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

August 11-13, 2009

National Institute of Standards and Technology (NIST)
100 Bureau Drive, Building 222, Room B263
Gaithersburg, MD 20899

Joint Device Standards Subcommittee (DSS) and Fuel Specifications Subcommittee (FSS)

Meeting

MEETING SUMMARY

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) Subcommittees met to continue their work to promote the establishment of a comprehensive set of (1) requirements for equipment design, accuracy, installation, and use, (2) test procedures, and (3) quality standards for hydrogen fuel and method of sale requirements for hydrogen measurements for vehicle and other refueling applications.

AGENDA ITEMS

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Attachment List

Appendix	Related Agenda Item(s)	Title
A	(2)(a)	Draft Summary of the July 2009 USNWG Meeting
B	(4)(a)	Draft 4.0 of NIST Handbook 44 Hydrogen Gas-Measuring Devices Code
C	(5)(a)	Weights and Measures Standards Development Process
D	(3)(v)	ASTM D03.14 Work Items Update
E	(4)(b)	Powertech Presentation-Single Test Standard
F	(3)(iii)	Van Putten-Blue Energy Observatories, Inc. Comments (13AUG2009-08:42)
G	(4)(b)(i)	Hydrogen Test Method Assessment – Options, Pros, and Con (Rev.2)
H	(4)(b)(i)	Draft EPO No. 29 (Rev.2)
I	(4)(b)(ii)	Equations Used in NIST Uncertainty Analysis of Hydrogen Field Standards
J	(1)	Attendee List

AGENDA TOPICS

(1) Welcome Current/New Members and Roll Call
Members of the USNWG and visitors were welcomed, the meeting was called to order, a roll call conducted, and the meeting's purpose reviewed. The collaborative work by the meeting's sponsors was recognized. Participants provided their name, affiliation, and stated their specific area of interest in the work to develop hydrogen measurement standards.

(2) Administrative Business
The USNWG discussed procedures for managing and documenting its technical work. The following items were addressed:

(a) Approve the Summary of the July 2009 USNWG Meeting
A draft summary of the July 7, 2009 USNWG teleconference/webconference meeting (see Appendix A) was emailed on August 6, 2009 to the group for its review and approval. The USNWG agreed to approve the July 2009 summary with no changes. The July 2009 summary will be posted on the web site: http://ts.nist.gov/WeightsAndMeasures/Developing-Commercial-Hydrogen-Measurement-Standards.cfm.

(b) Agenda Updates for August 2009
No additional items were added to the August 11-13, 2009 meeting agenda.

(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 received updates on work by organizations such as ASTM, CaFCP, DMS, NHA, OIML, SAE and other related activities as follows:

(a) California Division of Measurement Standards (DMS)
Kristin Macey (DMS) updated the USNWG on the status of DMS funding for hydrogen related projects. The U.S. DOE has declined DMS' request for federal stimulus funding. DMS is still on track with California Assembly Bill 118 (AB 118) funding to receive $3.5M for its work on hydrogen projects and $500K for work in the area of biodiesel fuel. The AB 118 funding will be used toward the development and deployment of innovative technologies that will help California attain its climate change goals.

(b) Air Products and Chemical, Inc (APCI)
Joe Cohen (APCI) reported on recent performance tests of a gaseous hydrogen vehicle fuel dispensing system at the APCI Allentown, PA facility. The tests of the dispenser were observed by Diane Lee (NIST) and Juana Williams (NIST). Lee and Williams observed the dispensers operation to refuel a small shuttle bus and the gravimetric test of the system's performance to procedures in Draft EPO 29. Several USNWG members along with APCI indicated they are using a Mettler Toledo Model KS1 (150 kg x 0.0001 kg) weighing element as the reference standard because of its high resolution and rating for Class I, Division 1 hazardous locations and classification as an Accuracy Class II/III device. Tests were performed at 1/3, 2/3, and 3/3 the 1 kg tank capacity. Dan Reiswig (DMS) noted that when performing tests with compressed gases the draft sizes are predetermined, the scale should have sufficient resolution or error weights should be used to correct for reference scale errors at a minimum in the weighing range of the predetermined test draft loads. The resolution of the scale indication may not be sufficient for test drafts at 1/3 tank capacity (333 grams). Lee and Williams will provide APCI with a more detailed report on their observations.

(c) Van Putten-Blue Energy Observatories, Inc. (VPGEO)
Maurice H.P.M. van Putten, Ph.D. (VPGEO) requested input on five topics listed below (see Appendix F):

1. In response to the presentation by Mark McDougall of Powertech, what are the best uncertainties in net weight achievable from scale measurements in the laboratory?
   (This question is separate from resolution.) Is this on the order of 0.25%, 0.5% or 1%?

Response:
On deliveries at 500 g using a scale with a 10 g division Mr. McDougall was able to achieve a maximum uncertainty of 2.0 %.

2. Could NIST please discuss the achievable uncertainties on VPGEO's suggested "decant method" with a field transfer standard traceable to a Bell Prover.

Response:
NIST WMD forwarded the information to NIST PMD.

3. Can NIST look into a "kink" in the NIST Thermophysical database thermal conductivity of hydrogen as a function of pressure around 600 bar thermal conductivity?

Response:
NIST Boulder Chemical Science and Technology Laboratory, Thermophysical Properties Division is aware there is a need to update the information, but believes the values are reasonable. There are active projects to redo both the viscosity and thermal conductivity surfaces for hydrogen. Once these projects are complete, work will start on a new correlation.

4. What, if any, is the current understanding for the error anomalies in Coriolis meters operating at high pressures?

Response:
…….

5. How about introducing two classes of accuracy for H2-dispensers: Accuracy Class 5 (5%, experimental, introductory) and an Accuracy Class 3 (3%, as possibly a final acceptable value, pending technological developments)?

Response:
The Accuracy Class and their corresponding tolerances are the same across the measuring devices codes for particular applications. This ensures, in part, that one meter technology does not have a competitive advantage over another. USNWG members who work with NIST Handbook 44 (HB 44) on a day-to-day basis noted that hydrogen dispensers have the same appearance as gasoline dispensers which are held to 0.3 % and 0.5 % accuracy tolerances (for new/type approval and in-use equipment, respectively).

Several weights and measures officials indicated that if dispensers are allowed for use in commerce with differences in accuracy classes then dispensers should have labels indicating their accuracy to eliminate any confusion for consumers making value comparisons. Additionally, they agreed that 5.0 % will not be accepted and even a tolerance of 3.0 % may be interpreted as the technology is not ready.

