

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

February 24, 2009

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

MEETING SUMMARY

This joint USNWG Subcommittee 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 America, Inc.

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-E to the meeting summary are available on request.

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Appendix	Related Agenda Item(s)	Title
A	(2)(b)	Summary of the January 2009 USNWG Meeting
B	(2)(c)	USNWG Guidelines
C	(3)(c) and (d)	Draft 3.4 of NIST Handbook 44 Gas Measuring Devices Code
D	--	Draft 2.3 of NIST Handbook 130 Uniform Laws and Regulations, Engine Fuel Quality
E	(3)(b)	Coriolis Hydrogen Fast Fill Test (Micro Motion and Powertech)
F	--	Attendee List

**Device Standards Subcommittee (DSS)
and
Fuel Specifications Subcommittee (FSS)
February 24, 2009 1:00 p.m. – 4:00 p.m. (EST)
Joint USNWG Subcommittees Teleconference/Webconference Meeting**

(1) Welcome Current/New Members and Roll Call

(2) Administrative Business

The USNWG discussed and agreed on procedures for managing and documenting its technical work. The USNWG wishes to express its thanks to Julie Cairns, CSA America, Inc., for hosting and organizing the February 24, 2009 teleconference and webconference meeting, and providing technical assistance with the meeting report.

During the February 24 meeting, the following administrative items were addressed:

(a) Results of the Ballot on the Summary of the December 2008 USNWG Meeting

The December 2008 meeting summary was first distributed by email on the day of the January 30, 2009 USNWG teleconference meeting. During the January 2009 meeting the USNWG agreed the Technical Advisor should redistribute the summary and ballot the work group by email for their approval. The USNWG was asked to complete their review and return their vote on the December meeting summary by February 23, 2009.

The Technical Advisor reported only a limited response to the ballot with one recommendation for a minor editorial change to DSS Agenda Item (3)(c). Changes were approved for the table titled " OIML R 139 Compressed Gaseous Fuel Measuring Systems for Vehicles (2007) - Corresponding Minimum Measured Quantity Definitions and Requirements for OIML R 139" in the row that corresponds to "8. Metrological Control; Errors on Indications of Mass" to modify the text "...When a text..." to read "...When a test..."

(b) Approve the Summary of the January 2009 USNWG Meeting (See Appendix A)

A draft summary of the January 30, 2009 USNWG teleconference/webconference meeting was emailed on February 17th to the group for its review. The USNWG voted to approve the summary of the January 2009 meeting with no changes.

(c) USNWG Guidelines (See Appendix B)

During the January 2009 meeting, the Technical Advisor reported that the vote was sparse but unanimously in favor of the guidelines. The USNWG requested that the Technical Advisor notify the group of the voting results by email within a week and post the guidelines on the USNWG web site at <http://www.nist.owm.gov>.

The Technical Advisor inadvertently missed questions regarding whether or not a USNWG member could simultaneously represent multiple types of stakeholders and if there would be any action as a result of a member's repeated nonparticipation in meetings/projects.

Type of Membership

A USNWG member could fall into multiple categories depending on the type of transaction (e.g., a member might distribute or sell hydrogen as fuel supplier and buy hydrogen as a consumer from another supplier). This entity might also sell hydrogen through a dispenser and operate in a jurisdiction where

they are permitted to service dispensers (on their site or units operating at stations owned by other businesses). In this case, this entity has many functions, but would be allowed only a single vote in the USNWG even though they are a supplier, consumer, and service agency. The USNWG will make every effort to maintain a balanced representation from all groups who are stakeholders in the hydrogen infrastructure. The USNWG considered a recommendation to add a footnote to the Membership section of the guidelines to read:

¹To the extent possible membership shall be drawn from these groups and other interested parties. Individuals may represent more than one category (except during the voting process).

Stakeholder Representation

In order to ensure adequate representation from all sectors affected by legal metrology requirements, it may be necessary for the USNWG to rethink the way it conducts business. The USNWG will need to periodically assess trends in the hydrogen economy to recruit and retain members and to ensure their active participation from sectors impacted by its work. Consequently, the USNWG considered a separate recommendation to add a second footnote to the Membership section of the guidelines to read:

²After an extended period of nonparticipation (i.e., three consecutive meetings) the Chair may contact a member to assess whether or not it is appropriate to change that member's status from participant to observer.

