

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

**May 25, 2010**

**Joint Device Standards Subcommittee (DSS) and Fuel Specifications Subcommittee (FSS)  
Tele/Web Conference Meeting**

**MEETING SUMMARY**

**Time:** Tuesday, May 25, 2010/3:00 p.m. – 4:30 p.m. ET-USA & Canada (GMT - 05:00)

**Meeting Name:** H2 U.S. National Work Group, May 25, 2010 Tele/Web Conference Meeting

**To join the meeting online:** <http://nist.na6.acrobat.com/hydrogen-usnwg/>

**Call-In Telephone Number:** 1-877-685-5350

**Call-In Password:** 908127

**Audio Conference Only:** \*6 to MUTE or UNMUTE

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

**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.

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Glossary of Acronyms			
ASTM	American Society of Testing and Materials International	MPa	megapascal
CaFCP	California Fuel Cell Partnership	NGV	Natural Gas Vehicle
CDFA DMS (also CADMS)	California Department of Food and Agriculture, Division of Measurement Standards	NHA	National Hydrogen Association
CSA	Canadian Standards Association, Incorporated	NIST	National Institute of Standards and Technology
DSS	Device Standards Subcommittee	NTP	Normal Temperature and Pressure
EPO 29	Draft Hydrogen Gas Retail Motor-Fuel Dispenser Examination Procedure Outline (EPO) 29	OEM	Original Equipment Manufacturer
FSS	Fuel Specifications Subcommittee	OIML	International Organization of Legal Metrology
HB 44	NIST Handbook 44 Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices (2010)	OIML R 139	Recommendation for Compressed gaseous fuel measuring systems for vehicles
HB 130	NIST Handbook 130 Uniform Laws and Regulations in the Area of Legal Metrology and Engine Fuel Quality (2009)	RMFD	Retail Motor-Fuel Dispenser
HGV	Hydrogen Gas Vehicle	SAE	Society of Automotive Engineers
ISO	International Organization for Standardization	SI	International System of Units
MMQ	Minimum Measured Quantity	TIR	Technical Information Report
MOS	Method of Sale	USNWG	U.S. National Work Group
This table is meant to assist the reader in the identification of acronyms used in this agenda and does not imply that these terms are used solely to identify these organizations or technical topics.			

Attachments List		
Appendix	Related Agenda Item(s)	Title
<b>A</b>	(2)(a)	Draft Summary of the April 2010 USNWG Meeting
<b>B</b>	(4)(a)	Preliminary USNWG's Responses to Input on the Draft Hydrogen Codes from the Fall 2009 Regional Weights and Measures Associations and USNWG (rev.3)
<b>C</b>	(4)(a)	Draft 5.0 of the NIST Handbook 44 Hydrogen Gas-Measuring Devices Code
<b>D</b>	(1)	Attendee List
*Device Standards Subcommittee (DSS)		
**Fuel Specifications Subcommittee (FSS)		

## AGENDA TOPICS

**3:00 P.M. (ET)**

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

New members of the USNWG and visitors were welcomed, the meeting was called to order, time for roll called, and the meeting's purpose was reviewed. The collaborative work by the meeting's sponsors was recognized.

**(2) Administrative Business**

The USNWG discussed and agreed on procedures for managing and documenting its technical work. The following items were addressed:

**(a) Approve the Summary of the April 27, 2010 USNWG Meeting**

A draft summary (see Appendix A) of the April 27, 2010 tele/web conference meeting was emailed on May 21, 2010 to the group for its review. There were two items reported on in the summary that require modification. The first item to be modified is a clarification that Dan Reiswig, Norm Ingram, Van Thompson and Kristin Macey (all with CA), Tina Butcher, Diane Lee, Ralph Richter, Lisa Warfield, and John Wright (all with NIST), Steve Malone (NB), and Ken Ramsburg (MD) were requested to review and comment on Dr. Van Putten's concept for instrument billing by May 19, rather than given an assignment. The second item is the missing report on two Group [2] comments discussed by the USNWG. Due to time limitations during the May 25<sup>th</sup> meeting, the DSS Technical Advisor planned to email a ballot to the USNWG for its final position on the three remaining Group [2] comments from the weights and measures regional associations. The April Summary will be corrected to reflect these actions by the USNWG.