It may be expedient to promote the code with large tolerances; however, given the advances seen in this technology, indications from some manufacturers that the proposed tolerances of 1.5 % and 2.0 % are

reasonable, and experiences encountered when tolerances were tightened in the past; revisiting the code to tighten the tolerances will create difficulties for officials who must enforce these more restrictive tolerances on old equipment at some future date. An Accuracy Class 3.0 is already permitted in HB 44 Section 3.33 Hydrocarbon Gas Vapor-Measuring Devices Code for gases at low pressure. However, the tolerances for meters used in this application are 1.5 % for overregistration and 3.0 % for underregistration. Without sufficient data it will be difficult to justify different tolerances based on differences in pressure. The USNWG agreed that based on current technology that tolerances of 2.0 % and 3.0 % may be reasonable.

The USNWG plans to do further research on meters that are compatible for hydrogen delivery, equipment performance, and test methods with countries such as Japan and Germany who have done extensive work to develop their hydrogen infrastructure. The USNWG is encouraged to continue gathering data to confirm reasonable tolerances for these systems. The USNWG discussed the effects of fire, metal fatigue, wall thickness, and high pressure as critical factors in the choices for meter materials that are currently available for the hydrogen application. The list of materials is constantly changing and there are adequate materials available.

(d) SAE/CSA

The SAE/CSA HGV 4.3 is researching bids for verifying fueling parameters (i.e., pressure and temperature) and possibly fuel quality. SAE 2719 is waiting on ASTM updates for total nonHelium constituents before any modifications to the fuel quality definition. The hydrogen fuel index limit remains at 99.97 % and will not be set at 99.99 %. Although the limit is important to fuel cell performance, there is little to no effect on mass measurements at a level of 99.97 %.

After hearing the report about the status of the fuel quality standard it should be noted that within the weights and measures community there is already a precedent for citing the most current version of a fuel standard, while technical committees work to finalize requirements. NIST Handbook 130 would include the table of constituents until there is final standard with a numerical designation that can be cited. Like all previous new equipment codes the hydrogen code, if given voting status by the January 2010 NCWM S&T Committee, could be adopted at the July 2010, 95th NCWM Annual Meeting, but only as a tentative code for trial and experimental status. This enforcement status is always for a reasonable time period after a newly adopted code is published and appears for the first time in NIST Handbook 44.

(e) ASTM D03

Jackie Button (CaFCP) updated the USNWG on the status of work under development in ASTM D03 5847 Standard Practice for Sampling of High Pressure Hydrogen and Related Fuel Cell Feed Gases. The work to describe sampling with an in-stream filter at the nozzle for determining; total hydrocarbons, sulfur (mercaptan), and gravimetrically subparticles passed ballot of the subcommittee (see Appendix D).

(f) NIST Weights and Measures Division (WMD)

In FY2010 NIST WMD will continue to receive funding through an interagency agreement (IAA) with the U.S. Department of Energy. As in FY2009 the funding will allow NIST to accelerate its efforts in promoting and encouraging the development of uniform and appropriate commercial hydrogen measurement standards.

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

(a) Draft Hydrogen Code

The USNWG worked to update, where necessary, draft code requirements and to ascertain the equipment code's readiness for an upgrade in its status from a Developing Item to become a voting item ready for

adoption in July 2010 as a tentative code. The weights and measures community begins its 2010 standards development process in September 2009. The USNWG discussed Draft 4.0 of the Hydrogen Gas-Measuring Devices Code (see Appendix B) rather than Draft 4.1. Currently Draft 4.0 is the basis for commercial gaseous hydrogen refueling equipment test procedures in Draft EPO 29. The USNWG delayed a review of Draft 4.1 which addresses both retail and wholesale applications to allow sufficient time to gather more information about the wholesale method of sale and because vehicle dispensing systems used in retail applications do not have uniform guidelines based on industry wide practices or other metrological requirements in place.

The resulting changes to Draft 4.0 are listed in the table below in 4.(a)(ii) and will be reflected in Draft 5.0. The USNWG discussions that lead to changes to Draft 4.0 are as follows:

Dynamic Mass Measurement

The USNWG discussed whether or not the intent of the code language is clear about which device technology the code is intended to address. Draft 4.0 Application Section paragraph A.1. specifies that the "code applies to devices that are designed to dynamically measure the mass of hydrogen gas used as a vehicle fuel." This wording describing the type of measurement as dynamic was borrowed from corresponding paragraph A.1. in the Application Section of NIST Handbook 44 Section 3.37 Mass Flow Meters Code.

The USNWG held an in-depth discussion about the meaning of the term dynamic metering. Dynamic metering occurs in various meter technologies (e.g., coriolis, positive displacement, turbine, etc.) where there is continuous measurement during the fill of the receiving vessel. Static metering will typically involve tanks and a limited number of readings based on the indicated volume on tank gauges, then possibly calculations that include factors such as product temperature to determine a more accurate quantity. Industry wide there appears to be different standards documents in use for each hydrogen application, e.g., API MPMS Chapter 21.1 Electronic Gas Measurement is in use for deliveries at the pipeline, but not for dispensers or bulk deliveries of hydrogen gas. One manufacturer indicated that many deliveries are dynamic because measurements do not involve the opening or closing of valves, but result from the simultaneous capture of multiple pieces of measurement information (e.g. pressure, temperature, etc.).

Since the USNWG will require more time to address wholesale applications, the group focused its work in this session on determining if all retail applications are adequately addressed by the draft code. In April 2009, the USNWG examined various aspects of the commercial equipment, the assessment of charges, and measurement methodology. The USNWG should always examine all methodologies from a technological standpoint based on the merits of its use in this application. There is one methodology currently in use for retail dispensers, where gaseous hydrogen deliveries are not made through a meter and the quantity of product delivered is calculated from the pressure-volume-temperature (PVT) differential between the dispenser and receiving vessel/tank. The temperature and pressure of the gas along with the fixed volume of the tank are used to calculate the quantity of gas in the delivery. There is no lag time between the continuous display of mass indication for the retail PVT systems.

Dispenser manufacturers indicated that the predominant methodology for hydrogen measurement in wholesale deliveries into tube trailers is also the PVT method. Wholesale deliveries are made in standard cubic feet (SCF), whereas retail dispensers indicate in mass (kg). In the PVT method, the volume is determined using the equation of state for hydrogen gas densities developed at NIST-Boulder (for more information go to http://www.nist.gov/jres click on Journal of Research, then click on Past Issues, and last select 2008, Volume 113, No. 6, November-December 2008)). One manufacturer noted in this instance the PVT method uses the Real Gas Law rather than the Ideal Gas Law since this is a high pressure application. The calculations are carried out with software.