During the February 24, 2009 meeting, the USNWG agreed to modify Draft 3.0 of the USNWG Guidelines to include changes to: (1) define a participating member, (2) define a member that has "observer" status, (3) permit an entity to designate an alternate, (4) explain that the rationale for not permitting a proxy vote is to ensure all members entitled to a vote have full knowledge of all technical discussion on an issue when votes are cast, (5) include the modified footnotes 1 and 2 above in the body of the guidelines, and (6) specify that a member who has not participated in more than three *consecutive* meetings or projects will be contacted by the Subcommittee Chair to determine their status as either a participating USNWG member or observing the work. Since these changes are more than editorial the guidelines were distributed and the USNWG balloted a final time on Draft 4.0 of the Guidelines (Appendix D). All guidelines were reviewed and votes returned to the Technical Advisor by March 13, 2009. The Guidelines (Draft 4.0) are posed on the NIST USNWG web site.

(d) Vice Chair Vacancies

The USNWG Guidelines recognize the Vice Chair's position. However these positions are currently vacant. The Guidelines state "the term for the Vice Chair shall be two years. A Vice Chair may be reappointed with the approval of a majority of the USNWG membership. In the case of a vacancy the membership shall act to appoint a new Vice Chair within 30 days of the vacancy. The USNWG should act to ensure Chair and Vice Chair seats are not simultaneously vacant."

There may be instances where the Vice Chair must assume the Chair's responsibilities. The USNWG did not entertain any discussion or nominees for filling the Vice Chair vacancies on the DSS and FSS Subcommittees at this time.

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

The USNWG began its February 24th discussions on carryover items for test procedures, labeling of marking information, and the allowable minimum measured quantity. The USNWG reviewed Draft 3.4 of the NIST Handbook 44 Hydrogen Gas Measuring Devices Code (See Appendix C), which was the result of work by the USNWG at its January 2009 meeting.

(a) Test Procedures

Diane Lee (NIST WMD) provided the USNWG with an update on the work that she and John Wright (NIST PMD) are conducting to assess the uncertainties associated with each test method. NIST Handbook 44 Appendix A Fundamental Considerations Section 3.2. Tolerances for Standards specifies use of standards with an accuracy one-third (i.e., 0.5 %) that of the equipment under test. The determination of acceptable test methods is essential to the ability to verify commercial hydrogen measurements.

Gravimetric, Volumetric, and Master Meter Test Methods

Uncertainty analyses by Monte Carlo simulations were performed on variables attributed to mass measurement errors. For the analysis, values were assigned to the variables of temperature, relative humidity, pressure, and air density and then the estimated uncertainties associated with each variable were inserted into the equation. The analysis looked at the uncertainties and standard deviation of the results. The simulations examined variables that are major contributors to uncertainties in each test method. However, variables such as the measurement process and reference standard (e.g., the reference scale) that may also contribute to uncertainty were not part of the analysis. The analysis for the gravimetric method is nearing completion and will result in guidelines on the specifications for test equipment such as the pressure gauge (% accuracy, etc.).

Simulations of the volumetric method will include analysis of pressure, volume, and temperature as well as the gas constant. Spreadsheets for the gravimetric and volumetric test methods will be prepared for possible distribution to the USNWG in late spring 2009.

Currently, there is no equation for the master meter test method therefore the uncertainty analysis for this method will be determined by the root sum square method. One USNWG member noted that work on proving of master meters may be under development by API Committee 4.8 Operation of Proving Systems which is scheduled to meet March 2009. The USNWG was reminded that the uncertainties for master meters will vary based on meter technology (e.g., coriolis, turbine, sonic nozzle, etc.). Additionally, the chain of traceability must be established and documented for a master meter and should include the source(s) of uncertainty. It may be possible to quantify the reference standard's uncertainties, correct for these variables, and still comply with NIST Handbook 44 Fundamental Considerations when selecting a test standard. There is no new progress to report on the development of a 105 Series NIST Handbook "Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures-Master Meters" for use by officials and others in the verification of commercial weighing and measuring devices.

(b) Test Data

This was an opportunity to discuss existing and any new test data that demonstrates the performance of equipment in achieving the proposed 1.5 % Acceptance Tolerance (for type evaluation and new equipment) and 2 % Maintenance Tolerance (for equipment in actual use).

The USNWG discussed test data Marc Buttler (Micro Motion, Inc.) made available in December 2008. The data from tests performed by Powertech (See Appendix E) on coriolis mass flow meters was summarized and made available to the USNWG in a PowerPoint presentation. The performance data represented fast fill testing of two separate meters used to deliver gaseous hydrogen. The data demonstrates the performance of meter A with an average error of - 4.06% and meter B with an average error of - 0.99%, where meter B was within the proposed tolerances specified in the draft code. The gravimetric test method was used to gather the results.

