

**U.S. National Work Group  
for the  
Development of Commercial Hydrogen Measurement Standards**

**July 7, 2009**

**Joint Device Standards Subcommittee (DSS) and Fuel Specifications Subcommittee (FSS)  
Teleconference/Webconference Meeting**

**MEETING SUMMARY**

**Time:** Tuesday, July 7, 2009/3:00 p.m. - 5:00 p.m. EDT-USA & Canada (GMT - 4:00)

*This meeting was sponsored by the U.S. Department of Energy and U.S. Department of Commerce's National Institute of Standards and Technology.*

*This meeting was hosted by CSA Standards*

**Purpose:** The U.S. National Work Group (USNWG) met to continue its work to promote the establishment of a comprehensive set of (1) design, accuracy, installation, use, and method of sale requirements, (2) test procedures, and (3) quality standards for hydrogen fuel and equipment used in hydrogen measurements for vehicle and other refueling applications.

**AGENDA ITEMS**

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**NOTE: Appendices A through D to the meeting summary are available on request.**

**Joint Device Standards Subcommittee and Fuel Specifications Subcommittee Meeting Agenda**

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**Table A**  
**Attachments List**

<b>Appendix</b>	<b>Related Agenda Items(s)</b>	<b>Title</b>
A	(2) (a)	Draft Summary of the June 2009 USNWG Meeting
B	(3)	Draft 4.1 (R/W) NIST Hydrogen Gas-Measuring Devices Code Recommendations for Retail and Wholesale Application Requirements
C	(3)	Analysis of Paragraphs That Do Not Apply to Wholesale/Bulk Deliveries
D	(3)	Current NIST Handbook 44 Retail/Wholesale Code Requirements
E	(1)	Attendee List

**Device Standards Subcommittee (DSS) and Fuel Specifications Subcommittee (FSS)  
Teleconference/Webconference Meeting**

**(1) Welcome Current/New Members and Roll Call**

New members of the USNWG and visitors were welcomed; the meeting was called to order, roll call conducted (see Appendix E), and the meeting's purpose reviewed. The collaborative work by the meeting's sponsors was recognized. New participants were invited to provide their name, affiliation, and state their specific area of interest in the work to develop hydrogen measurement standards.

Please note that since the distribution of the December 2008 USNWG meeting summary, the attendee list has included only meeting participants, rather than naming the entire list of USNWG members and designating their presence or absence at each session. This format change was made for better management of the size of the summary. Please notify any Subcommittee Technical Advisor if your name erroneously appears on the attendee list of a meeting in which you did not attend or if your name fails to appear on an attendee list of a meeting you attended. Contact the Technical Advisors if you would like to return to the earlier format of listing each USNWG member's name and attendance at the end of each meeting summary.

No USNWG member can be removed from membership without first requesting a Subcommittee Chair take such action or unless USNWG Guideline procedures for "Membership" removal are followed by a Subcommittee Chair after an extended period of nonparticipation by a USNWG member. To date the USNWG has experienced only one change in membership status, which was in response to a member's request for a change from participating to observing the USNWG work.

**(2) Administrative Business**

The USNWG discussed procedures for managing and documenting its technical work. The USNWG wishes to express its thanks to Julie Cairns, CSA Standards, for hosting and organizing the July 7, 2009 teleconference and webconference meeting. The following item(s) was addressed:

**(a) Approve the Summary of the June 2009 USNWG Meeting**

A draft summary of the June 17, 2009 USNWG teleconference/webconference meeting (see Appendix A) was emailed on June 26, 2009 to the group for its review and approval. During the July 7<sup>th</sup> meeting, the USNWG agreed a deadline of July 20, 2009 was necessary to allow all USNWG members additional time to complete their review of the June 2009 summary. The DSS Technical Advisor balloted the USNWG by email on July 9<sup>th</sup> for approval of the summary. The USNWG was given until July 20<sup>th</sup> to either vote or make recommendations for changes to the summary.

**(3) Development of Device Standards and Test Procedures for Commercial Hydrogen Measurement**

**(a) Retail/Wholesale (R/W) Applications and Measurement Methodologies**

*Retail/Wholesale Applications*

On June 17, 2009, the USNWG agreed this additional two-hour teleconference/webconference in July was necessary before the upcoming August 11-13, 2009 in-person meeting to fully develop separate requirements for retail and wholesale applications. The USNWG continued its review of Draft 4.1 (R/W) of the NIST Handbook 44 (HB 44) Hydrogen Gas-Measuring Devices Code to ensure there are no gaps in the final code that might delay its acceptance in the weights and measures standards development process in fall 2009.

During the June 17<sup>th</sup> teleconference/webconference meeting discussions, the USNWG focused on developing requirements that met the intent of current measuring device codes, which is to apply to all commercial devices and fully address equipment classified for use in retail and wholesale applications. Measuring equipment is

considered being used in a commercial application when measurements or computations obtained from the equipment are the basis for a charge or payment. Retail and wholesale commercial equipment falls under the jurisdiction of the weights and measures authority. The intent for this draft code is the same as other measuring device codes in that it should apply to both retail and wholesale measuring devices even in instances where there is a contractual agreement between the buyer and seller.