The USNWG concluded that the draft code should be kept broad so as not to exclude any technology. All retail dispensers used in refueling applications to deliver gaseous hydrogen may be equipped with any methodology as long as the system complies with requirements (accurate, not fraudulent, etc.) in the draft code. The application section of the draft code was not intended to prohibit a specific technology and there is no need to limit any measurement technology in the specifications section at this time. The USNWG may at some point revisit the application section should research and/or stakeholders find particular applications are more suited to a different code or other findings warrant the narrowing of the scope of the code. Officials should hold any dispenser to the code requirements even in instances where no meter is present in the system. Consequently, the USNWG modified paragraph A.1 to specify the code applies to all retail devices used to measure hydrogen gas in vehicle fueling applications. Paragraph N.7. Density was also modified to remove any reference to "metered" hydrogen gas since PVT systems are also recognized and should use the appropriate values and corrections, where appropriate, in the calculation of the quantity of hydrogen gas delivered.

Wholesale Applications

The USNWG has acknowledged that both wholesale and retail applications are regulated by the weights and measures authority. The current draft code would be the only code available to apply to wholesale devices used in hydrogen gas deliveries. In light of the differences in measurement methodologies, units of measurement (e.g., standard cubic feet), method of sale in both partial and whole tank exchanges, etc. for commercial wholesale devices, the USNWG agreed to conduct additional research to ascertain the best approach for fully developing legal metrology requirements that apply to this application. The USNWG recognized there was a greater urgency for developing requirements for retail refueling applications and the tentative or permanent code can be amended later to include wholesale device requirements. This approach would avoid any delays in the development of a code for gaseous hydrogen dispensers. The USNWG was cautioned about the difficulties that could be encountered in the standards development process when it begins with less stringent code requirements and then these same requirements must be tightened at a later date.

In August 2009 the USNWG modified the preamble to the draft code to include the text "Requirements that apply to wholesale applications are under study and development by the U.S. National Work Group for the Development of Commercial Hydrogen Measurement Standards." The USNWG modified paragraph A.2. to include a new paragraph (b) which specifies the draft code is not intended to apply to the wholesale delivery of hydrogen gas. The USNWG agreed not to include a paragraph in the Application Section that would identify the specific methodologies not covered by the code and therefore deleted proposed new paragraph A.4. from the text.

Changes to Terminology

Multiple paragraphs were modified for clarity and consistency.

Change the term "meter" to "measuring device" or "measuring system," where appropriate, in the following paragraphs to clarify the requirements apply to the entire device or system:

> A.3.Application; Meet Requirements of 1.10 General Code, S.3.4. Automatic Density Correction, S.7. Totalizers for Retail Motor-Fuel Devices, N.3. Test Drafts, N.4.1. Master Meter (Transfer) Standard Test, N.6.1. General; Test Draft Normal Delivery, T.2. Tolerances, UR.2.3. Low-flow Cut-Off Value, UR.3.2. Ticket Printer; Customer Ticket, UR.3.4. Ticket in Printing Device, Vehicle-Mounted Metering Systems, and UR.3.8. Conversion Factors

Change the term "instrument" to "device" in the following paragraphs for consistency:

S.1.1. Indicating Elements, S.2.3. Nonresettable Indicator, and S.4.1. Diversion of Measured Product

Change the term "meter" to "device" in the following paragraphs to clarify the requirement applies to the entire device:

S.5.(e) Marking; Accuracy Class , T.1. Tolerances, General, T.4.1. Type Evaluation Examinations for Devices, and UR.3.2. Ticket Printer; Customer Ticket

Add the term "fuel" to the title of the following paragraph to describe the specific function of the dispenser which is to refuel vehicles:

S.1.2. Vehicle Dispensers

Change the term "retail motor" or "motor" to "vehicle," where appropriate, change the term "device" to "dispenser" and delete the term "application," where appropriate, in the following paragraph and Table since these dispensers are used to refuel both fuel cell and internal combustion engine vehicles and for clarity:

S.7. Totalizers for Retail Motor-Fuel Devices and Table T.2 Accuracy Classes for Hydrogen Gas Meter Applications and Table T.2. Accuracy Classes and Tolerances for Hydrogen Gas Meter Applications

Smallest Indicated Delivery
Added a new paragraph S.1.4. Value of Smallest Unit to specify limits on the size of the smallest indicated delivery, which could not be easily derived from other related paragraph in the draft code. This new paragraph is also consistent with values for the smallest indication specified in corresponding paragraph in HB 44 Section 3.37 Mass Flow Meters Code for compressed gas applications.

Density Correction
After a great deal of deliberation the USNWG agreed not to list specific factors that might have an influence on the measurement results. Given the dynamics of these dispensing systems, the effects of heating and high pressures and extreme changes in flow rates are possible, therefore the operator of the test equipment should attempt to reduce to the greatest extent possible all factors, not just the more common factors mentioned, that are likely to introduce errors into the test results. Consequently, the USNWG deleted the text "(e.g., the effects of temperature, pressure, or variations in composition due to feedstock, processing, storage, or the environment)" which provided specific example of factors found to affect the performance of some measuring systems from paragraph S.3.4. Automatic Density Correction.

Examples of Product Limitations
An example of the type of marking information that might be required if the system's ability to make measurements is influenced by properties of the product was added to paragraph S.5.(j) Marking; Product Limitations. The modification coincides with modifications made to paragraph S.3.4. Automatic Density Correction which no longer provides examples of factors that may affect measurements is some systems. This is also consistent with the philosophy that these systems are intended to be used to measure products with a fuel index of 99.97 % or higher hydrogen.

Multiple Hose/Single Measuring Element
Manufacturers indicated that a multiple hose/single measuring element system would be inadvertently omitted from the requirements for a zero-set-back interlock. Consequently, the USNWG added new subparagraph (d) to paragraph S.3.6. Zero-Set-Back Interlock, Retail Vehicle Fuel Devices to address

this design option for hydrogen dispensers. The term "source" was changed to "measuring element" for clarity.

Editorial Corrections
An earlier editorial mistake was corrected by deleting the word "not" from paragraph S.8.(b) Minimum Measured Quantity (MMQ); Not Exceeding 1.0 kg so that the lower limits on the range of the maximum flow rate are appropriate when establishing the MMQ.

Test Medium
Text was added to paragraph N.2. Test Medium to cite the reference document that lists the technical specification for the test medium. This information will be necessary to perform valid tests on hydrogen equipment.

Density Calculations-Temperature Limits
Modified the temperature limit from 220 K to 255 K in paragraph N.7 Density to stay within an area with tighter uncertainties. This change was recommended by the NIST Thermophysical Properties Division.

Refining the Tolerances
Text was added to paragraph T.2. Tolerances to acknowledge the ongoing work to gather performance data to refine the tolerances specified in the draft code.