**(b) Agenda Updates for May 2010 Meeting**

No additional item or other updates were made to the May agenda.

**(3) 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 receive updates on work by organizations such as ASTM, CaFCP, DMS, NHA, OIML, SAE and other related activities as their work continues to progress.

**(a) NHA**

***NHA Hydrogen Conference and Expo***

The 2010 NHA Hydrogen Conference and Expo was held May 3-6, 2010 in Long Beach, CA. USNWG members participating in the May 25<sup>th</sup> tele/web conference noted that there was a change in NHA administration to merge with the U.S. Fuel Cell Council, numerous discussions about commercialization, and the 2011 Conference and Expo will be held February 13-16, 2011 at the Gaylord National Hotel Convention Center in Washington, D.C. There was also interest in the device code developed by the USNWG.

**(b) Van Putten-Blue Energy Observatories Inc.**

***Instrumentation Billing Method***

Dr. Maurice van Putten developed the concept of an instrumentation billing method as a method for verifying hydrogen deliveries. Dr. van Putten has discussed the concept with two car manufacturers. Eleven members of the USNWG who have worked with measurement standards (development and regulation) and/or have type evaluation laboratory experience were asked to review the concept and provide input to Dr. van Putten. At this stage, Dr. van Putten has been responding to questions about the concept and whether or not the method falls into the category of a test standard or is for inventory use, and how its measurements would supplement and be reconciled with the indications on a hydrogen fuel dispenser. If the concept is a for a test standard, then NIST

Handbook 44 specifies the amount of error for a test apparatus. Dr. van Putten indicated in theory the uncertainty is reduced to zero the more frequently the customer refills their vehicle. The number of refills necessary to achieve this level of uncertainty is 10 for the vehicle owner and 100 for the station operator. The DSS Technical Advisor noted that during past USNWG discussions, weights and measures officials have commented there are no weighing or measuring devices permitted in commercial operation with 10 percent error. The USNWG agreed the concept may have merit; however, due to time limitations the USNWG agreed a separate teleconference meeting should be scheduled to continue discussions of the concept. The DSS Technical Advisor will contact the parties who will participate in these discussions to make arrangements for this meeting.

#### **(c) California Division of Measurement Standards (DMS)**

##### **DMS-CEC Contract**

DMS reported its contract with the California Energy Commission in support of its developing test methods for use to assure compliance with hydrogen standards will run from June 2010 through January 2013.

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

#### **(a) Remaining Comments on the Draft Hydrogen Codes/USNWG Input to the July 2010 National Conference on Weights and Measures (NCWM)**

In preparation for input to the July 2010 NCWM, the USNWG continued its discussions to address comments (see Appendix B) received on the draft hydrogen codes (see Appendix C) from the U. S. regional weights and measures associations that met fall 2009 and USNWG members.

During this meeting the USNWG addressed five of ten comments on the draft hydrogen code in Groups [4] and Group [LOD]. Comments categorized as Group [4] and Group [Left Open for Discussion (LOD)] represent subjects which may need further research and work to resolve. For the USNWG conclusions on the five comments see Table A below:

<b>Table A - USNWG May 2010 Approach on Hydrogen Code Comments in Groups [4]</b>			
<b>Draft Code</b>	<b>Comment</b>	<b>Discussion</b>	<b>USNWG Approach</b>
[4] NEWMA # 1 - Draft EPO 29 Hydrogen Gas Retail Motor-Fuel Dispensers	An EPO should be developed before the proposal goes for a vote	Other requirements have been adopted without an examination outline procedure (EPO). In 2007 the USNWG planned for the simultaneous development of a hydrogen code and corresponding test procedures. Currently, the USNWG has Draft EPO 29 Hydrogen Gas Retail Motor-Fuel Dispensers under review. The EPO is based on the proposed hydrogen code.	See response below for [4] NEWMA #2. The USNWG has developed an EPO, with supplemental guidelines, and a test report for the gravimetric test method. This puts the work on test procedures ahead of past work on similar applications such as CNG.
[4] NEWMA # 2 - Safety Considerations	All safety considerations should be addressed before the proposal goes for a vote	The USNWG has developed a draft EPO for the gravimetric test method. EPOs are planned for the volumetric and master meter test methods. The draft EPO includes safety notes and alerts and cross references "Safety Considerations" in the same manner as existing	NEWMA was contacted to clarify the nature of its comments on safety. NEWMA's S&T Chairman's response was:  "concerns surrounded whether or not the code had an EPO that was ready to go. The members who spoke

Table A - USNWG May 2010 Approach on Hydrogen Code Comments in Groups [4]			
Draft Code	Comment	Discussion	USNWG Approach
		<p>EPOs used by the weights and measures community. The appropriate references to recognized safety standards/guidelines for grounding, equipment selection, testing, venting, etc. developed by organizations such as UL, ANSI, etc. will be part of the EPO.</p>	<p>recognized that this was so new that any field inspectors who may encounter these devices would need an EPO as they would be completely unfamiliar with almost all aspects of the inspection and test and safety issues unique to hydrogen was a big concern.</p> <p>However, it was widely agreed that if the EPO was ready and it covered these issues then they had more comfort with the proposal and could see no reason not to support it if that were the case."</p> <p>The USNWG has developed an EPO, with supplemental guidelines, and a test report for the gravimetric test method. California has indicated it will use these documents when testing begins later this year. Copies of these documents will be made available to the July 2010 NCWM membership in St. Paul MN. The USNWG will rely on industry safety experts for safety practices included in the test procedures it develops. The USNWG will continue to refine these documents and address procedures for other test methods as more data is gathered.</p>
[4] SWMA # 17 - T.4.1. <b>Type Evaluation Examinations for Devices.</b> - For type evaluation examinations, the tolerance values shall apply under the following conditions:  (a) at any temperature and pressure within the operating range of the	Recommend text read this test is "only" for type evaluation	<p>Paragraph T.4.1. includes requirements similar to those found in corresponding paragraph T.4. Type Evaluation Examinations for Liquid-Measuring Devices in the Mass Flow Meters Code. The Mass Flow Meters Code specifies the conditions for applying a tighter acceptance tolerance during type evaluation. A tighter</p>	<p>The USNWG modified draft version 5.0 of the HB 44 hydrogen code paragraphs, T.4., T.4.1., and T.4.2. to clarify which requirements apply to type evaluation as follows:</p> <p><b>T.4. Tolerance Application.</b></p> <p><b>T.4.1.5      Tolerance Application in Type</b></p>

