

International Standards Activities in Hydrogen Technologies

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Background: The NHA

- Approximately 70 Members
- Diverse Membership
 - Large Companies
 - Small Businesses
 - Universities, Institutes, National Labs
- Dedicated to commercializing hydrogen-related energy systems



Background: NHA C&S Process

- Identify areas where codes and standards for the safe use of hydrogen energy systems are needed
- Determine if adequate codes and standards exist
- Identify other stakeholder and expertise
- Develop new draft standards through the NHA, only when the work is needed but not being accomplished elsewhere in a timely way.
- Support efforts led by others, especially in area of hydrogen safety



CODES & STANDARDS ISSUES

- **Codes and Standards Are Being Developed in Advance of or in Parallel with Hydrogen-Fueled Systems. Standards Development Must Be Coordinated with Technology Development.**
- **Efforts Should Be Devoted to R&D Efforts to Validate Proposed Standards (i.e., Need for Data to Support Proposed Standards)**
- **Since All Applications Involve Production, Transportation, Storage, Dispensing and Use of Hydrogen, There Are a Lot of Organizations Involved in Generating Standards. These Efforts Need to Be Coordinated.**



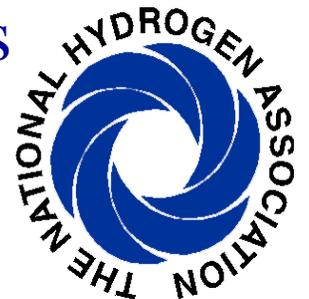
Goals and Objectives

- Build industry consensus on technical criteria for hydrogen energy components and systems nearing commercialization
- Advance U.S. industry positions in the international arena
- Participate in applicable hydrogen codes and standards of others
- Work closely with the ICC AHC to include H2 and H2-energy systems in the U.S. model codes
- Identify gaps in H2 C&S efforts
- Transfer the information to increase acceptance



NHA Work Items

- WG1: Connectors (completed)
- WG2: Containers (Hydrides)
- WG3: Refueling Stations (completed)
- WG4: Use of electrolysers and fuel cells at customer sites, including homes. (completed)
- WG5& 6:(SAE Coordination)
- WG7: C&S for maritime unique applications of hydrogen



NHA Coordination efforts

- DOE Hydrogen C&S Coordinating Committee (NREL)
- ICC Ad Hoc Committee on Hydrogen
- SAE Fuel Cells Standards Committee
- IEC TC 105
- ISO TC 197 - with liaisons with ISO TC 22
ISO TC 58/SC3, ISO TC 220



Why International Standards?

- Continue to work toward new hydrogen standards internationally and develop preliminary information prior to proposing new international standards and establish liaison with national and international organizations that are involved in developing hydrogen-related standards
- Rationale: For hydrogen to be other than a curiosity, it requires standards to assure the public, financiers, and insurance companies that hydrogen products, equipment, and systems are safe.



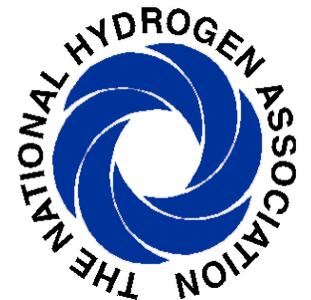
U.S. Position on International Level

- National Versus International Standards
- Need for U.S. Position
- European activities driving toward global regulations
- Process differs between Europe and U.S.
- Government Role



Upcoming International Standards Meetings

- ISO TC 197 US TAG meeting last week
- ISO TC 197 Plenary and Working Groups in June
- IEC TC 105 Plenary and Working Groups in June
- WHEC C&S Sessions



Status of Progress - International

- Category D liaison with ISO TC 197
- Bob Mauro is Chair of the U.S. Technical Advisory Group for ISO TC 197
- Karen Miller is on the Permanent editing committee for ISO TC 197
- IEC TC 105
- ISO TC 22/SC-21 liaison with SAE



Scope of TC 197

Standardization in the field of systems and devices for the production, storage, transport, measurement and use of hydrogen



Membership of TC 197

Participating (P) members

Argentina, Australia, Belgium, Canada, Egypt, France, Germany, Italy, Japan, Libya, the Netherlands, Norway, the Republic of Korea, the Russian Federation, Sweden, Switzerland, and the United States of America