Defining "Motor Fuel" Devices
All reference to proposed new hydrogen code section number 3.39 was removed from the current Appendix D definition of "motor-fuel device or motor-fuel dispenser or retail motor-fuel device" because this equipment will be used to refuel fuel cell and internal combustion engine vehicles of all types

(i) Change the Draft Code Title
The USNWG considered, but after some discussion opposed a NIST WMD recommendation to modify the draft code title to change any reference to "devices" to "systems." NIST WMD believed the modification would clarify that the intent of the code is to address all parts, components, elements of a device or system that are necessary for measurement and metrologically significant. Additionally the intent of the NIST WMD recommendation was to ensure the weights and measures and hydrogen communities understood the broad scope of the code to include methodologies such as pressure differential systems.

The USNWG agreed the current title Sec. 3.3X. Hydrogen Gas-Measuring Devices is adequate and should not be changed. The definition of commercial equipment includes devices and any accessory to the device that affects the accuracy of measurements so the current title is in keeping with that philosophy.

(ii) Code Sections Identified for Updates
Draft NIST Handbook 44 (HB 44) Section 3.39 Hydrogen Gas-Measuring Devices Code paragraphs modified by the USNWG during the August 2009 meeting and the rationale for their actions are discussed in detail in section (4)(a)(i) above. Edits to each code section paragraph and a brief rationale for its modification is shown in the table below.

Drafts of the HB 44 hydrogen code modifications were distributed by email to the USNWG on August 13, and September 8, 2009. Draft 3.0 of the corresponding hydrogen method of sale and fuel quality codes for NIST Handbook 130 were distributed to the USNWG on September 9, 2009. These most recent modifications to HB 44 are now reflected in Draft 5.0. Draft 3.0 of the HB 130 and Draft 5.0 of the HB 44 hydrogen codes were distributed to the four U.S. regional weights and measures association with a

recommendation that the draft codes be supported for a vote at the national level in January 2010. The voting process will take place in July 2010.

Change to Requirements: Text added to the Preamble	Requirement Title: Preamble	Reason for Change: Text added to alert the community the wholesale application will be addressed and the urgency to establish requirements for retail dispensing equipment
This tentative code has only a trial or experimental status and is not intended to be enforced. The requirements are designed for study prior to the development and adoption of a final code. Requirements that apply to wholesale applications are under study and development by the U.S. National Work Group for the Development of Commercial Hydrogen Measurement Standards. Officials wanting to conduct an official examination of a device or system are advised to see paragraph G-A.3. Special and Unclassified Equipment.		
Change to Requirements: Modified paragraph A.1.	Requirement Title: Application; Measurement	Reason for Change: Modification keeps the scope of the code broad so it does not exclude any technology and addresses all retail dispensers used in refueling applications
A.1. This code applies to devices that are used for ~~designed to dynamically measure~~ the measurement ~~mass~~ of hydrogen gas in the vapor state used as a vehicle fuel.		
Change to Requirements: Added new subparagraph (b) to paragraph A.2.	Requirement Title: Application; Code Does Not Apply	Reason for Change: Text added to alert the community and avoid any prohibitive requirements for wholesale applications and to acknowledge wholesale devices will be addressed
A.2. This code does not apply to: **(a) devices used solely for dispensing a product in connection with operations in which the amount dispensed does not affect customer charges.** **(b) the wholesale delivery of hydrogen gas**		
Change to Requirements: Modified paragraph A.3.	Requirement Title: Application; Meet Requirements of 1.10 General Code	Reason for Change: Change the term "meter" to "measuring device" to clarify the requirements applies to the entire device
A.3. In addition to the requirements of this code, hydrogen gas ~~meter~~measuring devices shall meet the requirements of Section 1.10 General Code.		

Change to Requirements: Deleted proposed paragraph A.4	Requirement Title: Application; Methodologies Not Covered	Reason for Change: No retail gaseous hydrogen dispensing applications are excluded from the code at this time

~~A.4. ADD USNWG PROPOSAL TO ADDRESS METHODOLOGIES NOT COVERED BY THIS CODE. LANGUAGE TO BE DEVELOPED BY THE USNWG~~

Change to Requirements: Modified paragraph S.1.1.	Requirement Title: Indicating Elements	Reason for Change: Changed the term "instrument" to "device" in for consistency

S.1.1. Indicating Elements. – A measuring assembly shall include an indicating element that continuously displays measurement results relative to quantity and total price. Indications shall be clear, definite, accurate, and easily read under normal conditions of operation of the ~~instrument~~device.

Change to Requirements: Modified the title of paragraph S.1.2.	Requirement Title: Vehicle Dispensers	Reason for Change: Add the term "fuel" to the title of the paragraph to describe the specific function of the dispenser which is to refuel vehicles

S.1.2. Vehicle Fuel Dispensers. – A hydrogen gas dispenser used to fuel vehicles shall be of the computing type and shall indicate the mass, the unit price, and the total price of each delivery.

Change to Requirements: Added new paragraph S.1.4.	Requirement Title: Value of Smallest Unit	Reason for Change: Added a new paragraph to specify limits on the size of the smallest indicated delivery and for consistency with corresponding requirements in the Mass Flow Meters Code

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

Change to Requirements: Modified term in paragraph S.2.3.	Requirement Title: Nonresettable Indicator	Reason for Change: Changed the term "instrument" to "device" in for consistency

S.2.3. Nonresettable Indicator. - A~~n instrument~~ device may also be equipped with a nonresettable indicator if the indicated values cannot be construed to be the indicated values of the resettable indicator for a delivered quantity.		
Change to Requirements: Modified a term and deleted examples from paragraph S.3.4.	Requirement Title: Automatic Density Correction	Reason for Change: Change the term "meter" to "measuring system," to clarify the requirements apply to the entire system
S.3.4. Automatic Density Correction. - An automatic means to determine and correct for changes in product density shall be incorporated in any hydrogen gas me~~ter~~asuring~~tering~~ system where measurements are affected by changes in the density ~~(e.g., the effects of temperature, pressure, or variations in composition due to feedstock, processing, storage, or the environment)~~ of the product being measured.		
Change to Requirements: Modified term in subparagraph S.3.6.(c) and added new subparagraph S.3.6.(d)	Requirement Title: Zero-Set-Back Interlock, Retail Vehicle Fuel Devices	Reason for Change: Modified the term "source" for clarify Zero-Set-Back Interlock requirements were inadvertently omitted for this equipment design
S.3.6. Zero-Set-Back Interlock, Retail Vehicle Fuel Devices. - A device shall be constructed so that: (a) **when the device is shut-off at the end of a delivery an automatic interlock prevents a subsequent delivery until the indicating elements, and recording elements if the device is equipped and activated to record, have been returned to their zero positions;** (b) **it shall not be possible to return the discharge nozzle to its start position unless the zero set-back interlock is engaged or becomes engaged ~~and~~** ~~(c)~~**(c) in a system with more than one dispenser supplied by a single ~~source~~measuring element, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.** **(d) In a system with more than one hose supplied by a single measuring element, effective automatic means must be provided to prevent product from being delivered until the indicating element(s) corresponding to each hose are in a correct zero position.**		
Change to Requirements: Modified a term in paragraph S.4.1.	Requirement Title: Diversion of Measured Product	Reason for Change: Changed the term "instrument" to "device" in for consistency

