April 2008

What's Next in Hydrogen?

U.S. National Work Group (USNWG) March 2008 Meeting

By Juana Williams

The USNWG for the Development of Commercial Hydrogen (H_2) Measurement Standards met March 4, 5, and 6, 2008, at the California Fuel Cell Partnership (CaFCP) in West Sacramento, California. The U.S. Department of Energy and NIST were joint sponsors of this meeting. At the conclusion of its October 2007 meeting, the USNWG divided its tasks into two areas to be carried out by two separate subcommittees, one for device standards and test procedures and the other for fuel specifications. On March 4 and 5, the Device Standards and Test Procedures Subcommittee resumed work on a draft NIST Handbook 44 Hydrogen Gas Meters Code and corresponding field test procedures. The Subcommittee agreed that Kristin Macey (California Division of Measurement Standards) will chair the device subcommittee. On March 6, the USNWG Subcommittee for Hydrogen Fuel Specifications held its first meeting to address weights and measures requirements for product including: (1) identity, (2) specifications, (3) method of sale, (4) labeling, (5) signage, and (6) sampling and laboratory test procedures. The Fuel Specifications Subcommittee was not able to select a chair at this meeting.

Participants represented H_2 dispenser and component original equipment manufacturers (OEMs), NTEP, fuel providers/partnerships and quality regulators, NIST, NCWM, Inc., DOE, and state weights and measures and air quality regulators. The USNWG had the opportunity to learn more about fueling procedures and dispenser operations during its participation in a Ride and Drive of four OEMs H_2 fuel cell vehicles and tours of H_2 refueling facilities at the CaFCP and Sacramento Municipal Utilities District (SMUD). The SMUD facility uses a solar array to generate power for electrolysis of city water to produce hydrogen. Two back-to-back sessions were held to address equipment and fuel specifications as follows:

USNWG Subcommittee on Device Standards and Test Procedures

Device Requirements

The USNWG is on track with the WMD 2008 - 2012 plan for drafting device standards. At its October 2007 meeting the USNWG began incorporating comments into a second draft of the Hydrogen Gas Meters Code being developed for NIST Handbook 44. An intermediate draft 2.1 resulted from that meeting and was distributed prior to the March 2008 meeting. During the March 2008 meeting, the Device Standards and Test Procedures Subcommittee incorporated industry and weights and measures comments into draft 2.1 of the Hydrogen Gas Meters Code to address: (1) marking temperature ranges, (2) pressurization of the hose, (3) units of measurement, (4) selection of the unit price, and (5) receipt requirements in retail applications. Several members of the Subcommittee are working on additional language to clarify how product composition relates to meter technology and the terms "nonresettable totalizer" and "minimum measured quantity." NIST WMD will incorporate the final language into a third draft of the code and that draft will be made available shortly for electronic review and input by the Subcommittee. Several dispenser OEMs are working to provide performance data to the Subcommittee for comparison with current accuracy requirements of 1.5 % listed in the draft code.

Test Procedures

Draft test procedures for gaseous applications are planned for distribution and comment in 2009. The Subcommittee began laying ground work for testing the performance of retail H_2 refueling dispensers. Test procedures will be derived from the NIST Handbook 44 code developed by the USNWG.

The Subcommittee is interested in H_2 refueling equipment test procedures from dispenser OEMs, energy suppliers, research facilities, and other sources. The California Division of Measurement Standards (CA DMS) is nearing completion of a draft checklist of test procedures for type approving dispensers and is examining sources for test equipment and standards so that DMS can begin gathering data. With more than 30 H_2 refueling stations in California, CA DMS anticipates it will be the first state to receive a request for type evaluating and approving a H_2 dispenser for commercial use. The Subcommittee had lengthy discussions about how to simulate real world filling conditions to $^1/_3$, $^2/_3$, and full vehicle tank capacity, and test dispenser accuracy using either a gravimetric,

volumetric, or transfer standard. It is anticipated that field test procedures for commercial equipment will be the primary focus of the next Subcommittee meeting which is scheduled for the June 17 - 19, 2008.

USNWG Subcommittee on Fuel Specifications

Fuel Quality Expectations
The WMD has set a goal for developing fuel quality specifications by 2009. The USNWG Fuel Specifications Subcommittee discussed the many similarities between the fuel specifications standards being developed by the CA DMS, Society of Automotive Engineers, and International Organization for Standardization (ISO) and reviewed a corresponding draft of NIST Handbook 130 language developed by NIST WMD. Drafts of the CDFA and ISO standards are available. The Subcommittee discussed which contaminant levels are acceptable based on the capability of test equipment and from a fuel production standpoint. The Subcommittee witnessed the handoff of a first generation fuel quality test unit from a private test facility to CA DMS. Discussion of sampling procedures and laboratory practices will be withheld until the next meeting. Finalization of a H_2 fuel quality standard for weights and measures may be hampered somewhat by the lack of a nationally approved fuel standard.

