

**U.S. National Work Group
for the
Development of Commercial Hydrogen Measurement Standards
January 13, 2010**

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

Time: Wednesday, January 13, 2010/3:00 p.m. – 4:30 p.m. ET-USA & Canada (GMT - 05:00)

Meeting Online Link: <http://nist.na6.acrobat.com/usnwg-h2/>

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

Call-In Password: 908127

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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Attachments List		
Appendix	Related Agenda Item(s)	Title
A	(2)(a)	Draft Summary of the April 2009 USNWG Meeting
B	(2)(b)	Draft Summary of the August 2009 USNWG Meeting
C	(2)(c)	Draft Summary of the December 2009 USNWG Meeting
D	(4)(a)	Preliminary USNWG's Responses to Input on the Draft Hydrogen Codes from the Fall 2009 Regional Weights and Measures Associations and Other Groups (rev.1)
E	(4)(a)	Draft 5.0 of the NIST Handbook 44 Hydrogen Gas-Measuring Devices Code
F	(4)(a)	Draft 3.0 of the NIST Handbook 130 Uniform Laws and Regulations and Hydrogen Fuel Quality Codes
G	(1)	Attendee List

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	NHFCCSCC	National Hydrogen Fuel Cells Codes and Standards Coordinating Committee
DSS	Device Standards Subcommittee	NIST	National Institute of Standards and Technology
EPO 29	Draft Hydrogen Gas Retail Motor-Fuel Dispenser Examination Procedure Outline (EPO) 29	NTP	Normal Temperature and Pressure
FSS	Fuel Specifications Subcommittee	OEM	Original Equipment Manufacturer
HB 44	NIST Handbook 44 Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices (2010)	OIML	International Organization of Legal Metrology
HB 130	NIST Handbook 130 Uniform Laws and Regulations in the Area of Legal Metrology and Engine Fuel Quality (2009)	OIML R 139	Recommendation for Compressed gaseous fuel measuring systems for vehicles
HGV	Hydrogen Gas Vehicle	RMFD	Retail Motor-Fuel Dispenser
ISO	International Organization for Standardization	SAE	Society of Automotive Engineers
MMQ	Minimum Measured Quantity	SI	International System of Units
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 summary and does not imply that these terms are used solely to identify these organizations or technical topics.			

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, roll called (see Appendix G), 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 item(s) were addressed:

(a) Approve the Summary of the April 2009 USNWG Meeting

A draft summary of the April 28-30, 2009 USNWG in-person meeting held at the California Fuel Cell Partnership, West Sacramento, CA (see Appendix A) was emailed on December 12, 2009 to the group for its review. The USNWG agreed to review, compile any comments, and be ready to vote on approval of the summary during the January 13, 2010 tele/web conference meeting. The USNWG voted to approve the summary with no changes.

(b) Approve the Summary of the August 2009 USNWG Meeting

A draft summary of the August 11-13, 2009 USNWG in-person meeting held at NIST, Gaithersburg, MD (see Appendix B) was emailed on December 12, 2009 to the group for its review. The USNWG agreed to review, compile any comments, and be ready to vote on approval of the summary by the upcoming January 13, 2010 tele/web conference meeting. The USNWG voted to approve the summary with no changes.

(c) Approve the Summary of the December 2009 USNWG Meeting

A draft summary of the December 15, 2009 USNWG tele/web conference meeting (see Appendix C) was emailed on January 4, 2010 to the group for its review. During the January 13, 2010 meeting, the USNWG did not make any modifications to the summary. The Technical Advisor sought the USNWG's input on any remaining issues on density that were not included in the summary. The USNWG voted to approve the summary with no changes.

Approved meeting summaries will be posted to the website: <http://ts.nist.gov/WeightsAndMeasures/Developing-Commercial-Hydrogen-Measurement-Standards.cfm>.