S.4.1. Diversion of Measured Product. - No means shall be provided by which any measured product can be diverted from the measuring ~~instrument~~ device.		
Change to Requirements: Modified term in subparagraph S.5.(e) and included an example in subparagraph S.5.(j)	Requirement Title: Marking; (e) Accuracy Class, (j) Product Limitations	Reason for Change: Changed the term "meter" to device to clarify the requirement applies to the entire device Added an example of a factor that must be marked when it affects the measurement even though the product is 99.97 % hydrogen
S.5. Markings. - A measuring system shall be conspicuously, legibly, and indelibly marked with the following information: (a) **pattern approval mark (i.e., type approval number);** (b) **name and address of the manufacturer or his trademark and, if required by the weights and measures authority, the manufacturer's identification mark in addition to the trademark;** (c) **model designation or product name selected by the manufacturer;** (d) **nonrepetitive serial number;** (e) **the accuracy class of the ~~meter~~ device as specified by the manufacturer consistent with Table T.2.;** (f) **maximum and minimum flow rates in kilograms per unit of time;** (g) **maximum working pressure;** (h) **applicable range of ambient temperature if other than -10 °C to +50 °C;** (i) **minimum measured quantity; and** (j) **product limitations (such as fuel quality), if applicable.**		
Change to Requirements: Modified terminology in paragraph S.7.	Requirement Title: Totalizers for Retail Motor-Fuel Devices	Reason for Change: Change the term "meter" to "measuring device" to clarify the requirements apply to the entire device Change the term "retail motor" or "motor" to "vehicle," where

		appropriate and the term "device" to "dispenser" to clarify these dispenser are for use to refuel fuel cell and ICE vehicles
S.7. Totalizers for Vehicle ~~Retail Motor~~ Fuel ~~Devices~~Dispensers . - ~~Retail~~ Vehicle ~~motor~~ fuel dispensers shall be equipped with a nonresettable totalizer for the quantity delivered through each separate measuriter~~i~~ng device.		
Change to Requirements: Corrected an editorial mistake in paragraph S.8.	Requirement Title: Minimum Measured Quantity	Reason for Change: Corrected editorial error that should not have included the "not". Change clarifies the lower limit on the maximum flow when establishing the MMQ
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 4 kg/min shall have a minimum measured quantity not exceeding 0.5 kg.** **(b) Measuring systems having a maximum flow rate ~~not~~ greater than 4 kg/min but not greater than 12 kg/min shall have a minimum measured quantity not exceeding 1.0 kg.**		
Change to Requirements: Modified paragraph N.4.	Requirement Title: Test Medium	Reason for Change: Paragraph updated to cite a reference document that lists the technical specification for the test medium. This information will be necessary to perform valid tests on hydrogen equipment.
N.2. Test Medium. - The device shall be tested with the product commercially measured except that, in a type evaluation examination, hydrogen gas as ~~defined by~~ specified in NIST Handbook 130 …..~~(NOT YET PUBLISHED)~~ ~~may~~shall be used.		
Change to Requirements: Delete a term from paragraph N.3.	Requirement Title: Test Drafts	Reason for Change: Delete the term "meter" to clarify the requirements applies to the entire system
N.3. Test Drafts. - The minimum test shall be one test draft at the declared minimum measured quantity and one test draft at approximately ten times the minimum measured quantity or 1 kg, whichever is greater. More tests may be performed over the range of normal quantities dispensed. (See		

T.3.)

The test draft shall be made at flows representative of that during normal delivery. The pressure drop between the dispenser and the proving system shall not be greater than that for normal deliveries. The control of the flow (e.g., pipework or valve(s) size, etc.) shall be such that the flow of the ~~meter or~~ measuring system is maintained within the range specified by the manufacturer.

NOTE: Corresponding SAE requirements are under development and this paragraph will be revisited.

Change to Requirements: Modified a term in paragraph N.4.1.	Requirement Title: Master Meter (Transfer) Standard Test	Reason for Change: Change the term "meter" to "measuring system," to clarify the requirements apply to the entire system

N.4.1. Master Meter (Transfer) Standard Test. - When comparing a ~~meter~~ measuring system with a calibrated transfer standard, the minimum test shall be one test draft at the declared minimum measured quantity and one test draft at approximately ten times the minimum measured quantity or 1 kg, whichever is greater. More tests may be performed over the range of normal quantities dispensed.

Change to Requirements: Delete a term in paragraph N.6.1.	Requirement Title: General	Reason for Change: Delete the term "meter" to clarify the requirements applies to the entire system

N.6.1. General. - The device or system shall be tested under normal operating conditions of the dispenser.

The test draft shall be made at flows representative of that during normal delivery. The pressure drop between the dispenser and the proving system shall not be greater than that for normal deliveries. The control of the flow (e.g., pipework or valve(s) size, etc.) shall be such that the flow of the ~~meter or~~ measuring system is maintained within the range specified by the manufacturer.

Change to Requirements: Modified a term and temperature limit in paragraph N.7.	Requirement Title: Density	Reason for Change: Removed any reference to "metered" hydrogen gas since PVT systems are also recognized and should use the appropriate values and corrections in the calculation of the quantity of hydrogen gas

		delivered. Modified the temperature limits from 220 K to 255 K to stay within an area with tighter uncertainties as advised by NIST Boulder

N.7. Density. - Temperature and pressure of ~~metered~~ hydrogen gas shall be measured during the test for the determination of density or volume correction factors when applicable. For the thermophysical properties of hydrogen the following publications shall apply: for density calculations at temperatures above ~~22~~55 K and pressures up to 120 MPa, a simple relationship may be used that is given in the publication of Lemmon et al., J. Res. NIST, 2008. Calculations for a wider range of conditions and additional thermophysical properties of hydrogen are available free of charge online at the "NIST Chemistry WebBook" http://webbook.nist.gov/chemistry, or available for purchase from NIST as the computer program NIST Standard Reference Database 23 "NIST Reference Fluid Thermodynamic and Transport Properties Database (REFPROP): Version 8.0" http://www.nist.gov/srd/nist23.htm. These calculations are based on the reference Leachman, J.W., Jacobsen, R.T, Lemmon, E.W., and Penoncello, S.G. "Fundamental Equations of State for Parahydrogen, Normal Hydrogen, and Orthohydrogen" to be published in the Journal of Physical and Chemical Reference Data. More information maybe obtained from NIST online at http://www.boulder.nist.gov/div838/Hydrogen/Index.htm.