The USNWG appreciates the opportunity provided by Micro Motion and Powertech to examine and discuss hydrogen measuring device performance data. The USNWG encourages others in the hydrogen

and weights and measures community to provide this critical data as work continues to move forward on the code and test procedures.

(c) Draft Code

Paragraphs (i) through (iv) represent areas in the draft code which require further consideration by the USNWG to either modify requirements for clarity and/or consistency or to include requirements to adequately address commercial applications. Due to time constraints the USNWG was only able to review the suggested code language in paragraphs (i) and (ii). The USNWG plans to develop strategies for fully developing the code language by the start of the fall 2009 weights and measures standards development cycle.

(i) Marking Information

During the development of the Draft NIST Handbook 44 Hydrogen Gas-Measuring Devices Code a requirement specifying the proper location of marking information required in paragraphs S.5. Markings (a) through (j) may have been inadvertently omitted. Similar retail applications in NIST Handbook 44 3.30 Liquid Measuring Devices and 3.37 Mass Flow Meters Codes include a requirement that specifies the location of marking information.

The Liquid Measuring Devices Code specifies:

S.4.4.2. Location of Marking Information; Retail Motor-Fuel Dispensers. – The marking information required in the General Code, paragraph G-S.1. Identification shall appear as follows:

- (a) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;*
- (b) either internally and/or externally provided the information is permanent and easily read; and*
- (c) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).*

Note: *The use of a dispenser key or tool to access internal marking information is permitted for retail liquid-measuring devices.*

[Nonretroactive as of January 1, 2003]

(Added 2002) (Amended 2004)

The Mass Flow Meters Code specifies:

S.5.1. Location of Marking Information; Retail Motor-Fuel Dispensers. – The marking information required in General Code, paragraph G-S.1. Identification shall appear as follows:

- (a) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;*
- (b) either internally and/or externally provided the information is permanent and easily read;
and*
- (c) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).*

Note: *The use of a dispenser key or tool to access internal marking information is permitted for retail liquid-measuring devices.*

[Nonretroactive as of January 1, 2003]

(Added 2006)

These design requirements are intended to ensure that required marking information is placed in an easily accessible location for inspection purposes. During the January 30, 2009 meeting, the USN WG was asked to consider whether or not a similar requirement should be included in the Draft Hydrogen Gas-Measuring Devices Code.

At the February 2009 meeting, the USN WG agreed that a similar requirement for the location of marking information should be included in the draft code. The USN WG acknowledged that hydrogen refueling is similar to other refueling applications. The marking information is necessary to identify a dispenser model as one that conforms to national criteria established for that type of equipment and is operating under conditions that the manufacturer intended for its use. The USN WG recognized that the labeling information does not have to be placed in a single location on the dispensing system, but can be placed in multiple places on the system so long as the location complies with the proposed distance, ease of accessibility, and permanence requirements. The USN WG noted that equipment manufacturers and installers should be familiar with these requirements so as not to place the marking information in a location where an official inspection might void or interfere with the operation of the equipment's safety features. Industry will be asked if access to this or other required information varies in their product line or might interfere with or defeat safety features on the refueling systems. These requirements are intended to apply to existing and new equipment; therefore, the enforcement date will not be delayed. The wording in the paragraph that allows the exception for accessing the information through a key or tool was modified to specify that the exemption applies to all types of retail hydrogen measuring devices (gaseous and possibly future liquid fuels). The USN WG agreed to include in the draft code new paragraph S.5.1. as follows:

S.5.1. Location of Marking Information; Retail Dispensers. – The marking information required in the General Code, paragraph G S.1. Identification shall appear as follows:

- (a) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;**
- (b) either internally and/or externally provided the information is permanent and easily read; and**

(c) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).

Note: The use of a dispenser key or tool to access internal marking information is permitted for retail hydrogen-measuring devices.

(ii) Minimum Measured Quantity (MMQ) Requirements

The USNWG agreed that Marc Buttler (Micro Motion, Inc.) and Juana Williams (NIST WMD) would rework the language in paragraph S.8 Minimum Measured Quantity and examine related paragraphs in the draft code to eliminate any conflicts between requirements. The USNWG agreed the two should explore a formula that establishes the value of the MMQ based on the relationship of the equipment's maximum flow rate to a specific factor. The USNWG recommended that the formula should be one that could be applied to all applications.

