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

April 27, 2010

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

Tele/Web Conference Meeting

MEETING SUMMARY

Time: April 27, 2010/3:00 p.m. – 4:30 p.m. ET-USA & Canada (GMT - 05:00)

Meeting Online Link: http://nist.na6.acrobat.com/usnwg/

Call-In Telephone Number: 1-877-685-5350
Call-In Password: 908127

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

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

AGENDA ITEMS

Attachments List		
Appendix	**Related Agenda Item(s)**	Title
A	(2)(a)	Summary of the January 2010 USNWG Meeting
B	(3)(a) and (4)(a)	Preliminary USNWG Responses to Input on the Draft Hydrogen Codes from the Fall 2009 Regional Weights and Measures Associations and USNWG (rev.2)
C	(3)(a)	5.0 of the NIST Handbook 44 Hydrogen Gas-Measuring Devices Code
D	(3)(a)	Draft 3.1 of the NIST Handbook 130 Uniform Laws and Regulations and Hydrogen Fuel Quality Codes
E	(1)	Attendee List
*Device Standards Subcommittee (DSS)		
**Fuel Specifications Subcommittee (FSS)		

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

AGENDA TOPICS

3:00 P.M. (ET)

(1) Welcome Current/New Members and Roll Call
The meeting was called to order, roll called, and the meeting's purpose was reviewed. The collaborative work by the meeting's sponsors was recognized.

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

(a) Approve the Summary of the January 13, 2010 USNWG Meeting
A draft summary (see Appendix A) of the January 13, 2010 tele/web conference was emailed on April 16, 2010 to the group for its review. The summary included information emailed to the USNWG on February 1, 2010 in the Abbreviated January 2010 Meeting Summary. The USNWG was asked to review the summary, compile any comments, and vote on the approval of the summary at the April 27, 2010 tele/web conference meeting.

On April 27, the USNWG agreed the vote should be postponed until May 5th to allow additional time for input from a majority of the USNWG members. Many of the USNWG had prior commitments and were not able to participate in the April 27 meeting. The DSS Technical Advisor balloted the USNWG by email on April 30, 2010 and requested their review and approval of the January 2010 Draft Meeting Summary by May 10, 2010.

(b) Agenda Updates for April 2010

(i) Instrumentation Billing Method
Dr. Maurice van Putten asked that the USNWG discuss the concept of using a low pressure meter installed on each vehicle's fuel cell supply line for invoice billing of the hydrogen consumed by the vehicle's fuel cell.

The USNWG agreed to simultaneously work on a device code and a corresponding method(s) for verification of hydrogen devices. The three methods recognized in the draft code are the: (1) master meter (transfer) standard test, (2) gravimetric test, and (3) pressure-volume-temperature (PVT) test. The USNWG agreed to recognize multiple test methods, in part, because of their successful use in similar applications, such as CNG, and also because of the unique properties of hydrogen fuel in vehicle refueling applications. Most recently, the USNWG has discussed the possibility of a master meter test method where hydrogen gas is decanted from the receiving vessel at low pressure. In light of the uncertainties associated with various test methods, the USNWG remains open to possible options that can be used to verify the accuracy of deliveries.

Currently, the USNWG has prioritized its workload and agreed to address the remaining 19 comments from the weights and measures community on the draft code and regulations. In the interim Dan Reiswig, Norm Ingram, Van Thompson and Kristin Macey (all with CA), Tina Butcher, Diane Lee, Ralph Richter, Lisa Warfield, and John Wright (all with NIST), Steve Malone (NB), and Ken Ramsburg (MD) who have worked with measurement standards (development and regulation) and/or have type evaluation laboratory experience were requested to volunteer for a review and then comment on Dr. Van Putten's concept by May 19. This group should, if they agree, consider if the draft code addresses the concept and examine how the concept relates to current practices that occur during weights and measures transactions. Does this concept provide an early solution to the challenge of developing a final test procedure?