Observing (O) members

Austria, the Czech Republic, China, Hungary, India, Israel, Jamaica, Spain, Thailand, Turkey, Ukraine, the United Kingdom, and Yugoslavia



ISO TC 197 Work Items

- WG 1 Liquid hydrogen -- land vehicle fuel tanks
- WG 2 Tank containers for multimodal transportation of liquid hydrogen
- WG 4 Airport refueling facility
- WG 5 Gaseous hydrogen blends and hydrogen fuel
 - filling station
 - land vehicle filling connectors



ISO TC 197 Work Items (Cont'd)

- WG 6 Gaseous hydrogen and hydrogen blends - land vehicle fuel tanks - joint working group with ISO TC 58/SC3
- WG 7 Basic considerations for the safety of hydrogen systems
- WG 8 Hydrogen generators using water electrolysis process - new item



WG 1 Liquid hydrogen -- land vehicle fuel tanks

- Convener: Canada
- Status: DIS 13985-1
- Input from vehicle manufacturers
- Cooperation with UN ECE WP29 through WP 29 GRPE Ad hoc working group



WG 2 Tank containers for multimodal transportation of liquid hydrogen

- Convener: Canada
- Status: WI 13986 has been discontinued by TC 197. The work has been continued by TC 220 WG 1
- Relationship between two technical committees is informal. Last meeting was held in November 2001
- TC 220 WG 1 document is based on European harmonized draft *Cryogenic vessels -- design and construction*
- Major sticking point is what pressure vessel code to use
- U.S. voted with major to ask for equal voting rights with TC 220



WG 4 Airport hydrogen refueling facility

- Convener: Germany
- Status: DPAS 15594 has been approved as a Publicly Available Specification



WG 5 Gaseous hydrogen blends and hydrogen fuel --filling station

- Convener: Canada
- Status: WD 15866 has change of title and scope approved
- Basis for standard: CSA B108 NGV refueling station standard; NFPA 52/50A; prEN 13638
- Cancelled due to slow progress in May 2002
- Any P-member country may reinitiate future work on filling stations



WG 5 Gaseous hydrogen blends and hydrogen fuel -- land vehicle filling connectors

- Convener: Canada
- Status: WD 17268 looking to develop formal relationship with SAE and adopt connector profiles for 250, 350, 500 and 700 bar
- Issue with proposed design was potential cross connection of worn CNG connectors and hydrogen connectors
- Meeting June 11, 2002 in Montreal
- Committee Draft anticipated



WG 6 Gaseous hydrogen and hydrogen blends - land vehicle fuel tanks

- Convener: Canada
- Status: CD 15869 is a joint working group between ISO TC 197 and TC 58 SC 3. Remaining technical issue a TC 58 SC 3 internal disagreement over design factors related to hydrogen embrittlement
- The U.S. TAGs 197 & 58 SC 3 voted to not move the draft forward



WG 7 Basic considerations for the safety of hydrogen systems

- Convener: Germany
- Status: The Committee voted to change DPAS 15916 to a technical report TR
- Dr. Steve Woods of the US agreed to draft a new introduction and recast the current draft to conform to the format for a technical report
- Draft report in circulation; DTR 15916
- Meeting June 13, 2002 in Montreal



WG 8 Hydrogen generators using water electrolysis process

- Convener: Canada
- Status: approved as a new work item
- WD 22734
- Met in Canada in April 2002. Report in June in Montreal.



ISO TC 197 Liaisons

- Formal agreements with ISO TC 58/SC3 and IEC TC 105
- Joint standard on tanks under development with ISO TC 58/SC 3
- Under negotiation with ISO TC 22
- Joint TC 220 standard sought on multimodal transport of liquid hydrogen



European Integrated Hydrogen Project

- To develop draft regulations for the use of hydrogen as a vehicle fuel
- Two draft standards developed in phase 1
- Presentation made at ISO Plenary Meeting in Paris
- U.S. and Canadian position was that the EIHP tank standards should be considered within ISO and not have duplicate efforts



UN ECE WP 29

GRPE ad hoc group

- ISO TC 197 and ISO TC 22 are currently cooperating in producing an ISO report for the next GRPE meeting to identify conflicting requirements between the draft regulations prepared by the EIHP and ISO WI 13985 and ISO WI 15869