Table A - USNWG May 2010 Approach on Hydrogen Code Comments in Groups [4]			
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device, and  (b) for all quantities greater than the minimum measured quantity.		<p>tolerance would apply under the conditions of a test with one liquid at one temperature and pressure over all flow rates within the device's operating range.</p> <p>In the case of hydrogen devices, there is only one gas to be tested at temperatures and pressures within the operating range of the device. These devices will not be evaluated with a wide range of products with various characteristics. It may be possible to observe device performance over a range of changes in temperatures and pressures that occur during the fueling process.</p> <p>Paragraph (b) may add to the confusion about whether or not to apply acceptance tolerances during type evaluation or the test of a new device for a delivery at the MMQ. Is this paragraph more stringent than the corresponding Mass Flow Meter Code requirement?</p>	<u>Evaluation Examinations for Devices. - For type evaluation examinations, the tolerance values shall apply under the following conditions:</u> <u>(a) at any temperature and pressure within the operating range of the device, and</u> <u>(b) for all quantities greater than the minimum measured quantity.</u> <u>T.4.24. Tolerance Application on Test Using Transfer Standard Test Method. - To the basic tolerance values that would otherwise be applied, there shall be added an amount equal to two times the standard deviation of the applicable transfer standard when compared to a basic reference standard.</u>
[4] SWMA # 19 - UR.1.2. <b>Discharge Hose-Length.</b> - The length of the discharge hose on a retail fuel dispenser:  (a) shall not exceed 4.6 m (15 ft) unless it can be demonstrated that a longer hose is essential to permit deliveries to be made to receiving vehicles or vessels;  (b) shall be measured from	The LMD Code requires protection of a hose if the hose exceed a specified length. Is there any time when a hose longer than 15 ft is permitted?	The 15 ft. hose length corresponds to limitations on hose length specified in the Mass Flow Meters Code. In contrast, 18 ft. is the limit on length specified in the Liquid Measuring Devices Code. The hose length is specified to reduce the risk of damage to the hose and to minimize the effects of computer jump. Exceptions might be possible if additional length is necessary to fuel the receiving vehicle.	The limitation on hose length for a retail vehicle fuel dispenser is driven by safety and accuracy. Any hose that is too long may be improperly stored and left in the driveway to be run over and damaged by vehicle traffic. For systems that pressurize the hose before the start of a delivery, the hose length does not affect the quantity delivered. This is the case for 70 MPa dispensers. One

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<p>its housing or outlet of the discharge line to the inlet of the discharge nozzle; and</p> <p>(c) shall be measured with the hose fully extended if it is coiled or otherwise retained or connected inside a housing.</p> <p>An unnecessarily remote location of a device shall not be accepted as justification for an abnormally long hose.</p>		<p>The Liquid Measuring Device Code limits dispensing systems hose length when located in a marina or airport to 50 ft. However, the dispenser operator is required to protect hoses in these applications that exceed 26 ft. from weather and the environment.</p> <p>► Do these applications warrant the immediate attention of the USNWG?</p> <p><b>Note:</b> Corresponding international standard R 139 paragraph 5.2.2. specifies a "...maximum permissible error for the complete measuring system is 1.5 %... if fitted with a hose shorter than or equal to 5 meters, 2.0 % ...with a hose longer than 5 meters..."</p>	<p>manufacturer indicated the quantity of hydrogen gas in the hose is relatively small.</p> <p>No modifications were made to the draft code.</p>
[4] SWMA #21- Effects of Constituents That Exceed the Allowable Levels for Hydrogen Fuel Quality	Request for documents on the effects of constituents that exceed levels in the specification table	<p>This question was asked by a weights and measures official who already participates on a number of fuels and lubricants technical committees.</p> <p>► Does anyone have information that the USNWG can point to in either published studies or work in progress to determine the effects on the fuel cell, etc. when constituents levels exceed the limits set in the current fuel quality specification?</p>	<p>To date, Jackie Button (CaFCP) and Chad Blake (NREL) have provided documents and web links to information on the effects of constituents in hydrogen fuel. John Mough (DMS) reported he is working with ISO standards which are at the TIR stage. The NCWM will be notified about this information in response to requests for fuel quality studies and reports. The USNWG will work to provide information to the NCWM as updates are made available to the USNWG and accessible to interested parties.</p>
[4] USNWG #1-Examples of Factors Affecting Changes in Density  S.3.4. Automatic Density	Request for the USNWG to revisit its decision to remove examples of factors that affect changes in density. Wording is inconsistent with		Due to time limitations during the May 25 meeting, the DSS Technical Advisor will carry this item over to the June 17 meeting.