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

(a) Draft Hydrogen Code Status in the U.S. Weights and Measures Standards Development Process

January 2010 NCWM Interim Meeting Positions on the Draft Hydrogen Codes
A status update on the NCWM's position on the draft hydrogen codes was emailed to the USNWG on February 1, 2010. Those updates will be included as part of this USNWG meeting agenda and subsequent meeting summary. The status of the draft hydrogen-equipment, method of sale, and fuel quality legal metrology requirements developed by the USNWG are:

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

The time, effort, and resources contributed by members of the USNWG were instrumental in reaching this point in the weights and measures standards development process.

The Committee on Specifications and Tolerances (S&T) for the National Conference on Weights and Measures (NCWM) met January 24-27, 2010. The S&T Committee heard testimony, discussed, and then decided that the proposal for a new NIST Handbook 44 Hydrogen Gas Measuring Devices - Tentative Code should move forward as a voting item. The proposal will be voted on at the July 11-15, 2010, 95th NCWM Annual Meeting to be held at the Crowne Plaza, St. Paul Hotel, St. Paul, Minnesota.

A tentative code is needed as a starting point for inspection and test procedures of these devices. A tentative code has only a trial or experimental status and is not intended to be enforced. These requirements are designed for study prior to the development and adoption of a final code. The requirements are also the basis for type evaluation criteria. Rapid commercialization of hydrogen gas dispensers may require individual states to deal with new technology through that jurisdiction's policy and protocol. Devices ready for commercial use and submitted for type evaluation prior to the hydrogen code achieving permanent status is NIST Handbook 44 could also be evaluated within a jurisdiction. The intent is not to prohibit innovations in measurement technology.

The trial period between the tentative and final status for a code allows the weights and measures and hydrogen communities to further examine factors, such as those affecting accuracy, under normal operating conditions, to reach agreement on where to set acceptable limits for this application and technology. Typically, tolerances for new devices are not permitted to be any larger than those for existing devices that are used for similar applications. Safety is of paramount importance. Other factors typically selected by the manufacturer, such as the meter's material, design, and construction must be such that (1) accuracy can be maintained, (2) operating parts function as intended, and (3) adjustments will remain reasonably permanent.

The Committee on Laws and Regulations (L&R) for the NCWM, heard testimony, discussed, and then decided to make the method of sale and fuel quality proposals two separate items. The method of sale requirements will be voted on at the July 2010 NCWM Annual Meeting to become a permanent part of NIST Handbook 130. The fuel quality proposal will appear in the L&R Committee's report as an Information Item because hydrogen fuel does not yet have a finalized ASTM or other national consensus standard. The L&R Committee will continue to consider recommendations from the USNWG on hydrogen's fuel quality and will carry over the proposal on its 2011 agenda.

The NCWM was advised the USNWG will continue to meet to address all comments on the draft hydrogen codes and to refine the requirements.

Upcoming Regional Weights and Measures Association Spring and Summer 2010 NCWM Meetings
The Central and Northeastern Weights and Measures Associations meet in May 2010 and National Conference on Weights and Measures holds its 95th Annual Meeting, July 11-15, 2010. Participants in those meetings will want and need to hear any further input, updates, etc. (presented in writing or in-person) on the draft hydrogen codes. Every effort should be made to notify affected groups, businesses, private or public associations, etc. about the proposed new hydrogen code and encourage their input on the standards development process.

The USNWG will continue to work through input it has received to refine the draft codes for the July 2010 NCWM Annual Meeting. A list of contacts for all three meetings is provided in the table below. All stakeholders are encouraged to provide input to the NCWM by participating either in-person at the July Annual Meeting, or by sending their comments to the contacts listed in the table below by postal mail or email, by fax, or by communicating through their industry associations. The USNWG will contact organizations serving large numbers of stakeholders, such as the California Fuel Cell Partnership, to make everyone aware of the status of the hydrogen codes and to encourage their input in the process.

