

**September 2008**

## **U.S. National Work Group (USNWG) for the Development of Commercial Hydrogen Measurement Standards**

*By Juana Williams*

The USNWG Subcommittees met on June 17 - 19, 2008, at the Gas Technology Institute (GTI), Des Plaines, Illinois. The Subcommittees' meeting summaries will be made available on the NIST WMD web site in the next few weeks at <http://ts.nist.gov/WeightsAndMeasures/index.cfm>, under "W&M Resources" – click on the link to "Developing Commercial Hydrogen Measurement Standards." This article includes a preliminary summary of the Subcommittees' June 2008 discussions.

### ***USNWG Device Standards and Test Procedures Subcommittee (DSTPS)***

The DSTPS conducted an in-depth review of the specification requirements in Draft 3.0 of the Hydrogen Gas Measuring Devices Code. The DSTPS modified several specification paragraphs primarily to clarify how those design requirements apply.

The DSTPS also identified requirements needing further research and/or discussion to ensure they are appropriate and/or properly address the gaseous hydrogen application. The draft code includes a requirement for a non-resettable totalizer similar to those in NIST Handbook 44 Codes that apply to motor-fuel dispenser applications. However, equipment manufacturers questioned where to derive quantity values to achieve agreement between the totalizer and dispenser indications. The DSTPS discussed marking requirements for the "minimum measured quantity," (MMQ) which are a part of international requirements for all meter technologies and a NIST Handbook 44 requirement for mass flow meter technology. The MMQ is used to determine the limits for other requirements in international standards. Consequently, the DSTPS is looking for the best technical approach to include MMQ requirements in the draft code. The design of some refueling systems for pressurization of the hose and high pressure deliveries may affect the control of the flow rate during test. Also in question is whether or not to permit the venting of product from the standard after a test of the refueling equipment in highly industrial areas.

The location of USNWG meetings is somewhat driven by the technical tasks before the subcommittees. To date, these sites have provided the USNWG with opportunities to observe various types of device manufacturers' equipment. At GTI, the DSTPS observed the operation of a Greenfield Compression, Inc. hydrogen refueling dispenser and the associated test standard that uses the gravimetric test method to verify the system's performance.

With regard to accuracy requirements, the DSTPS is requesting performance data to demonstrate whether or not the proposed 1.5 % accuracy tolerance requirement in the draft code is appropriate.

The California Division of Measurement Standards reported on its observation of the set up and operation of a mobile station test apparatus that uses the gravimetric test method for determining the accuracy of hydrogen delivery. As a result of their report, a number of issues were raised about the procedure from a metrological standpoint (uncertainties, repeatability, etc.), which will be discussed by the USNWG.

Since the next steps for the DSTPS will be to develop test procedures, Diane Lee (NIST WMD) will request stakeholders such as OEMs, R&D laboratories, international standards developing organizations, etc. provide information on current test procedures/equipment.

### ***USNWG Fuel Specifications Subcommittee (FSS)***

Since its March 2008 meeting, the FSS has reviewed draft method of sale and fuel quality requirements. Ken Butcher, the FSS Technical Advisor, developed "The Starting Point: A Discussion Paper Describing a Proposed Method of Sale and Quality Specification for Hydrogen Vehicle Fuel." The background and discussions covered in the paper lay the foundation for the FSS to agree upon the correct usage of units of measurement and a starting point

for a fuel quality standard. The FSS will conduct an in-depth review of the paper to determine the appropriate units for pressure and other relevant units of measurement, and reference standards for fuel quality.

At its next meeting the FSS will discuss whether or not the interim California Department of Food and Agriculture Fuel Specification should be the basis for its work on the fuel quality standard. The FSS will consider NIST Special Publication (SP) 330 "The International System of Units (SI)" and NIST SP 811 "Guide for the Use of the International System of Units (SI)" as the source for uniform implementation of SI units. Given the importance of SI units in science and technology the 2008 editions of the SPs provide guidance on international and U.S. conventions for SI units.

Currently, the operating pressures for many hydrogen refueling dispensers are marked in "bar" units. Since 1982 one bar has been used as the standard pressure for tabulating all thermodynamic data. The bar is expressed as a unit of pressure (in SI units, 1 bar = 0.1 megapascal (MPa)) or force divided by area. The FSS must agree on a conversion value when the bar value is derived from U.S. Customary units (psi). U.S. weather watchers will recognize the unit "millibar" from meteorological reports on the atmospheric air pressures in hurricanes (the lower the millibar value the more severe the storm). It is permissible to use the bar, a non-SI unit, where its use is part of an established practice. The bar is widely used in industry. However, the SI unit should be used first and then followed by the bar value.

The FSS also discussed sampling procedures for hydrogen fuel quality. The FSS questions the ability of field officials to obtain samples from systems that operate at 700 bar pressure (approximately 10 000 psi). The California Division of Measurement Standards reported on the set up and operation of a hydrogen quality sampling apparatus it took possession of in March 2008. Questions were raised about the level of training necessary to properly use of the equipment under field conditions and advancements in technology that make equipment readily available that is capable of detecting contaminants/particulates at the levels specified in the interim standard.

More details are available on these topics in the discussion paper which is posted on the NIST WMD web site at <http://ts.nist.gov/WeightsAndMeasures/index.cfm>. Look for the link to "Developing Commercial Hydrogen Measurement Standards" under W&M Resources.

As this article goes to publication, the USNWG will have met August 26 – 27, 2008, in Allentown, Pennsylvania. The USNWG will be submitting a request to the 2009 NCWM Specifications and Tolerances and Laws and Regulations Committees to include an item on those Committees' Developing Items Agendas to make the weights and measures community aware of upcoming proposals to change NIST Handbook 44 and NIST Handbook 130 requirements to address hydrogen refueling applications. If you have questions about the USNWG or are interested in participating in the ongoing work to develop commercial hydrogen measurement standards please contact Juana Williams by e-mail at [juana.williams@nist.gov](mailto:juana.williams@nist.gov) or by telephone at 301-975-3989.