<b>Table A - USNWG May 2010 Approach on Hydrogen Code Comments in Groups [4]</b>			
<b>Draft Code</b>	<b>Comment</b>	<b>Discussion</b>	<b>USNWG Approach</b>
<b>Correction.</b> - An automatic means to determine and correct for changes in product density shall be incorporated in any hydrogen gas-measuring system where measurements are affected by changes in the density of the product being measured.	corresponding requirements in NIST HB 44 3.37 Mass Flow Meters Code for volume-measuring devices that indicate in mass		
<b>[4] USNWG #2- PVT Dispenser Diversion of Product and Value Source</b>	Consider whether or not the operation of dispensers that use the pressure-volume-temperature (PVT) methodology to determine the quantity of hydrogen gas in a delivery includes the use of the vehicle's storage tank volume in calculating the measurement results. If this is the case, then is there sufficient language in paragraph S.4.1. to address this application?		<p>Due to time limitations during the May 25 meeting, the DSS Technical Advisor will carry this item over to the June 17 meeting.</p> <p>Please note that a subgroup is working on possible requirements and a definition to address comments on the PVT system.</p>

Comments in Group [LOD], a category left open for USNWG discussion, were not discussed due to time constraints. The USNWG will discuss these comments and the remaining two Group [4] comments at its upcoming June 17, 2010 meeting. To further expedite the USNWG review process, the three comments in the [LOD] Group were made part of comments in Group [4].

#### **(5) Next Steps/Tasks**

The USNWG will continue its discussions to address comments on the draft hydrogen codes up through July 2. The USNWG will resume its work to fully develop hydrogen measurement standards and test procedures and set priorities and target dates based on existing goals and the outcome of the vote on the hydrogen equipment and method of sale codes at the 95<sup>th</sup> NCWM Annual Meeting this July.

#### **(6) Next Meeting**

The USNWG has no in-person meetings scheduled for 2010, but will hold a tele/web conference from 3:00 p.m. to 4:30 p.m. on Thursday, June 17, 2010. Chris Damiani (Energy & Environmental Research Center (EERC)) Grand Forks, ND has extended an invitation for the USNWG to hold its next in-person meeting at the EERC. Mr. Damiani is recommending the week of September 13 to coincide with two events at the Center, the Hydrogen Action Summit and Mountain States Hydrogen Business Council Conference.

#### **4:45 P.M. (ET) Meeting Adjourned**

**Appendix D****Attendee List-May 25, 2010****Meetings of the USNWG Hydrogen Device Standards and Fuel Specifications Subcommittees**

Name	Agency	Device Standards Subcommittee (DSS) Member Yes (Y)	Fuel Specifications Subcommittee (FSS) Member Yes (Y)	Attended Yes (Y)
Tina Butcher	NIST – TS WMD	Y	Y	Y
Marc Buttler	Micro Motion/Emerson Process Management	Y	Y	Y
Jackie Button	Calif. Fuel Cell Partnership	Y	Y	Y
Joe Cohen	Air Products and Chemicals, Inc.	Y	Y	Y
Ron Hayes	Missouri Dept. of Ag Wgts. & Meas. Div.	Y	Y	Y
Diane Lee	NIST – TS WMD	Y	Y	Y
Kristin Macey Chair DSS	CA – Food and Agriculture, County/State Liaison Office	Y	Y	Y
Charlie Nelson	CA – Food and Ag. Div. of Measurement Standards	Y	Y	Y
Dan Reiswig	CA – Food and Ag. Div. of Measurement Standards	Y	Y	Y
Lisa Warfield	NIST – TS WMD	Y	Y	Y
Curt Williams	C P Williams Energy Consulting, LLC	Y	Y	Y
Juana Williams	NIST – TS WMD	Y	Y	Y
<b>Guests</b>				
John Mough	CA-Food and Ag. Div. of Measurement Standards			Y
Van Thompson	CA-Food and Ag. Div. of Measurement Standards			Y
Maurice Van Putten	Van Putten-Blue Energy Observatories, Inc.			Y