The USNWG reviewed an alternate proposal developed by Marc Buttler intended to address the value of the MMQ based on the minimum and maximum flow range of the device for fill rates during a normal fueling operation. These requirements for MMQ apply to the design and user/operator of the device. The alternate proposals read as follows:

S.8. Minimum Measured Quantity. – The minimum measured quantity shall satisfy the conditions of use of the measuring system as follows:

(a) Measuring systems having a maximum flow rate less than or equal to 5 kg/min shall have a minimum measured quantity not exceeding the quantity delivered in 1 minute at the specified minimum flow rate of the system.

(b) Measuring systems having a maximum flow rate greater than 5 kg/min shall have a minimum measured quantity not exceeding the quantity delivered in 1 minute at the specified minimum flow rate of the system or 1.0 kg, whichever is the lesser.

UR.1.3. Minimum Measured Quantity

(c) The minimum measured quantity shall satisfy the conditions of use of the measuring system as follows:

(1) Measuring systems having a maximum flow rate less than or equal to 5 kg/min shall have a minimum measured quantity not exceeding the quantity delivered in 1 minute at the specified minimum flow rate of the system.

(2) Measuring systems having a maximum flow rate greater than 5 kg/min shall have a minimum measured quantity not exceeding the quantity delivered in 1 minute at the specified minimum flow rate of the system OR 1.0 kg, whichever is the lesser.

Marc Buttler pointed out that because of the relative size of the MMQ to the resolution of the reference standard, a significant amount of product flow would be necessary to reduce the amount of error in the measurement process.

The USNWG briefly reviewed the history of U.S. MMQ requirements for mass flow meters. In 1991, the NCWM discussed the similarities in scales and metering devices and how concepts and guidelines for establishing appropriate tolerances, resolution of the indications for a particular transaction, and the accuracy of a technology might be used to determine the suitability of equipment. That same year the

NCWM considered and adopted a new mass flow meters code. The NCWM recognized that OIML requirements specified the relationship of the MMQ to other device parameters, defined the term, and specified that a device be marked with the MMQ. Only the "MMQ" marking requirement and the relationship of the quantity division to MMQ for liquid dispensers were placed in the newly adopted U.S. mass flow meters code. The NCWM differed from OIML because it (1) applied a tighter accuracy tolerance to deliveries at the MMQ, (2) did not specify how to establish a suitable MMQ for the measuring system, or (3) the relationship of MMQ to other operational characteristics and technical requirements for the device.

The NCWM viewed MMQ as comparable to the minimum load that can be weighed on a scale and therefore "one method for determining if a device is suitable for use in a given application." Although NIST Handbook 44 has always specified the minimum test draft for a measuring device, the NCWM acknowledged that there are some devices such as a retail motor-fuel dispenser that are used for deliveries smaller than the minimum test draft. Therefore the minimum test draft and MMQ are not, in concept, one and the same. The MMQ declared by the manufacturer would in theory be a mechanism to determine the suitability of a device, and it would not be appropriate to expect accurate deliveries below this amount.

The USNWG, like the NCWM, recognizes that hydrogen stations will not immediately be in operation on every street corner, which means drivers will top off their tanks at deliveries near the MMQ. The USNWG agreed deliveries at the MMQ and all other quantities within the operating range of the device should be accurate. Industry would like the code to specify a "hard number" for the dispenser manufacturers to target for the value of MMQ.

The USNWG anticipates the work necessary to rework the requirements for MMQ requires more time and the input of all stakeholders. This collaboration along with one or more teleconferences or in-person meetings are necessary to focus on this issue to arrive at requirements that are clear, consistent, and appropriate for the hydrogen application.

(iii) Wholesale/Bulk Delivery Requirements

At its December 2008 meeting, the USNWG discussed the importance that no aspect of the weights and measures component in the hydrogen infrastructure is overlooked so as not to hinder the U.S. transition to a hydrogen economy. At this time, the primary focus of the USNWG is the retail dispenser; however, all methodologies for commercial sales will need to be adequately addressed. These applications include pipeline metering and vehicle tank deliveries, considered wholesale applications, which must be addressed so that appropriate provisions are in place. Officials must have the tools and guidelines should the unit of measurement be questioned or a dispute arise over measurement accuracy because of improper connections to receiving vessels or other practices that result in a potential for product loss during a transaction. The USNWG will consider a strategy to ensure requirements for wholesale equipment are eventually addressed and recognized by stakeholders in April 2009.

