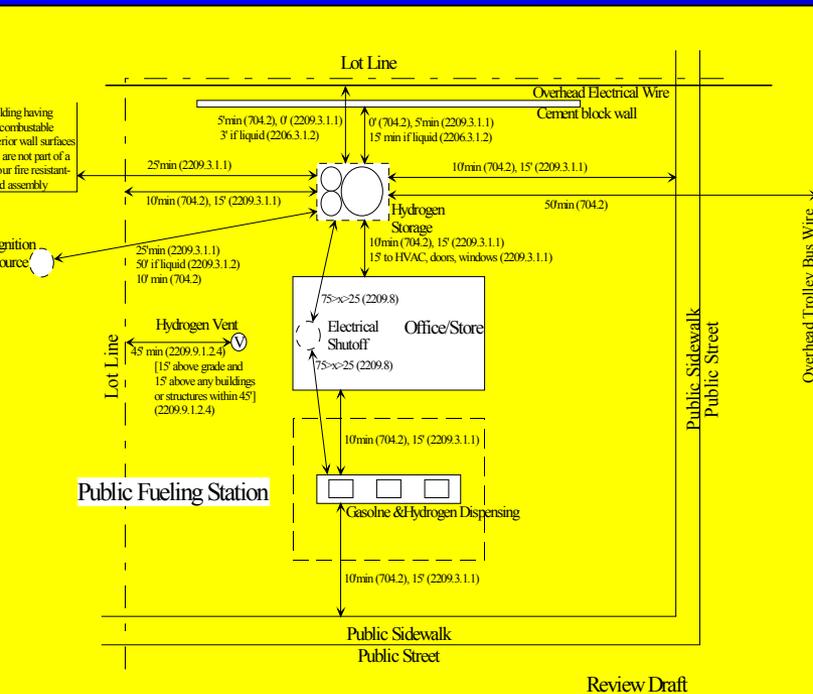
- Focus for the continued effort
 - Optimize/Economize refueling station footprint
 - Canopy-top & underground storage options
 - Additions to acceptable H2 piping materials
 - Metal hydride storage systems
 - Testing, inspection and purging of H2 piping
 - Improvements to usability and enforcability
- Meeting May 7-8, 2003 -- NREL, Golden, CO
 - Receive input from interested/affected parties
 - Finalize AHC proposals for 2003-04 cycle

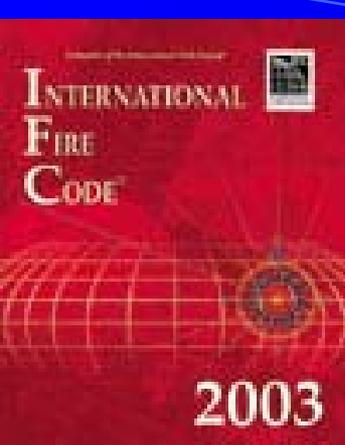


F153-03/04

Separation Distances

- T2209.3.1 Separation distances
- Improvements to terminology such as type of construction
- Ultimate goal: Use research underway at Sandia National Laboratory
 - Validate or revise separation distances
 - Test effects of a hydrogen fire on materials
 - Confirm flammability limits of H₂





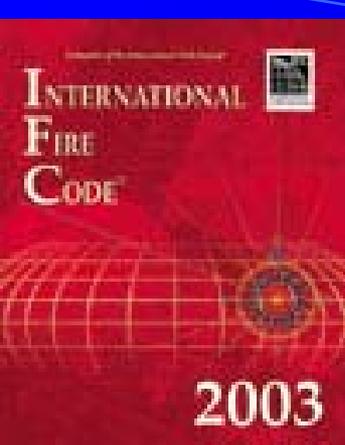
F154-03/04

Canopy-top Storage

- Locate high pressure tube storage & compression equipment on canopy top
- Canopy shall be Type 1B construction
- Fuel dispensing areas underneath shall be sprinklered
- Occupancies underneath limited to Mercantile “convenience store”
- Canopy constructed to prevent accumulation of hydrogen gas