(d) Agenda Updates for January 2010

There were no new items added to the January 2010 agenda. Two editorial changes were made to renumber items (4) Next Steps/Tasks and (5) Next Meeting in the agenda to Items (5) and (6), respectively, and to correct the designation of Draft 3.0 of the NIST Handbook 130 Uniform Laws and Regulations and Hydrogen Fuel Quality Codes from Appendix E to Appendix F. The meeting materials emailed on January 7, 2010 to the USNWG included incorrect alphanumeric designations in those documents.

(3) Opportunity for Reports on Related Activities

The USNWG works 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, etc. and other related activities as their work continues to progress.

(a) National Hydrogen Fuel Cells Codes and Standards Coordinating Committee (NHFCCSCC) - Units of Measurement for Pressure

Juana Williams (NIST) reported on a new agenda topic for discussion at the February 3, 2010 NHFCCSCC meeting. The NHFCCSCC will address the inconsistent use of units for expressing pressure measurement in standards documents and concerns about the nonuniformity of this practice.

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

(a) Address the Comments on the Draft Hydrogen Codes to Develop the USNWG’s Position for the January 2010 National Conference on Weights and Measures (NCWM)

USNWG Position on the Draft Hydrogen Codes

During its January 13, 2010 meeting the USNWG finalized its position that it will submit on the draft hydrogen codes to the January 2010 NCWM. The USNWG recommended that the Hydrogen Gas-Measuring Devices Draft Code and Method of Sale Regulation published in NCWM Publication 15 should move forward for a vote of the July 2010 NCWM Annual Meeting as a Tentative Code in NIST Handbook 44 and permanent code in NIST Handbook 130, respectively. This recommendation would be submitted at the Open Hearing on January 25, 2010 at the NCWM Interim Meeting to the Specifications and Tolerances Committee and Laws and Regulations Committee. The USNWG agreed that a tentative code is urgently needed as a starting point for inspection and test procedures of these devices. The USNWG agreed that, to date, the comments received did not represent issues which should delay adoption of those codes. Additionally, a draft gravimetric test method, including guidelines and a test report, were under revision for distribution by late February to the USNWG. The USNWG planned to work through comments and drafts of the hydrogen codes (see Appendix E and Appendix F) to further refine the code language.

January 2010 Meeting Discussion Points

The USNWG continued on with last month’s discussions of comments it received on the draft codes from the U. S. regional weights and measures associations that met fall 2009 (see Appendix D).

The reasons given for the regional associations’ comments on the draft codes varied and are as follows:

- Clarify some text/terms borrowed from existing codes
- Address safety
- Provide an equipment test procedure
- Consider any limits imposed on other applications
- Select suitable corresponding terms/wording from alternative code sections
- Determine if some code sections apply to a laboratory environment
- Regroup paragraph(s) with similar technical requirement(s)

The USNWG identified 24 comments from the weights and measures community it needed to address. The USNWG also agreed the comments should be grouped into four separate categories, based on four different strategies for addressing the comments as shown below in Table A.

Table A. USNWG Approach on Hydrogen Code Input			
[1] No Modification to the Draft Code	[2] Low to Moderate Level of Modification to Draft Code Warranted; Language Needs Development	[3] Respond to Comment(s) as Suggested in Appendix C to the H2 USNWG-December 15, 2009 Meeting Agenda)	[4] Response Requires Further Research and Work