Method of Sale (MOS) Requirements
The USNWG Fuel Specifications Subcommittee reviewed a proposed draft of MOS requirements for hydrogen fuel ahead of the 2009 distribution planned by WMD. The proposed requirements were developed for NIST Handbook 130 Section IV. Uniform Regulations Part B. Uniform Regulations for the Method of Sale of Commodities Section 2 Non-food Products. The Subcommittee agreed that the conditions for sale such as operation pressure or purity should be stated with the associated price in whole cents/kilogram in street signage and dispenser labeling. For example, if a kilogram of hydrogen were offered at two different prices and the price difference was based on the dispensers' operation pressures of 350 bar and 700 bar (note that these pressures are roughly equivalent to 5 000 psi and 10 000 psi, respectively) the station would need to disclose the pressure information on the street price sign and on the dispenser. The draft text will be revised to incorporate this information and distributed electronically for the Subcommittee's review and input.

Future Tasks
At its June 2008 meeting, the USNWG Subcommittees will most likely focus on dispenser test procedures and fuel quality specifications, and laboratory and sampling procedures. The USNWG is considereding either Allentown, Pennsylvania, Des Plaines, Illinois, or California fueling sites based on logistical and technical needs of the project. It may be necessary to hold two separate meetings one to finalize the draft device code and continue its work on developing test procedures and a second to continue discussions on fuel specifications and MOS requirements. The USNWG agreed that invitations should continue to be extended to auto OEMs and energy providers for their input and participation in anticipation of some resistance to requirements for specific uniform pricing units and fueling protocols.

International Hydrogen Standards Development

The International Committee on Legal Metrology approved a new project to revise International Recommendation 81 (R 81) "Dynamic measuring devices and systems for cryogenic liquids" to include:

(1) Electronic tests in accordance with the latest edition of OIML D 11 (2004) and/or the latest International Electrotechnical Commission and ISO standards,
(2) Technical requirements to include new developments in hydrogen measurements, and
(3) Current recommendations for density equations.

As Secretariat for R 81 the United States is responsible for work on the international standards document and plans to also consider revising the format of existing sections into three distinct parts (requirements, test method, and test report) similar to the format of other recently developed OIML recommendations. Many of the requirements in this document correspond to NIST Handbook 44 Section 3.34 Cryogenic Liquid-Measuring Devices.

A first committee draft with all of the modifications listed above will be distributed to U.S. stakeholders for comment in June 2008.

U.S. National Outreach and Hydrogen Standards Development

NIST WMD encourages the weights and measures community at the state, local, and regional levels to continue to participate in the development of national and international legal metrology standards for hydrogen and training opportunities on emerging hydrogen technology. Updates and links to reports and other related work on the development of commercial hydrogen measurement standards and a schedule of upcoming hydrogen workshops, presentations, and meetings will be posted shortly on the NIST WMD website at http://www.nist.gov/owm. A presentation was given to the Northeastern Weights and Measures Association Annual Meeting May 13, 2008, in Fishkill, New York.

Is Hydrogen in Your State?

Currently, there are hydrogen refueling stations operating in support of fleet and other fuel cell vehicles. These stations are equipped with stationary and mobile refueling systems with various levels of public accessibility. The hydrogen community recognizes that more stations are necessary and the distance between stations must be within the driving range of vehicles to better serve the general public. Nationwide hydrogen refueling stations are in operation in the states of Arizona, California, Connecticut, Washington, D.C., Florida, Hawaii, Illinois, Indiana, Michigan, Missouri, Nevada, New York, North Carolina, Ohio, Pennsylvania, Vermont, and Virginia. More information about each station's: (1) city location, (2) type of fuel, (3) start-up dates, (4) photos, (5) method of fuel production, and (6) project type and partners, is available on the website at http://www.fuelcells.org/info/charts/h2fuelingstations.pdf.

In the interim the following list of helpful web sites provides some basic information on hydrogen refueling sites, storage, transportation, safety, and production:

-Basics, safety, storage, delivery: http://www.fuelcells.org/hydrogen/basics.html
-Fuel sites (chart): http://www.fuelcells.org/info/charts/h2fuelingstations.pdf
-Interactive map: http://www.hydrogen.gov/interactive_map.html
-Fact sheets: http://www1.eere.energy.gov/hydrogennandfuelcells
-Videos, vehicle costs, challenges: http://www.fueleconomy.gov/feg/hydrogen.shtml
-Broad overview of NIST hydrogen activities: http://www.nist.gov/hydrogen.

Stakeholders who are not able to participate at this time in upcoming hydrogen work groups and workshops, but wish to actively observe this work or who have questions should contact Juana Williams by email at juana.williams@nist.gov, by telephone at 301-975-3989, or by fax at 301-975-8091.