On July 7th the USNWG continued its review of newly proposed requirements in Draft 4.1 (R/W) of the code (see Appendix B) developed by the DSS Technical Advisor to address both retail and wholesale applications. The analysis of draft code paragraphs prepared by Bob Boyd (Linde, Inc.) and Joe Cohen (APCI) that do not apply to wholesale applications includes a new 5<sup>th</sup> column outlining some strategies for addressing this issue (see Appendix C). The added column to the analysis corresponds to the newly proposed and formatted paragraphs that apply to retail and wholesale hydrogen devices in Draft 4.1. These draft requirements were developed using the same approach used in other measuring device code sections that include general and specific requirements to address both applications (see Appendix D).

The California Division of Measurement Standards (DMS) provided recommendations to address the value of the smallest unit for retail and wholesale devices in proposed new paragraphs S.1.4.(a) and (b), which is based on the ranges of flow rates found on approved mass flow meters for use in compressed gases and CNG retail motor-fuel dispenser applications. DMS based the 10 to 1 ratio for the display resolution on the existing ratio in Liquid Measuring Devices Code 3.30 paragraph S.1.2.3. Value of Smallest Unit. The DMS recommendation to modify paragraph S.1.4. was proposed to read as follows:

**S.1.4. Value of Smallest Unit. The value of the smallest unit of indicated delivery, and recorded delivery if the device is equipped to record, shall not exceed the equivalent of:**

- (a) 0.001 kg on devices with a maximum rated flow rate of 30 kg/min or less**
- (b) 0.01 kg on devices with a maximum rated flow of more than 30 kg/min**

The USNWG reviewed Draft 4.1 and the DMS proposal to determine if the modifications represented viable options for addressing both retail and wholesale applications.

The USNWG discussed how to best address the technologies currently in use to measure hydrogen when sold to the end user (retail) and when the buyer intends to resell the product (wholesalers). Currently, measuring device codes apply in the same manner to multiple technologies. However, within a specific code there might be a distinction between the requirements for retail and wholesale devices. Technology is not the basis for this distinction. For example, the requirements in 3.30 Liquid Measuring Devices Code apply in a similar manner to positive displacement and turbine meters. When either of these metering technologies are used in retail and wholesale applications the code includes variances in the limits for the size of smallest unit for a delivery, discharge rate, or the test draft because these differences are more suitable for the a retail versus a wholesale application. The differences in requirements are not based on the technology.

In instances where a specific device code is not intended to apply to a particular application (product, technology, etc.), the exclusion is specified in the Application Section of that code which is given the letter "A" designation. General Code paragraph G-A.3. Special and Unclassified Equipment states that, where appropriate, requirements of the General Code and/or other specific device codes apply to equipment that for one reason or another do not fall under the application of a single device code. Should any methodology be excluded from a specific code for hydrogen devices, a jurisdiction regulating those commercial devices would rely on the provisions in paragraph G-A.3. and look to the appropriate General Code and/or other specific device codes for the requirements necessary to inspect and test such equipment.

Throughout Section 3 of HB 44 devices are assigned an Accuracy Class and an associated performance tolerance. The Accuracy Classes are based on specific product applications. Hence, the same tolerances apply across several codes for measurements made in similar product applications--to do otherwise would give a competitive advantage to one technology over another when they are used for measurements in similar applications. Any new device technology must perform as well or better than devices currently in commercial use.

USNWG industry representatives reported that wholesale deliveries are predominantly based on certified fixed tank volumes using the pressure-volume-temperature (PVT) method for measurements. More time may be needed to adequately address these applications in the draft code. Therefore, the USNWG agreed to reconsider Draft 4.0, which does not include specific requirements to address the wholesale applications. The USNWG will set aside any further discussions of Draft 4.1 and focus on retail dispensers that are currently most in need of addressing.

#### *Draft Code Application to Various Methodologies*

The USNWG continued its review of the draft code to determine if the code adequately addresses all methodologies currently in retail use to measure hydrogen gas. The USNWG has discussed only systems equipped with either mass flow meter technology or using the PVT method for making measurements. It is appropriate that the draft hydrogen code address multiple methodologies as demonstrated in other HB 44 codes (e.g., Section 3.30).

The USNWG held lengthy discussion about the types of applications using the PVT method to determine product measurements. Industry indicated that this method is used in dispensing systems for refueling vehicles and for large deliveries of product for resale. These discussions prompted questions about proposed paragraph A.1. which specifies that the code applies to devices designed to dynamically measure the mass of hydrogen gas. Would the measurements made in either application be considered dynamic? In each case, an equipment manufacturer and weights and measures official should ask before beginning work on a commercial hydrogen device:

- Does the device fall within the parameters for "dynamic" measurements of hydrogen gas specified in draft code paragraph A.1.? and
- Is the device "suitable" (with respect to its design, indications, etc.) for use in that commercial application as described in HB 44 General Code paragraph G-UR.1. Suitability of Equipment?