ISO TC 220 - Cryogenic Vessels

- **ISO/CD 20421-1** Cryogenic vessels — Large transportable vacuum insulated vessels — Part 1 : Design, fabrication, inspection and testing
- **ISO/CD 20421-2** Cryogenic vessels — Large transportable vacuum insulated vessels — Part 2 : Operational requirements
- **ISO/CD 21010** Cryogenic vessels — Gas/material compatibility N 226 Annex 3 **ISO/CD 21028-1** Cryogenic vessels — Toughness requirements for materials at cryogenic temperature — Part 1: Temperature below -80 °C



ISO TC 220 - Cryogenic Vessels - Continued

- **ISO/CD 21028-2** Cryogenic vessels — Toughness requirements for materials at cryogenic temperature — Part 1: Temperature between $-80\text{ }^{\circ}\text{C}$ and $-20\text{ }^{\circ}\text{C}$
- **ISO/CD 21029-1** Cryogenic vessels — Transportable vacuum insulated vessels of no more 1000 l volume - Part 1: Design, fabrication , inspection and testing
- **ISO/CD 21029-2** Cryogenic vessels — Transportable vacuum insulated vessels of no more 1000 l volume - Part 2: Operational requirements
- **ISO/CD 21009-2** Cryogenic vessels — Static vacuum insulated vessels — Part 2 : Operational requirements



ISO TC 22/SC 21

Published Standards

- **ISO 6469-1:2001** Electric road vehicles — Safety specifications — Part 1: On-board electrical energy storage
- **ISO 6469-2:2001** Electric road vehicles — Safety specifications — Part 2: Functional safety means and protection against failures
- **ISO 6469-3:2001** Electric road vehicles — Safety specifications — Part 3: Protection of persons against electric hazards
- **ISO 8715:2001** Electric road vehicles — Road operating characteristics



ISO TC 22/SC 21

Standards Under Development

- **ISO/PRF 8713** Electric road vehicles — Vocabulary
- **ISO/PRF 8714** Electric road vehicles — Reference energy consumption and range— Test procedures for passenger cars and light commercial vehicles
- **ISO/AWI 22918** Electrically propelled road vehicles —Measurement of road operating ability — Fuel cell electric hybrid vehicles — Hydrogen based
- **ISO/AWI 22919** Electrically propelled road vehicles — Measurement of road operating ability — Pure fuel cell electric vehicles — Hydrogen based
- **ISO/AWI 22920** Road vehicles — Energy performance — Fuel cell electric hybrid vehicles
- **ISO/AWI 22921** Road vehicles —Energy performance — Pure fuel cell vehicles
- **ISO/AWI 22922** Road vehicles — Emission of hybrid vehicles — Fuel cell electric hybrid vehicles
- **ISO/AWI 22923** Road vehicles — Emission of hybrid vehicles — Pure fuel cell vehicles



ISO TC 22/SC 25

- Compressed Natural Gas Standards
 - There is a long list of standards developed by this group for compressed natural gas systems that may be valuable for ongoing and future hydrogen systems standards development.



IEC TC 105

- Scope - Fuel Cell Technologies
- Efforts Underway
 - The first meeting of International Electrotechnical Commission, IEC TC 105 was held in Frankfurt, Germany February 23-23, 2000.
 - A. The standards work structure agreed upon includes;
 - i. Definitions
 - ii. Fuel Cell Modules
 - iii. Stationary Fuel Cell Power Plants
 - iv. Fuel Cell Systems in Transportation
 - v. Portable Fuel Cell Systems.
- Role of NHA



Upcoming Events

- World Hydrogen Energy Conference
 - June 9-13, Montreal, Quebec
 - Technical sessions on Hydrogen and fuel cells, including two sessions specifically on codes and standards
 - ISO TC 197 Plenary and Working Group Meetings
 - IEC TC 105 Plenary and Working Group Meetings
 - www.HydrogenConference.org



Free Monthly Publication

- Hydrogen Safety Report
- monthly electronic newsletter - 15th of each month
- www.HydrogenSafety.info
- Contributions encouraged!



Summary

- Hydrogen Industry has hydrogen safety expertise
- NHA works with other groups to provide hydrogen safety expertise to ongoing codes and standards
- U.S. position in international standards is essential for level playing field
- There is a lot of activity in international standards
- Safety is NOT proprietary!