Table A. USNWG Approach on Hydrogen Code Input

[1] No Modification to the Draft Code	[2] Low to Moderate Level of Modification to Draft Code Warranted; Language Needs Development	[3] Respond to Comment(s) as Suggested in Appendix C to the H2 USNWG-December 15, 2009 Meeting Agenda)	[4] Response Requires Further Research and Work
[1] SWMA #2 Kilogram	[2] SWMA #5 Display; Unit Price/Product ID	[3] SWMA #1 Computing Type See Technical Advisor's suggested modification to paragraph S.1.2. Vehicle Fuel Dispensers to specify continual display of transaction information.	[4] NEWMA #1 Test Procedure
[1] SWMA #4 Smallest unit value	[2] SWMA #6 Agreement Between Indications	[3] SWMA #3 Division Description See Technical Advisor's suggested modification to paragraph S.1.3.2. Numerical Value of Quantity-Value Divisions to remove the term "scale interval" and replace it with the term "division."	[4] NEWMA #2 Safety
[1] SWMA #8 Max and Min Flow Rates	[2] SWMA #7 Indication of Delivery	[3] SWMA #10 Sealing See Technical Advisor's suggested modification to paragraph S.3.3. Provision for Sealing to include additional language to ensure that physical sealing of the dispenser does not allow operation in either the calibration or configuration mode physical seal	[4] SWMA #17 Type Evaluation
[1] SWMA #18 Transfer Standard Test Method	[2] SWMA #9 Discontinuous Adjustment Means; Definition	[3] SWMA #12 Markings See Technical Advisor's suggested modification to paragraph S.5 Markings to recognize the approval number from the NTEP Certificate of Conformance, cross reference corresponding marking requirements in proposed paragraph S.5.1. and existing General Code paragraph G-S.1.	[4] SWMA #19 Discharge Hose Length
[1] SWMA #20 Dispenser Labeling	[2] SWMA #16 Repeatability	[3] SWMA #13 Printed Receipt See Technical Advisor's suggested modification to paragraph S.6.1. Printed Receipt to clarify the identity of the seller and types of acceptable identification numbers listed on the receipt.	[4] SWMA #21 Effects of Constituent

Table A. USNWG Approach on Hydrogen Code Input			
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			[4] USNWG #1 Factors Affecting Density
Comments left open for USNWG discussion [LOD]:			
[LOD] SWMA # 11 Zero Set-Back Interlock; Diversion of Product			
[LOD] SWMA # 14 Totalizers; Each Dispenser			
[LOD] SWMA # 15 MMQ; Achievable Test at MMQ			

New Comments on the Draft Hydrogen Codes-Post January 13, 2009 USNWG Meeting

Prior to the meeting adjourning, several members of the USNWG indicated they would email additional input on the comments to the Technical Advisor. Two additional comments received from one USNWG member made the total count of 26 comments and they are outlined below. These latest comments are related to paragraph S.4.1. Diversion of Measured Product and the commenter questions if:

- (1) the design specification in subparagraph S.3.6.(c) for zero-set-back interlock for a retail vehicle fuel device will, like the requirement in subparagraph S.3.6.(d) (see SWMA #11), also impact the restriction on the diversion of product that is addressed in paragraph S.4.1., and
- (2) there is a need to modify the text in paragraph S.4.1. to include language to address dispensers using the pressure-volume-temperature (PVT) methodology to ensure there is no perpetration of fraud by the user or customer.

Background: On January 13 and 14, these two additional comments from Marc Buttler (Micro Motion/Emerson Process) were forwarded by email to the Technical Advisor and were included in this summary for the USNWG’s consideration.

The first comment relates to SWMA # 11- S.3.6. Zero-Set Back Interlock, a comment left open for future USNWG discussions. The SWMA indicated the zero-set back interlock requirement in subparagraph S.3.6.(d) for a hydrogen system with more than one hose supplied by a single measuring element can be interpreted to allow both hoses to flow simultaneously. The SWMA asked how does subparagraph S.3.6.(d) affect the requirement in paragraph S.4.1 Diversion of Measured Product which prohibits any means that allows diversion of measured product. Mr. Buttler requested that the USNWG also ensure that corresponding requirements in subparagraph S.3.6.(c) for a hydrogen system with more than one dispenser supplied by a single measuring element not conflict with paragraph S.4.1. Specifically are there any circumstances where a test port or some similar feature will cause the system to be out of compliance with requirements in paragraph S.4.1.