Change to Requirements: Modified a term in paragraph T.1.	Requirement Title: Tolerances, General	Reason for Change: Changed the term "meter" to device to clarify the requirement applies to the entire device

T.1. Tolerances, General.

(a) The tolerances apply equally to errors of underregistration and errors of overregistration.

(b) The tolerances apply to all products at all temperatures measured at any flow rate within the rated measuring range of the ~~meter~~device.

Change to Requirements: Modified a term and added text to paragraph T.2. Modified terminology and deleted a notation from corresponding Table T.2.	Requirement Title: Tolerances and Accuracy Classes for Hydrogen Gas Meter Applications	Reason for Change: Change the term "meter" to "measuring device" to clarify the requirements apply to the entire device Removed any reference to term "motor" and replaced the term with the term "vehicle" because this equipment will be used to refuel fuel cell and internal combustion engine vehicles of all types

		Added text to the table to clarify the tolerances are also values specified in the table

T.2. Tolerances. - The tolerances for hydrogen gas ~~meter~~measuring devices are listed in Table T.2. (Proposed tolerance values are based on previous work with compressed gas products and will be confirmed based on performance data evaluated by the U.S. National Work Group.)

Table T.2. Accuracy Classes and Tolerances for Hydrogen Gas ~~Meter~~ Measuring ~~Applications~~Devices

Accuracy Class	Application or Commodity Being Measured	Acceptance Tolerance	Maintenance Tolerance
2.0	Hydrogen gas as a ~~motor~~ vehicle fuel	1.5 % ~~(STAY OPEN FOR DISCUSSION)~~	2.0 %

Change to Requirements: Modified a term in paragraph T.4.1.	Requirement Title: Type Evaluation Examinations for Devices	Reason for Change: Changed the term "meter" to device to clarify the requirement applies to the entire device

T.4.1. Type Evaluation Examinations for Devices. - 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 ~~meter~~device, and

(b) for all quantities greater than the minimum measured quantity.

Change to Requirements: Modified terms in paragraph UR.2.3. and subparagraph UR.2.3.(a)	Requirement Title: Low-Flow Cut-Off Value	Reason for Change: Change the term "meter" to "measuring device" or "measuring system," where appropriate to clarify the requirements apply to the entire device or system

UR.2.3. Low-Flow Cut-Off Value. - If a me~~ter~~asuring system is equipped with a programmable or adjustable "low-flow cut-off" feature:

(a) **the low-flow cut-off value shall not be set at flow rates lower than the minimum operating flow rate specified by the manufacturer on the ~~meter~~ measuring device; and**

(b) **the system shall be equipped with flow control valves which prevent the flow of product and stop the indicator from registering product flow whenever the product flow rate is less than the low-flow cut-off value.**

Change to Requirements: Modified a term in paragraph UR.3.2.	Requirement Title: Ticket Printer; Customer Ticket	Reason for Change: Change the term "meter" to "device" or "measuring system," where appropriate, to clarify the requirements applies to the entire device or system Changed the term "meter" to device to clarify the requirement applies to the entire device

UR.3.2. Ticket Printer; Customer Ticket. - Vehicle-mounted me~~ter~~asuring systems shall be equipped with a ticket printer which shall be used for all sales where product is delivered through the ~~meter~~ device. A copy of the ticket issued by the device shall be left with the customer at the time of delivery or as otherwise specified by the customer.

Change to Requirements: Modified a term in paragraph UR.3.4.	Requirement Title: Ticket in Printing Device, Vehicle-Mounted Meter Systems	Reason for Change: Change the term "meter" to "measuring device" to clarify the requirements applies to the entire system

UR.3.4. Ticket in Printing Device, Vehicle-Mounted Me~~ter~~asuring Systems. - A ticket shall not be inserted into a device equipped with a ticket printer until immediately before a delivery is begun, and in no case shall a ticket be in the device when the vehicle is in motion while on a public street, highway, or thoroughfare.

Change to Requirements: Modified a term in paragraph UR.3.8.	Requirement Title: Conversion Factors	Reason for Change: Change the term "metered" to "measured" to clarify the requirements applies to all methodologies

UR.3.8. Conversion Factors. – Established correction values (see references in N.7) shall be used whenever ~~metered~~ measured hydrogen gas is billed. All sales shall be based on kilograms.

Change to Requirements: Deleted a reference to the	Requirement Title: Definition; motor-fuel device or motor-fuel	Reason for Change: All reference to proposed new

hydrogen draft code from a definition	dispenser or retail motor-fuel device	hydrogen code section number 3.39 was removed from the current Appendix D definition of "motor-fuel device or motor-fuel dispenser or retail motor-fuel device" because this equipment will be used to refuel fuel cell and internal combustion engine vehicles of all types
~~**motor-fuel device or motor-fuel dispenser or retail motor-fuel device. A device designed for the measurement and delivery of liquids products used as fuel for internal combustion engines. The term "motor-fuel dispenser" means the same as "motor-fuel device"; the term "retail motor-fuel device" applies to a unique category of device (see definition of "retail device").[3.30, 3.32, 3.37, 3.3X]**~~		

(iii) Tolerances

The USNWG continued its discussions on the appropriateness of the proposed 1.5 % (type evaluation/new systems) and 2.0 % (systems in use) performance tolerances. In its discussion, the USNWG considered the following principles that should be adhered to in the establishment of tolerances:

- Proposed tolerances are practical given the capability of today's hydrogen equipment technology
- Tolerance values are sufficiently small so as not to cause serious injury to either the buyer or seller of hydrogen
- Tolerance values are not so stringent as to make the equipment unreasonably costly, complicated, or delicate
- Tolerances allow for the effects of controllable (maintenance, etc.) and uncontrollable (environment, etc.) factors that affect accuracy under normal operating conditions for hydrogen equipment
- A test method and its associated field standard equipment is available and its accuracy meets the minimum requirement of not exceeding one-third of the smallest applicable tolerance applied to hydrogen equipment under test
- Inaccuracies of the test standard were a consideration in the establishment of the tolerances

The USNWG modified the current draft of the hydrogen code Table T.2. and corresponding paragraph T.2. Tolerances by adding text to paragraph T.2 indicating the possibility for refining the tolerance values, by deleting a notation for keeping the performance tolerances open for discussion, and further clarifying what information is included in Table T.2 as follows:

T.2. Tolerances. - The tolerances for hydrogen gas ~~meter~~measuring devices are listed in Table T.2. (Proposed tolerance values are based on previous work with compressed gas products and will be confirmed based on performance data evaluated by the U.S. National Work Group.)

Table T.2. Accuracy Classes and Tolerances for Hydrogen Gas ~~Meter~~ Measuring ~~Applications~~Devices			
Accuracy Class	**Application or Commodity Being Measured**	**Acceptance Tolerance**	**Maintenance Tolerance**
2.0	**Hydrogen gas as a ~~motor~~ vehicle fuel**	**1.5 %** **~~(STAY OPEN FOR DISCUSSION)~~**	**2.0 %**

For more details on the USNWG decision see Agenda Item 3.(c)5.