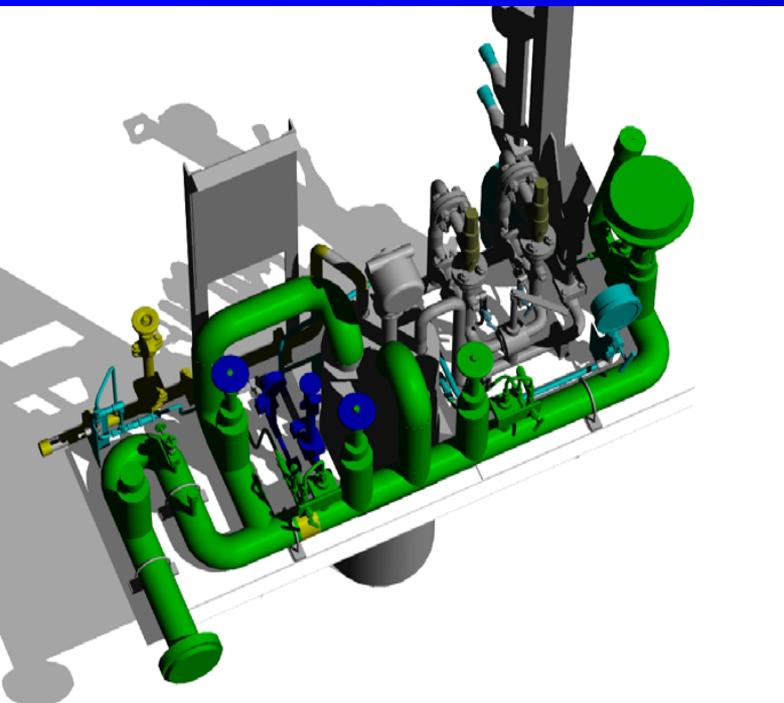


Photo courtesy of Sunline Transit Agency
www.sunline.org



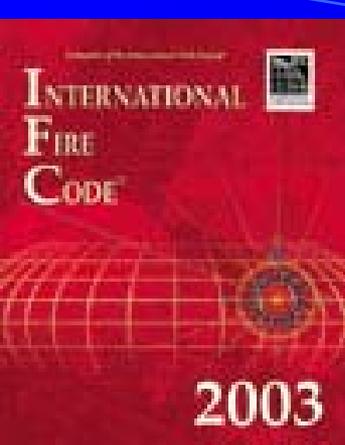
F155-03/04

Underground Liquid Storage



- Constructed in accordance with
 - ASME BPVC, Section VII, Div. 1
- Vacuum jacket in accordance with
 - CGA 341, Insulated Cargo Tank Spec.
 - Stainless steel or corrosion resistant
- Location requirements
 - 3 Ft. from lot line; 1 Ft. shell-to-shell
- Depth, cover and fill
- Anchorage and security per IBC
- Corrosion protection required
- Vacuum level monitoring required

Rendering courtesy of Air Products & Chemicals,
www.airproducts.com

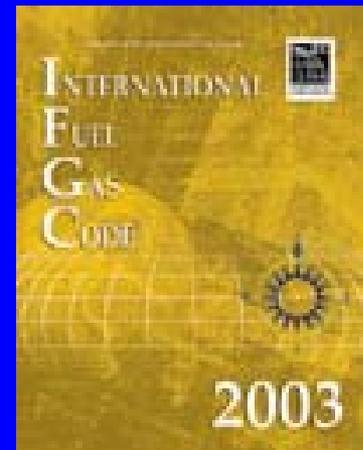


F181-03/04

Metal Hydride Storage

- Metal hydride storage systems for the storage of hydrogen gas contain solid material that might be flammable, susceptible to spontaneous combustion or water-reactive.
- Adds a definition to Ch. 35 Flammable Gases:
 - METAL HYDRIDE STORAGE SYSTEM. A system for the storage of hydrogen gas absorbed in solid material.
- Establishes hazard classification of system based on hydrogen stored without regard to metal hydride content.
- Systems must be listed for application and designed to prevent the removal of the metal hydride.

FG47-03/04 FG48-03/04 Hydrogen Piping Updates



- §704.1.2.3 Design & Construction
 - Applicability to both piping and tubing
 - Adds Type 316L Stainless Steel
 - Types 304, 304L, 316 Stainless
- §705 Testing, Inspection & Purging
 - Inspection methods clarified
 - Purging provisions added
- §705.2 Inspections, §705.3 Pressure Test
 - B31.3 not mandatory but recognized as practice
 - Pressure test revised from 1.5 to 1.3 MAWP
 - Reference to B31.3 updated to 2002 Ed.



Photo courtesy of California Fuel Cell Partnership
www.fuelcellpartnership.com

Why Should We Bother to Change Codes and Standards?

They can positively or negatively affect

- Manpower and marketing requirements
- Costs, profit and loss
- Competition and international trade
- Realization of the benefits of the technology
- Industry participation in the ICC *Code Development Process* is essential for complete and comprehensive coverage.
- Education and outreach to the building code, design and construction communities to facilitate adoptions

Summary

2003/04 Code Development

- Deadline for Proposals
 - March 24, 2003
- Proposals Available
 - July 3, 2003
- Code Hearings
 - September 5-14, 2003
 - Opryland Hotel, Nashville
- Report of Hearings
 - November 14, 2003
- Public Comment Deadline
 - April 1, 2004
- Final Action Hearings
 - May, 2004 (Location, TBD)
- 2004 Supplement Issued
 - August, 2004
- 2004-05 Proposals Deadline
 - August 20, 2004