As per Mr. Buttler’s recommendation, the USNWG should also include subparagraph S.3.6.(c) in its discussion on diversion of product as they relate to subparagraph S.3.6.(d). The DSS Technical Advisor agreed with Mr. Buttler’s recommendation that both subparagraphs should be discussed by the USNWG at the same time.

Mr. Buttler’s second comment is a request for the USNWG to 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? Should there also be a corresponding User Requirement to address the PVT application? Is additional code language necessary to deal with any attempts by a buyer who adds a second or more vehicle storage tanks equipped with a manual valve

between the primary and the auxiliary tanks from causing the PVT reading to under register after the initial PVT measurement. How would this requirement be enforced?

Are PVT systems that communicate with vehicles using the fuel storage tank information? Is the USNWG clear on how PVT systems operate and who controls the metrological components is the system (seller or buyer)? And does the remaining draft code include sufficient language to address the PVT application?

Mr. Buttler's second comment on PVT systems was given a number designation on USNWG #2 to be addressed during upcoming rounds of discussion.

USNWG General Discussion and Response to Comments on the Draft Hydrogen Codes

During the January 13, 2010 meeting, the USNWG reached a consensus that all five comments listed in Group [1] did not warrant making any modifications to the draft hydrogen equipment code. This action is consistent with the original categorization of these comments as issues that would not require modification of the draft code. The rationale for the USNWG's position is outlined in the discussion column below in Table B. The USNWG also reached a consensus to update the table of hydrogen fuel constituents, Table 1, to include the latest work by technical committees. The rationale for the update of Table 1 is also outlined in Table B and discussed further under the section that follows Table B titled *USNWG Input on the Fuel Specification Comments*.

Tests Performed at the Minimum and Maximum Flow Rates

The USNWG discussed at length the ability of officials and laboratories to reproduce the minimum and maximum flow rates proposed in the code language that corresponds to Group [1] comment SWMA # 8 - S.3.1. Maximum and Minimum Flow-Rates.

The NIST HB 44 measuring device codes include design requirements that specify the ratio of the maximum and minimum flow rate that can be specified by the manufacturer. The device's maximum and minimum flow rate shall be suitable for the commercial service where the device is used to deliver a quantity of product. Draft HB 44 Hydrogen Gas-Measuring Devices Code paragraph S.3.1. Maximum and Minimum Flow-Rates specifies a ratio of 10:1 or greater for hydrogen dispenser flow rates.

Tests are performed to determine the performance characteristics at the minimum and maximum flow rates. Tests should be performed over flow ranges at which the dispenser is used. However, type evaluation laboratory and field officials have encountered other types of compressed gaseous measuring devices that have no means in the test mode of determining the equipment's real time high or low flow rate. Throttling the system down to achieve the minimum flow rate may work with other measuring system technology, however, it is not recommended for hydrogen dispensers since some system's safety features may shut down the device. Officials will also need to achieve a constant flow rate during the test. The USNWG agreed the examination procedure outline (EPO) will need to prescribe the test conditions, e.g., the test that simulates a high pressure delivery to top-off the vehicle's storage tank or if a specific delivery might be simulated.

Verification of the dispenser's performance using the gravimetric test method will require a reference scale with high resolution since a test at the 10:1 ratio will result in a relatively small test draft size. Test trials will confirm the test method least likely to introduce large uncertainty into the process.

The device operator is prohibited from modifying the device to operate outside of the flow range specified by the manufacturer. For hydrogen dispensers Draft Hydrogen Gas-Measuring Devices Code paragraph UR.2.3. Low-Flow Cut-Off Value specifies that the dispenser operator shall not set the low-flow cut-off value lower than the minimum flow rate specified by the manufacturer. The USNWG noted that NIST Handbook 44 does not define the term "low-flow cut-off."