(iv) New Methodologies
The USNWG considered a July 2009 proposal to modify the Application Section of the draft code to exempt specific applications such as systems that use pressure-volume-temperature (PVT) methodology. The justification made for excluding these systems was they did not fall in the category of systems able to make "dynamic" measurements of hydrogen gas. In Draft 4.0 application code section paragraph A.1. specifies that the code applies to devices designed to dynamically measure the mass of hydrogen gas.

After lengthy discussion, the USNWG concluded that the draft code will be kept broad so as not to exclude any technology. All retail dispensers used in refueling applications to deliver gaseous hydrogen may be equipped with any methodology as long as the system complies with requirements (accurate, not fraudulent, etc.) of the draft code. See Agenda Item 4.(a)(i) *Dynamic Measurements* for more information on changes made to the draft code requirements.

(b) Test Procedures
On Wednesday, August 12, 2009, at 1:00 p.m. (EDT) the CSA HGV 4.3 Technical Advisory Group (TAG), Hydrogen Test Device Working Group for Temperature Compensation Devices for Hydrogen Dispensing Systems and USNWG held a joint session in an effort to determine if there is a single test standard that can be used to determine if gaseous hydrogen fuel station temperature compensated devices meet safety performance requirements and weights and measures accuracy requirements. The safety requirements are intended to avoid over-pressurization and over filling of the vehicle fuel storage tanks under the temperature conditions encountered by these systems. The groups' discussions included a PowerPoint presentation on a Dual Purpose Test Standard developed by Mark McDougall (Powertech Lab, Inc.)

CSA HGV 4.3 TAG is targeting December 2009 for completion of a fueling and station protocol. At this point the specifications for the test standard will most likely be proprietary. Plans are for the test standard to include instrumentation capable of PVT calculations for the filling of the receiving tank. A test unit designed to include a means for conducting the gravimetric test method is under consideration. The CSA HGV 4.3 TAG is aware that accuracy testing may require repeating tests under the same test conditions (e.g., flow rate, pressure, etc.). A test unit able to conduct both safety and accuracy performance testing would streamline the process and would open up the possibility of cost sharing by agencies using the dual purpose unit.

As a start CSA HGV 4.3 TAG is examining procedures for three types of tests over a range of temperatures. The three procedures would include a: (1) test over a temperature range for least heat rejection in a large Type IV tank (composite with polymer liner), (2) test over a range of densities in a

small Type III tank (composite with metal liner), and (3) volume calculations. Manufacturers will not be required to provide algorithms. The test procedures are similar to those in SAE 2601 Compressed Hydrogen Vehicle Fueling Communication Devices and are performed to not greater than a 60 g/s maximum flow rate to avoid overfilling the tank. A hot soak is performed to demonstrate a worse case scenario on a hot day at 50 ºC. The type and size of tank, and pressures at a fill time of three minutes are as follows:

Tank Capacity	Tank Type	Pressure	Notes
9.8 kg	Type 4	70 MPa	
4.7 kg*	Type 4	70 MPa	Applicable to USNWG test
1.4 kg	Type 3	70 MPa	Applicable to USNWG test
1.0 kg	Type 3	35 MPa	Applicable to USNWG test
*Reportedly will fit on the platform of the 150 kg reference scale			

The groups discussed the concept of a trailer mounted series of possibly four tanks for the gravimetric test. Transportation of the tanks may only be permitted for vessels with DOT certification. This will have to be researched to determine if this certification must be included in the unit's design specifications and examination procedures equipment checklist.

The groups noted there are several factors in the measurement process that can contribute to uncertainties in each measurement. For the gravimetric test method the group identified factors associated with the tank and other associated with the scale. After the filling of the tank the effects of buoyancy due to the warmer tank exterior require a waiting period before recording the mass indicated by the reference scale. Condensation has been observed to form on the tank under some test conditions, if so, this must be resolved because it contributes to the uncertainty in the process. Provisions are also necessary to make allowances for the quantity of gas in the lines. Tanks with 0 MPa must have at least 2 MPa before station dispenser will begin the fill process. During testing when tanks are emptied by venting hydrogen to the atmosphere, the tank is left with 2 MPa because it is not possible to completely empty the tank. Any purging of the tanks with gases such as nitrogen results in inaccuracies in measurement. The scale must be level, transported without being damaged, not obstructed if mounted to any framework, and its accuracy verified using error weights. Other factors noted by laboratories and manufacturers are wind, vibration, and humidity. Currently, a unit with a 62 liter (3.5 kg) capacity has only been tested to CSA standards.

The groups discussed the expansion range for each tank which changes during the first cycles of testing. It was suggested to pressure cycle the tank to force air out the plastic fibers to minimize the tank's expansion range. It was noted that it is highly unlikely to establish a coefficient of expansion for these test tanks. Although one laboratory indicated it is able to calculate the tank's volume to within several cubic centimeters. If volumetric test methods are used to determine the tanks water volume, then there is a need to perform measurements that are traceable. Each tank would require certification of its volume. DMS suggested the NIST 105 Handbook Series which include the recommended minimum specifications and tolerances for volumetric and other types of field standards used by weights and measures officials and others to verify the quantity delivered by commercial devices. Other factors to consider in an uncertainty equation are the accuracy of the pressure and temperature gauge(s)/sensors(s). The draft hydrogen code or corresponding handbook sections do not typically specify accuracy requirements for these components. Typically it is required to seal or secure a feature if it is metrologically significant and sometimes for technical reasons the code language or a test procedure will specify that a component must be present in a particular location in the system.

The groups are a ware of only three laboratories that are contracting to perform test for high pressure dispensers (85 MPa). They are eTec (Arizona), the Japan Automobile Research Institute (JARI)(Japan)

and Powertech Labs, Inc. (Canada); however, there is interest in determining if there are other facilities that have this capability.

(i) Tentative Test Procedures
One primary goal of the USNWG continues to be to identify at least one suitable test method(s) and test standards for use to verify the equipment's performance to the proposed tolerances. The USNWG considered the technology available in the marketplace for similar and competing applications, the examination procedures (see Appendix H) that already exist, and the last two bullets listed above in Agenda Item (4)(a)(iii) (accuracies of the test standard) in their discussion of test procedures.

USNWG members agreed to forward data from performance tests conducted between August 2009 through January 2010 to Diane Lee (gloria.lee@nist.gov) and Juana Williams (juana.williams@nist.gov). Data is being gathered to further confirm at least one viable field test method and to verify the performance of hydrogen dispensers to tolerances in the proposed code. NIST is working to develop guidelines for test procedures used to gather performance data. If at all possible, it was suggested that those gathering data attempt to conduct all three test methods for each individual delivery to ensure test conditions are comparable.