(iv) Use of the Terms "Retail Device" and "Retail Dispenser"

The USNWG has modified several paragraphs to recognize that hydrogen may be delivered as a source of energy into other than motorized vehicles. The USNWG will plan in April 2009 for a review of paragraphs in the Draft NIST Handbook 44 Hydrogen Gas Measuring Devices Code to ensure that the terms are appropriate and do not conflict throughout the code or with similar applications in corresponding codes.

(d) Revisions to User Draft Code

New paragraph S.5.1 Location of Marking Information; Retail Dispensers was added to Draft 3.4 of the NIST Handbook 44 Hydrogen Gas-Measuring Devices Code by the USNWG during its February 2009

meeting. This modification to the draft code will be reflected in Draft 4.0. See Summary Agenda Item (3)(c)(i) for the wording of new paragraph S.5.1. and the rationale for the USNWG's action.

(4) Opportunity for Reports on Related Activities for Hydrogen Devices and Fuel Quality

(a) Update on Work at the California Department of Food and Agriculture Division of Measurement Standards

No Updates were heard at this meeting.

(b) Update on Work at Other Agencies/Organizations

The USNWG agreed that all future meetings will also include updates on related work in the following organizations: (1) ASTM, (2) CaFCP, (3) NHA, (4) OIML, and (5) SAE. The USNWG will also receive reports on the progress of proposals for hydrogen requirements in the four U.S. regional weights and measures associations and the National Conference on Weights and Measures, Inc.

(c) Update on 2010 Goals for the Development of U.S. Weights and Measures Requirements for Commercial Hydrogen Measuring Devices

The USNWG identified fall 2009 as the target date for submitting a final draft of the hydrogen device and fuel quality codes for national adoption. This means that the work needs to escalate to have the codes ready by mid August 2009 so that they can be distributed to all four fall 2009 meetings of the regional weights and measures associations and technical sector for measuring devices. These meetings signal the start of the weights and measures standards development process for 2010. The table below is a list of the meeting times and web site/contact information for the regional and national weights and measures meetings/committees that could play a role in the development of commercial hydrogen measurement standards. The hydrogen and weights and measures communities are encouraged to participate in these forums to field questions and provide support for the proposed hydrogen codes. Agendas are published on-line for the device and laws and regulations/fuel quality committees and available prior to the meetings (see <http://www.nist.gov/owm> or <http://www.ncwm.net>). Attendance and participation in these meetings typically requires membership (registration/membership fees range from \$50-250).

The USNWG agreed to discuss by email during the week of March 2, 2009, the best strategy and a timetable for completing any remaining projects that are necessary for fast tracking the approval (adoption by July 2010) of the proposed hydrogen codes. A list of remaining projects will be developed for distribution as part of the April 2009 meeting agenda.

U.S. Regional/National Weights and Measures Associations and Technical Committees 2009-2010 Meeting Schedules	
<p>Central Weights and Measures Association http://www.ncwm.net/central</p> <p>Annual Meeting May 3-6, 2009 St Louis, Missouri – Millennium Hotel St. Louis Contact: Steve Gill (steve.gill@mda.mo.gov)</p> <p>Interim Meeting September 13-16, 2009 Rock Island, Illinois – Holiday Inn Contact: Jonelle Brent (jonelle.brent@illinois.gov)</p>	<p>Northeastern Weights and Measures Association http://www.newma.us</p> <p>Annual Meeting May 11-14, 2009 Portland, Maine – Wyndham Portland Airport Hotel Contact: James Cassidy (jcassidy@cambridgema.gov)</p> <p>Interim Meeting October 14-15, 2009 TBD Contact: James Cassidy (jcassidy@cambridgema.gov)</p>

<p>Western Weights and Measures Association http://www.westernwma.org</p> <p>Annual Meeting September 20-24, 2009 Las Cruces, New Mexico – Hotel Encanto de Las Cruces Contact: Joe Gomez (jgomez@nmda.nmsu.edu)</p>	<p>National Type Evaluation Technical Committee (NTETC) Measuring Sector http://www.ncwm.net</p> <p>Meeting October 4-7, 2009 Clearwater Beach, Florida – Hilton Clearwater Beach Contact: NCWM HQ (info@ncwm.net)</p>
<p>Southern Weights and Measures Association http://www.ncwm.net/southern</p> <p>Annual Meeting October 4-7, 2009 Clearwater Beach, Florida – Hilton Clearwater Bch. Contact: Steve Hadder (hadders@doacs.state.fl.us/standards)</p>	<p>National Conference on Weights and Measures, Inc. (NCWM)</p> <p>2010 Interim Meeting: January 24-27, 2010 Hilton Nashville Downtown - Nashville, TN Contact: NCWM HQ (info@ncwm.net)</p> <p>2010 Annual Meeting: July 11-15, 2010 The Crown Plaza, St. Paul Riverfront - St. Paul, MN Contact: NCWM HQ (info@ncwm.net)</p>