**Table B. USNWG Approach on Hydrogen Code Comments in Group [1]
Resulting in No Modification to the Draft Code**

Draft Code	Comment	Discussion	USNWG Approach
<p>[1] SWMA # 2 - S.1.3.1. Units of Measurement. - Deliveries shall be indicated and recorded in kilograms and decimal subdivisions thereof.</p>	<p>Concerns that specifying units in only kilograms will limit technology. Current NIST HB 44 requirements list the SI value which is then followed by the customary inch-pound value.</p>	<p>The U.S. leads the world in numbers of gaseous hydrogen systems in use to refuel vehicles. In 2007, the USNWG announced its intent to address retail motor-fuel dispensing applications first since this equipment is in urgent need of a comprehensive and uniform set of design, performance, test, and use requirement to address legal metrology aspects of the equipment and transaction. The USNWG was encouraged by industry to specify the kilogram unit of measurement for the quantity of hydrogen delivered by dispensers. The kilogram is the displayed quantity unit for systems using mass flow meter and pressure-volume-temperature methodology. The USNWG does not intend to restrict technology and is willing to revisit these requirements in the code. This philosophy is consistent with the Scope of the first Working Draft of OIML R 139. This corresponding international standard specifies that the document is "not intended to prevent the development of new technologies. According to the state of art, ... is intended for measuring systems providing mass indications."</p>	<p>No modifications to the draft code are recommended at this time per the discussion in the adjacent column.</p>

**Table B. USNWG Approach on Hydrogen Code Comments in Group [1]
Resulting in No Modification to the Draft Code**

Draft Code	Comment	Discussion	USNWG Approach
		<p>Hydrogen's energy content by weight is three times that of gasoline. The energy content in a kilogram of hydrogen is roughly equivalent to that in a gallon of gasoline so there is no need to convert to other nonstandardized units or other customary, where calculations and inconsistencies in rounding result multiple differing numerical values.</p> <p>The USNWG is aware of wholesale applications that use other units of measurement and has agreed to review industry wide practices and examine how weights and measures requirements apply to these applications. To ensure that measurements are accurate and transactions transparent to all parties, the USNWG has already begun its review of other applications (such as those to the non-end user or that use other measurement technology) to determine if delivery practices and the use of units other than the kilogram are appropriate.</p>	
<p>[1] SWMA #4 - 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:</p>	<p>Paragraph recognizes two different divisions of 0.001 kg and 0.01 kg. What is permitted for mathematical agreement?</p>	<p>Technical Advisor will get further clarification on this comment.</p>	<p>This comment is no longer open for USNWG discussion since the submitter has indicated this issue is no longer an area of concern.</p>

**Table B. USNWG Approach on Hydrogen Code Comments in Group [1]
Resulting in No Modification to the Draft Code**

Draft Code	Comment	Discussion	USNWG Approach
<p>(a) 0.001 kg on devices with a maximum rated flow rate of 30 kg/min or less</p> <p>(b) 0.01 kg on devices with a maximum rated flow of more that 30 kg/min</p>			
<p>[1] SWMA # 8 - S.3.1. Maximum and Minimum Flow-Rates. - The ratio of the maximum to minimum flow-rates specified by the manufacturer for devices measuring gases shall be 10:1 or greater.</p>	<p>A 10:1 ratio is acceptable, but not certain systems need to meet this requirement</p>	<p>The text is consistent with corresponding paragraph S.3.1.(b) Maximum and Minimum Flow-Rates; Other Than Liquefied Gases in the Mass Flow Meters Code.</p> <p>Reviews of CNG dispensers indicate ratios of 20:1 and 100:1. OEMs indicated similar ratios for hydrogen dispensers during previous USNWG discussions.</p>	<p>No modifications to the draft code are recommended at this time per the discussion listed below. However, the USNWG agreed to revisit this paragraph if the requirement should be deemed not appropriate for the test or a particular type of measurement technology (i.e., dispensers equipped with other than mass flow meters).</p>
<p>[1] SWMA # 18 - T.4.2 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.</p>	<p>Explain how the official should apply two times the standard deviation of the applicable transfer standard</p>	<p>Part of the process for developing an Examination Procedure Outline (EPO) is to include supplementary procedures, equations, etc. Appendices such as those found in the draft hydrogen EPO 29 "Reference Scale Selection Criteria and Accuracy Verification" guide industry, field officials, and laboratories through the test process. The request for an explanation of how to apply tolerances is so noted and will be addressed in the Transfer Standard EPO when it is developed.</p>	<p>No modifications to the draft code are recommended at this time per the discussion in the adjacent column.</p>