The USNWG discussed use of the PVT method of measurement as being an industry-wide practice and that it may possibly be suitable for measurements in specific applications such as in wholesale applications. The USNWG is interested in hearing how these measurements are made and want to determine if this methodology is limited to only sales of liquid or gaseous hydrogen, and if the indicated quantities are based only on static measurements of variables such as temperature. One example of static measurements being used in the sale of a liquid commodity, would be taking readings from the receiving tank's calibrated gauge(s) before and after a delivery into the tank, then using that information in the determination of the quantity delivered.

The USNWG questioned the process a jurisdiction might follow to inspect and test commercial hydrogen deliveries if an application is not fully addressed in a code or in instances where the code specifies a particular application is not covered. Although there may not be a specific code that covers a device an official can inspect and test that device in commercial operation using existing general and specific codes for similar applications based on the provisions in General Code paragraph G-A.3. Therefore, this equipment would not be exempt from type evaluation and weights and measures regulation.

The USNWG requests input on methodologies to include mass flow meter and PVT systems and the trends for any other methodologies that are fading from use, currently in use and expanding, or that are planned for hydrogen deliveries. The USNWG will continue to examine how the PVT method for measurement operates in retail and wholesale applications to determine which codes, if any, are applicable. The USNWG discussed adding a new paragraph to the Application section to specify the draft code does not apply to devices using the PVT methodology. As the draft code is currently written, these devices will be held to all requirements to include continuous mass indications, zero-set-back interlock, etc. The USNWG did not come to agreement on specific language for the wording of a paragraph that would create an exemption for PVT systems.

**(b) Opportunity for Reports on Related Activities**

The USNWG is working to harmonize, wherever possible, with related standards to encourage uniformity and to avoid contradictory requirements and trade barriers for U.S. industry. The USNWG Subcommittees periodically receives updates on work by organizations such as ASTM, CaFCP, DMS, NHA, OIML, SAE and other related activities as their work continues to progress.

DMS reported that their funding under California Assembly Bill 118 for the development of commercial hydrogen equipment measurement standards and fuel quality test procedures is still secure.

The DMS concept paper was 1 of 4000 submitted in June 2009 to DOE's Advanced Research Projects Agency-Energy (ARPA-E). Due to the high number of submissions, the July 13, 2009 deadline for ARPA-E to notify applicants has been extended.

**(4) Next Steps/Tasks**

The USNWG discussed upcoming events and the next steps in the weights and measures standards development process that may affect its work to fully develop hydrogen measurement standards and test procedures. Projects, strategies, and target dates will be revisited in August to ensure that the USNWG meets its goals.

**(5) Next Meeting(s)**

**(a) Upcoming August 2009 Meeting Status**

In April 2009, the USNWG Subcommittees rescheduled the August 2009 meeting. The new date and location for that upcoming in-person meeting is:

Date(s)	Location
August 11-13, 2009 August 11 <sup>th</sup> 1:00 p.m. – 5:00 p.m. EDT DSS Meeting; August 12 <sup>th</sup> & 13 <sup>th</sup> 8:30 a.m. – 5:00 p.m. EDT DSS Meeting	NIST 100 Bureau Drive, Bldg. 222/Room B263 Gaithersburg, MD 20899

The USNWG agreed that it does not anticipate substantial changes to the fuel quality specifications from SAE prior to or after the September 2009 SAE meeting. Therefore, the USNWG agreed the entire two and one-half day August 2009 meeting will be dedicated to finalizing the device requirements proposed for HB 44.

**5:00 P.M. (EDT) Meeting Adjourns**

**Appendix E  
Attendee List - July 7, 2009**

**Teleconference/Webconference Meetings of the USNWG**

Name	Agency	Device Standards Subcommittee (DSS) Member Yes (Y)	Fuel Specifications Subcommittee (FSS) Member Yes (Y)	Attended USNWG July 7, 2009 Yes (Y)
Jackie Button	CA Fuel Cell Partnership		Y	Y
Robert Boyd	Hydrogen Solutions – Linde Group	Y	Y	Y
Marc Buttler	Emerson Process Mgmt-Micro Motion, Inc.	Y	Y	Y
Joseph Cohen	Air Products and Chemicals, Inc.	Y	Y	Y
Ron Hayes	Missouri Dept. of Ag.	Y	Y	Y
Mike Keilty	Endress & Hauser Flowtec AG	Y	Y	Y
Diane Lee	NIST – TS WMD	Y	Y	Y
Kristin Macey	CA – Food and Agriculture, Division of Measurement Standards	Y	Y	Y
Lisa Warfield	NIST – TS WMD	Y	Y	Y
Curt Williams	Georgia Ag. Dept./ CPW Energy Consulting	Y	Y	Y
Juana Williams	NIST – TS WMD	Y	Y	Y
<b>GUESTS</b>				
Roger Macey	CA – Food and Ag. Div. of Measurement Standards	--	--	Y
Mark McDougall	Powertech Labs			Y
Charlie Nelson	CA – Food and Ag. Div. of Measurement	--	--	Y

	Standards			
Van Thompson	CA – Food and Ag. Div. of Measurement Standards	--	--	Y