(ii) Test Method Uncertainty Analysis
Diane Lee (NIST WMD) updated the USNWG on the uncertainty analysis of data NIST has gathered for the gravimetric and volumetric test methods (see Appendix I) and reported on the status of the summary of NIST's efforts.

Diane Lee indicated that comparisons of specific factors that contribute to uncertainties in both the gravimetric and volumetric test methods resulted in higher uncertainties associated with the gravimetric test method.

(iii) Measured Decant Test Method
In December 2008 the USNWG was first introduced to the "measured decant" test, which is an alternative method for verifying measurement accuracy and possibly obtaining fuel quality samples. The "decant" test represents the fourth method under possible consideration by the USNWG. Both the Powertech and Van Putten-Blue Energy Observatories, Inc. laboratories indicated using this method. Powertech will look at the repeatability of data resulting from this test method.

The USNWG explored whether or not this is a practical and affordable test method that is suitable for demonstrating hydrogen refueling equipment's performance. The test procedure takes place at a 1 g/s flow rate and avoids the effects of high and transient pressures and changes in flow rates and possibly the inaccuracies in the procedure that are contributed by these factors. The test method involves dispensing hydrogen into a tank and then at a lower pressure flowing the hydrogen from the tank through a standard. Since the standard is some type of metering technology the measured decant test method would be considered a master meter test method which is one of three test methods recognized in the draft code developed by the USNWG.

The appropriate master meter must be selected for this procedure. The master meter or meters need to have an order of magnitude in its performance that is greater than the meter under test and be traceable. Additionally the meter materials must be compatible for use with hydrogen or there is a degradation in the meter's performa nce. The laboratories report that purging the tanks with nitrogen results in a mix of gases that change the measurement results.

One dispenser manufacturer reported performance test results of 5 % - 10 % using the measured decant test method and ± 10 % using the gravimetric test method. One manufacturer suggested the possibility of

using a bell prover to calibrate the transfer standard used in the low pressure measured decant test method and has requested input from NIST on this procedure.

(5) Next Steps/Tasks
The USNWG discussed upcoming technical meetings 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 were identified in Agenda Item (6) and in subparagraph (a) below to ensure that the USNWG meets its goals as follows:

(a) Upcoming 2010 Weights and Measures Standards Development Process
The USNWG discussed the weights and measures standards development process (see Appendix C) and the status of the proposals for hydrogen codes to address equipment, fuel quality, and the method of sale requirements. These proposals remain before the four regional weights and measures associations and will be carried over on the 2010 national agendas. The USNWG made necessary updates to the language and agreed the status of the codes was ready for an upgrade to move forward to the national level for a vote. The Technical Advisors to the DSS and FSS will forward the latest drafts of the codes to the USWNG and with their approval forward these drafts on to the next round of regional weights and measures association meeting fall 2009. (see Agenda Item 4.(a)(ii) for more details on changes made to the code)

(6) Next Meeting(s)
The August 2009 meeting was the last scheduled meeting of the USNWG for Fiscal Year 09 (01OCT2008-30SEP2009). The goals listed in the USNWG's Five-Year plan for 2010 are as follows:

- Field trials of draft test procedures for gaseous hydrogen measuring devices
- Training for test and inspection of gaseous hydrogen measuring devices
- Draft sampling and laboratory procedures for gaseous hydrogen

The USNWG is on track with its goals, but is now at a critical point in the development of test procedures for hydrogen equipment and fuel quality. The USNWG agreed that the adoption of the codes at the national level to establish requirements and guidelines for retail dispensers is most critical. The USNWG members and stakeholders in the hydrogen and weights and measures communities were encouraged to participate in upcoming meetings to support adoption of the codes and in the weights and measures standards development process taking place fall 2009 in regional associations and in January 24-27, 2010 at the NCWM in Nashville TN. The USNWG and entire community should take every opportunity to comment either in-person, by email, fax or calling representatives of the technical committees hearing equipment, method of sale, and fuel quality issues. Contact information for the committees is available at http://www.ncwm.net.

The NIST Technical Advisor to the DSS USNWG balloted the group on possible dates for the next meeting. Based on the results of the vote on times for the December 2009 and January 2010 tele/web conferences the USNWG was asked to save the dates of Tuesday, December 15, 2009 - 3:00 p.m. to 4:30 p.m. (ET) and Wednesday, January 13, 2010 - 3:00 p.m. to 4:30 p.m. (EST) for upcoming meetings. Tentative agenda topics for the December 15, 2009 and January 13, 2010 meetings are:

(1) Results of the Work to Gather Performance Data,

(2) Requirements for Wholesale Devices, and

(3) Input Received From the Fall Regional Weights and Measures Meetings

Appendix J Attendee List-August 11-13, 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 August 11, 2009 Yes (Y)	Attended USNWG August 12, 2009 Yes (Y)	Attended USNWG August 13, 2009 Yes (Y)
Mahesh Albuquerque	Colorado	Y	Y	Y	Y	Y
Robert Boyd	Hydrogen Solutions – Linde Group	Y	Y	Y	Y	Y
Tina Butcher	NIST – TS Wgts. & Meas. Div. (WMD)	Y	Y	Y	Y	Y
Jackie Button	Ca. Fuel Cell Partnership		Y	Y	Y	Y
Julie Cairns	CSA Standards	Y	Y	Y	Y	
Norm Ingram	CA – Food and Ag., Div. of Measurement Standards	Y	Y	Y	Y	Y
Diane Lee	NIST – TS WMD	Y	Y	Y	Y	Y
Kristin Macey	CA – Food and Agriculture, Division of Measurement Standards	Y	Y	Y	Y	Y
Dev Patel	Kraus Global, Inc.				Joint UNNWG/CSA	
Ralph Richter	NIST – TS WMD	Y	Y	Y		Y
Curt Williams	Georgia Ag. Dept./ CPW Energy Consulting	Y	Y	Y	Y	Y
Juana Williams	NIST – TS WMD	Y	Y	Y	Y	Y
Guests						
Russ Hewett	NREL				Joint UNNWG/CSA	

Roger Macey	CA – Food and Ag. Div. of Measurement Standards	--	--	Y	Y	Y
Mark McDougall	Powertech Labs			Y	Y	Y
Dan Reiswig	CA – Food and Ag. Div. of Measurement Standards	--	--	Y	Y	Y
Mark Richards	Versa Power				Joint UNNWG/CSA	
Jesse Schneider					Joint UNNWG/CSA	
Dr. Maurice HPM van Putten	Van Putten-Blue Energy Observatories, Inc.			Y	Y	Y
Van Thompson	CA – Food and Ag. Div. of Measurement Standards	--	--	Y	Y	Y