**Table B. USNWG Approach on Hydrogen Code Comments in Group [1]
Resulting in No Modification to the Draft Code**

Draft Code	Comment	Discussion	USNWG Approach
<p>[1] SWMA #20 - 2.XX.3. Retail Dispenser Labeling.</p> <p>2.XX.3.1. A computing dispenser must display the unit price in whole cents on the basis of price per kilogram.</p>	<p>The USNWG was cautioned about requiring the unit price to be based on whole cents rather than fractional cents. It was recommended that the group examine the federal fuel tax structure.</p>	<p>The USNWG is aware of tax incentives and credits for various hydrogen fuel applications. However, the group has not been apprised of the federal excise tax or any other tax structure for hydrogen motor fuel.</p> <p>► The USNWG requests input from parties participating in this process.</p> <p>Note: The results of research on fractional motor-fuel pricing indicate the practice began in the early 1900s. It appears that although the federal motor-fuel tax structure may have encouraged the practice it did not mandate the practice of a fractional price structure. Customers will pay and prepay to whole cents. Systems must be able to compute to any price that fuel is offered for sale.</p>	<p>No modifications to the draft code are recommended at this time per the discussion in the adjacent column.</p>
<p>[4] SWMA #21- Effects of Constituents That Exceed the Allowable Levels for Hydrogen Fuel Quality</p>	<p>Request for documents on the effects of constituents that exceed levels in the specification table</p>	<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</p>	<p>The USNWG expanded Table 1 Hydrogen Fuel Quality Specification to include space: (1) for the publication dates of test procedures, (2) to designate the technical committee responsible for developing the procedure, and will consider possibly providing a temporary column for information on the effects when constituents exceed the maximum permissible limits outlined in the</p>

**Table B. USNWG Approach on Hydrogen Code Comments in Group [1]
Resulting in No Modification to the Draft Code**

Draft Code	Comment	Discussion	USNWG Approach
		the limits set in the current fuel quality specification?	table. (see <i>USNWG Input on the Fuel Specification Comments</i> and Table 1 listed below)

The USNWG also briefly discussed comment SWMA #5 that proposes modifications to draft code paragraph S.2.5. Display of Unit Price and Product Identity to include a requirement for a continuous display of transaction information. Comment SWMA #5 is a Group [2] comment slated for later rounds of discussion. However, the USNWG began to address this comment because corresponding NIST HB 44 Section 3.30 Liquid Measuring Devices Code requirements for the display of transaction information on retail dispensers used in gasoline and diesel applications were recently modified and are still under review by the NCWM.

USNWG Input on the Fuel Specification Comments

The USNWG acknowledged that several States are searching for more specific information about what occurs when hydrogen fuel quality exceeds allowable constituent levels. Consequently, the USNWG moved to respond to this information request and to address related Group [4] comment SWMA #21- Effects of Constituents That Exceed the Allowable Levels for Hydrogen Fuel Quality. The USNWG agreed to modify proposed Table 1 Hydrogen Fuel Quality Specification, a new fuel quality specification for NIST Handbook 130, to include more up-to-date information on test procedures and possibly include a list of the effects of constituents on vehicle systems.