U.S. Regional Weights and Measures Meetings Contacts	National Weights and Measures Meeting Contacts
Northeastern Weights and Measures Association May 10-13, 2010 Groton, Connecticut John Walsh - Chairperson Town of Framingham 150 Concord Street Framingham, MA 01702 email: jbw@framinghamma.gov phone: 508.532.5480 fax: 508.626.8991 www.newma.us	***National Conference on Weights and Measures*** July 11-15, 2010 St. Paul, Minnesota Committee on Specifications and Tolerances S&T Committee Chair Brett Saum BSaum@co.slo.ca.us
Central Weights and Measures Association May 16-20, 2010 Springfield, Illinois Jonelle Brent Illinois Department of Agriculture 801 Sangamon Ave PO Box 19281 Springfield, IL 62794-9281 email: jonelle.brent@illinois.gov phone: 217.785.8301 www.cwma.net	***National Conference on Weights and Measures*** July 11-15, 2010 St. Paul, Minnesota Committee on Laws and Regulations L&R Committee Chair joe.benavides@texasagriculture.gov

(b) NIST
The NIST Technical Advisor reported that due to the shortage in WMD Legal Metrology Device Group personnel 50 percent of Juana Williams' time will remain in work on the hydrogen codes and the remaining portion will be dedicated to other high level measuring device projects.

(c) DMS
The California Energy Commission and DMS are in the final phase of the contract to award $3.5M to DMS in support of its developing test methods for use to assure compliance with hydrogen standards.

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

(a) Address Category Comments on the Draft Hydrogen Codes/Input to the July 2010 National Conference on Weights and Measures (NCWM)

History
In preparation for input to the July 11-15, 2010 NCWM, the USNWG continued its discussions to address comments received on the draft hydrogen codes from the U. S. regional weights and measures associations that met fall 2009 and USNWG members.

Since October 2009 there were 25 comments on the draft hydrogen codes from the weights and measures community and USNWG that require possible input from the USNWG. The reasons for these comments varied and are as follows:

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

There were four groups of comments left for the USNWG to address. On January 13, 2010, the USNWG worked through Comments in Group [1] that required no modification to the draft hydrogen code. The USNWG did not discuss how it will notify the submitter of those comments and the NCWM of its actions. This topic will carry over to the May 25, 2010 tele/web conference.

New Comments
One new comment on the HB44 Draft Hydrogen Code surfaced after the January 13, 2010 meeting from two USNWG members:

- The comment was designated as USNWG #2 and it is a request for more clarity on how Pressure-Volume-Temperature (PVT) RMFD systems work to ensure there can be no diversion of product. This comment needs further research and would be placed into Comment Group [4]. The DSS Technical Advisor recommended the USNWG begin work on this comment as soon as possible to assist members of the USNWG developing laboratory and field test procedures for hydrogen dispensers. This would also ensure there are no initial gaps in the tentative code for the only two known system's methodologies (mass flow meter and PVT) in operation.

- The Technical Advisor recommended that dispenser OEMs and other interested parties work together in a small group to clarify how PVT RMFDs operate. The group is not delving into proprietary information, but would need to clarify where PVT values are derived (from which metrologically significant components). Does the USNWG have a consensus (for now) that the requirements that might impact either the station owner or vehicle owner when refueling with PVT systems have not been overlooked? Could fraud be inadvertently or intentionally committed against either buyer or seller during the course of the transaction?

During the April 27th USNWG tele/web conference meeting Marc Buttler (Micro Motion), Joe Cohen (APCI), Dan Reiswig (DMS), Maurice Van Putten (VPGEO), and Juana Williams (NIST) agreed to work to develop language to clarify that dispensers using the Pressure-Volume-Temperature (PVT) methodology should be designed so as to (1) not facilitate diversion of product during a delivery of hydrogen gas into a vehicle's storage tank and (2) use certified values in the calculation of the mass quantity in a delivery. Language was suggested for a specification that requires PVT values, especially the volume values, to be derived from a known source such as the stationary service station storage tank rather than the vehicle's storage tank. For any system (to include PVT systems), the minimum technical requirements need not be prescriptive, but are needed to eliminate from use any devices that are (1) false, (2) not reasonably permanent in their adjustment, (3) do not repeat their indications correctly, or (4) facilitate fraud.