(5) Next Steps/Tasks

The USNWG agreed to discuss by email during the week of March 2, 2009 strategies for completing the remaining work necessary to fully develop hydrogen measurement requirements. The USNWG is targeting the draft hydrogen code requirements that apply to the minimum measured quantity and the need or the current lack of code paragraphs that apply to wholesale applications. The USNWG planned to identify any other areas that require work and will use a teleconference/webconference brainstorming session to decide on some possible approaches to resolve these issues and in preparation for its April 28-30, 2009 meeting sessions.

(6) Next Meeting(s)

(a) Upcoming April and August 2009 Meeting Status

The USNWG Subcommittees identified the dates listed in the table below for upcoming USNWG in-person meetings. It is anticipated that there may be a need to dedicate an entire meeting to finalize the requirements that address the appropriate minimum measured quantity (MMQ) for measuring devices and systems. Future meeting locations will be based on logistics and technical tasks that the USNWG must accomplish. The USNWG will 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.

Jackie Birdsall confirmed that the California Fuel Cell Partnership, West Sacramento, CA will host the April 28-30, 2009 meeting. The USNWG will be asked for updates on the sites of (1) NIST-Gaithersburg, MD, (2) Palm Springs, CA, (3) Grand Forks, North Dakota, and (4) Santa Monica, CA that were tentatively selected for the August 2009 meeting.

Schedule for the USNWG 2009 Meetings	
Date(s)	Location
Teleconference/Webconference-Brainstorming Session: MMQ, Other Topics, etc.	TBA
April 28-30, 2009 /Day1&2 8:30 a.m. – 5:00 p.m. EDT DSS Meeting; Day 3 8:30 a.m. – 12 noon EDT FSS Meeting	In-Person Meeting California Fuel Cell Partnership, West Sacramento, CA
August 18-20, 2009 /Day1&2 8:30 a.m. – 5:00 p.m. EDT DSS Meeting; Day 3 8:30 a.m. – 12 noon EDT FSS Meeting	In-Person Meeting TBD

Appendix F
Attendee List-February 24, 2009
Teleconference/Webconference Meeting
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 Joint Tele-/Webconference Yes (Y)
Mahesh Albuquerque	CO Dept Labor & Employment, Oil & Public Safety Div.	Y	Y	Y
Jackie Birdsall	California Fuel Cell Partnership		Y	Y
Robert Boyd	Hydrogen Solutions – Linde Group	Y	Y	Y
Tina Butcher	NIST – TS WMD	Y	Y	Y
Marc Buttler	Micro Motion/Emerson Process Management	Y	Y	Y
Julie Cairns	CSA America, Inc.	Y	Y	Y
Ronald Hayes	Missouri Dept. of Agric.-Weights and Measures Div.		Y	Y
Robert Ingram	CA – Food and Ag., Div. of Measurement Standards	Y	Y	Y
Michael Keilty	Endress & Hauser Flowtec AG	Y	Y	Y
Diane Lee	NIST – TS WMD	Y	Y	Y
Kristin Macey	CA – Food and Agriculture,	Y	Y	Y

	Division of Measurement Standards			
Kenneth Ramsburg	MD Dept of Agriculture, Weights and Measures Program	Y	Y	Y
Lisa Warfield	NIST – TS WMD	Y	Y	Y
Curt Williams	CP Williams Energy Consulting LLC-Consultant for Georgia Dept. of Agric., State Oil Laboratory	Y	Y	Y
Juana Williams	NIST – TS WMD	Y	Y	Y

Appendix F		
Guest List-January 30, 2009		
USNWG Hydrogen Device Standards and Fuel Specifications Subcommittees		
Name	Agency	Attended Joint Tele-/Webconference Yes (Y)
John Mough	CA – Food and Agriculture, Division of Measurement Standards	Y
Dan Reiswig	CA – Food and Agriculture, Division of Measurement Standards	Y
Van Thompson	CA – Food and	Y

	Agriculture, Division of Measurement Standards	
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