Jackie Button (CaFCP) and the Lisa Warfield, NIST Technical Advisor to the Fuel Specifications Subcommittee, updated Table 1 to include a new 7th column, which was submitted to the January 2010 NCWM for its consideration. The modified version of Table 1 shown below provides information on the technical committee work to develop emerging standards for gaseous hydrogen fuel quality:

Table 1. Hydrogen Fuel Quality Specification* (version 19JAN2010)

Property	Value	Unit	Limit	Test Method(s)	Responsible Standards Committee and Status of test method	
1	Ammonia	0.1	ppm v/v	Maximum	to be specified	WK 10196 under ASTM D03.14
2	Carbon Dioxide	2.0	ppm v/v	Maximum	to be specified	Wk 10196 and WK 4548 under ASTM D03.14
3	Carbon Monoxide	0.2	ppm v/v	Maximum	to be specified	WK 10196 under ASTM D03.14
4	Formaldehyde	0.01	ppm v/v	Maximum	to be specified	WK 10196 under ASTM D03.14
5	Formic Acid	0.2	ppm v/v	Maximum	ASTM D7550-09	WK 10196 under ASTM D03.14
6	Helium	300.0	ppm v/v	Maximum	to be specified	ASTM D03.14
7	Hydrogen Fuel Index	99.97	% (a)	Minimum	to be specified	
8	Nitrogen and Argon	100.0	ppm v/v	Maximum	to be specified	WK 4548 under ASTM D03.14
9	Oxygen	5.0	ppm v/v	Maximum	to be specified	WK 4548 under ASTM D03.14
10	Particulate Concentration	1.0	mg/kg	Maximum	to be specified	WK 9688 and WK 21611 under ASTM D03.14
11	Total Allowable Non-Hydrogen, Non-Helium, Non-particulate constituents	100.0	ppm v/v	Maximum	to be specified	
12	Total Non-Hydrogen Gases	300.0	ppm v/v (b)	Maximum	to be specified	
13	Total Halogenated Compounds	0.05	ppm v/v	Maximum	to be specified	WK 23815 under ASTM D03.14
14	Total Hydrocarbons	2.0	ppm v/v (c)	Maximum	to be specified	WK 22378 under ASTM D03.14
15	Total Sulfur Compounds	0.004	ppm v/v	Maximum	to be specified	WK 24073 under ASTM D03.14
16	Water	5.0	ppm v/v	Maximum	to be specified	WK 10196 and WK 4548 under ASTM D03.14

Footnotes to Table 1 –

- a. Hydrogen fuel index is the value obtained with the value of total gases (%) subtracted from 100 %.
- b. Total Gases = Sum of all impurities listed on the table except particulates.
- c. Total Hydrocarbons may exceed 2 ppm v/v only due to the presence of methane, provided that the total gases do not exceed 300 ppm v/v.

* The FTC's Fuel Rating Rule (16 CFR Part 309) see the requirements in "Labeling of Alternative Fuels" at <http://www.ftc.gov/bcp/edu/pubs/business/autos/bus29.shtm> requires dispensers to bear an declaration of minimum percent of hydrogen determined according to test methods described in "Standard Test Method for Analysis of Natural Gas by Gas Chromatography (ASTM D1946)

The USNWG agreed to continue its work by email to address the remaining comments since its discussions were limited due to time constraints. The USNWG will consider an entire group ([2], [3], [4], and [LOD]) of comments during each round of discussions by email and agreed that the more complex issues might be managed best as items on upcoming meeting agendas.

(5) 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 the USNWG identified are:

Task 1

Technical Advisor Juana Williams will poll the USNWG on possible dates for upcoming tele/web conference meetings (see Item (6)) to allow more time for the USNWG to consider the remaining comments on the hydrogen draft codes.

Task 2

Technical Advisor Juana Williams will provide an abbreviated summary of the January 13, 2010 meeting to the USNWG by January 15, 2010 close of business. An abbreviated summary was emailed to the USNWG on January 15.

Task 3

Technical Advisor Juana Williams will provide the USNWG with a report by February 3, 2010 on the status of the proposed device, method of sale, and fuel quality hydrogen codes based on the outcome of the January 24-27, 2010 - 95th Interim Meeting of the National Conference on Weights and Measures (NCWM) in Nashville, TN. The NCWM S&T Committee will look to the USNWG if it receives input that further modifications to the draft code are needed. An update on the January 2010 NCWM decisions on the status of the draft hydrogen codes was emailed to the USNWG on February 1 indicating the following:

- HB44 H2 Equipment Code-Voting as a Tentative Code
- HB130 H2 Method of Sale Requirements-Voting
- HB130 H2 Fuel Quality Code-Informational

Task 4

In response to SWMA #21 Effects of Constituents That Exceed the Allowable Levels for Hydrogen Fuel Quality, Technical Advisor Lisa Warfield will expand Table 1 Hydrogen Fuel Quality Specification to include space: (1) for the publication dates of test procedures, (2) to designate the technical committee responsible for developing the procedure, and (3) for information on the effects when constituents exceed the maximum permissible limits outlined in the table. The USNWG membership familiar with the status of this work by these technical committees is asked to continue to provide the latest information on technical committee work and the effects of each constituent on vehicle systems. A revised Table 1, including information on the fuel quality standards organization working on a test procedure and the corresponding document number for each constituent, was submitted to the January 2010 NCWM.

Task 5

Several members of the USNWG indicated they will provide the Technical Advisors with additional responses to comments received on the draft hydrogen codes. These comments were incorporated into the final meeting summary under Agenda Item (4)(a) under the heading *New Comments on the Draft Hydrogen Codes-Post January 13, 2009 USNWG Meeting* for review by the entire USNWG.

(6) Next Meeting

The USNWG agreed that possibly two to three additional tele/web conference meetings may be necessary in the first half of 2010 to fully address comments on the draft hydrogen codes (see Agenda Item (4)(a)). These meetings may be necessary should the discussions on any particular comment become too complex to manage through email. Technical Advisor Juana Williams polled the USNWG on the following meeting dates to determine the most opportune time for the USNWG to meet. The membership is asked to hold the **3:00 p.m. to 4:30 p.m. (ET)** time slot open on these dates for upcoming tele/web conference meetings:

Meeting	Tentative Dates for Tele/Web Conferences	Check () Preferred Dates
Meeting 1	Wednesday, February 17, 2010	No Meeting
	Tuesday, March 2, 2010	No Meeting
Meeting 2	Wednesday, March 17, 2010	No Meeting
	Wednesday, March 24, 2010	No Meeting
Meeting 3	Thursday, April 15, 2010	Tentative
	Wednesday, April 21, 2010	Tentative

It is anticipated that there may be a need to dedicate an entire meeting to one specific device related project/subject identified by the USNWG. Future meeting locations will be based on logistics and technical tasks that the USNWG must accomplish. The USNWG will continue to make every effort to post meeting information and to avoid scheduling conflicts with upcoming events and meetings in the weights and measures and hydrogen communities.

The USNWG was notified by the Technical Advisor Juana Williams that due to workloads and weather delays no meetings were schedule for February or March 2010. The next tele/web conference meeting of the USNWG was held April 27, 2010.

NOTE: 4:50 P.M. (ET) Meeting Adjourned

Appendix G

Attendee List-January 13, 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
Julie Cairns	CSA Standards	Y	Y	Y
Ron Hayes	Missouri Dept. of Agric.-Weights and Measures Div.	Y	Y	Y
Norm Ingram	CA – Food and Ag. Div. of Measurement Standards	Y	Y	Y
Kristin Macey Chair DSS	CA – Food and Agriculture, County/State Liaison Office	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	Georgia Ag. Dept./CPW Energy Consulting	Y	Y	Y
Juana Williams	NIST – TS WMD	Y	Y	Y
Guests				
Richard Harshman	NIST – TS WMD			Y
John Mough	CA – Food and Ag. Div. of Measurement Standards			Y
Maurice Van Putten	Van Putten-Blue Energy Observatories, Inc.			Y