Many field officials will not have had the opportunity to examine or test related dispensing applications such as CNG retail motor-fuel dispensers and will have even less experience with hydrogen dispensers. Therefore, the weights and measures community will rely on the USNWG to have addressed the minimum technical requirements for all hydrogen fuel devices (metered and PVT) that are recognized in the draft hydrogen code.

Strategies for Addressing the Remaining Comments

The USNWG agreed to the following strategy for working through the remaining comments (see Appendix B). The USNWG should consider:

Step 1:

Two tele/web conference meetings tentatively scheduled for:

- April 27th where the USNWG began to address Comments in Group [2] Low to Moderate Level of Modification to Draft Code Warranted (Language Needs Development) as follows:

Preliminary USNWG's Response to the Fall 2009 Regional Weights and Measures Associations and Other Comments on Draft 5.0 of the NIST HB44 Hydrogen Gas-Measuring Devices Code:			
Comments in Group [2] Low to Moderate Level of Modification to Draft Code Warranted (Language Needs Development)			
Draft Code Paragraph	**Comment**	**For the USNWG's Consideration**	**USNWG Recommended Modification to the Draft Code**
[2] **SWMA #5 - S.2.5. Display of Unit Price and Product Identity.** S.2.5.1. Unit Price. - A computing or money-operated device shall be able to display on each face the unit price at which the device is set to compute or to dispense. S.2.5.2. Product Identity. - A device shall be able to conspicuously display on each side the identity of the product being dispensed. S.2.5.3. Selection of Unit	Must have ***continuous*** display of the unit price and product identity on a computing device.	►Does the draft code need to specify in paragraph S.2.5. that these indications must be "continuous" as was done in paragraph 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 device.	Due to time limitations during the April 27 meeting the DSS Technical Advisor will email a ballot to the USNWG for its final position on the Group [2] items.

Price. - When a product is offered for sale at more than one unit price through a computing device, the selection of the unit price shall be made prior to delivery using controls on the device or other customer-activated controls. A system shall not permit a change to the unit price during delivery of a product.			
[2] **SWMA # 6 -** S.2.5.4. Agreement Between Indications. – All quantity, unit price, and total price indications within a measuring system shall agree for each transaction. – All quantity, unit price, and total price indications within a measuring system shall agree for each transaction.	Paragraph S.2.5.4. is missing the formula that is part of the Liquid Measuring Devices Code corresponding paragraph S.1.6.6. Agreement Between Indications. – When a quantity value indicated or recorded by an auxiliary element is a derived or computed value based on data received from a retail motor fuel dispenser, the value may differ from the quantity value displayed on the dispenser, provided the following conditions are met: (a) all total money values for an individual sale that are indicated or recorded by the system agree; and (b) within each element, the values indicated or recorded meet the formula (quantity x unit price = total sales price) to the closest cent.	►Consider adding the formula To paragraph S.2.5.4.	Due to time limitations during the April 27 meeting the DSS Technical Advisor will email a ballot to the USNWG for its final position on the Group [2] items.
[2] **SWMA # 7 -** **S.2.8. Indication of Delivery. -** The device shall automatically show on its face the initial zero condition and the quantity delivered (up to the nominal capacity).	Move to S.2.1. Return to Zero or S.2.2. Indicator Reset Mechanism		Due to time limitations during the April 27 meeting the DSS Technical Advisor will email a ballot to the USNWG for its final position on the Group [2] items.
[2] **SWMA # 9 - S.3.2.1. Discontinuous Adjusting Means. -** When the adjusting means changes ratio between the indicated quantity and the quantity of measured gas in a discontinuous manner, the consecutive values of the	Request an explanation or definition of "discontinuous adjustment means"	In June 2008 the USNWG modified paragraph S.3.2.1. to reflect the original intent, which was to specify requirements for the means to change the *ratio* for indicated quantities rather than apply to those that	Open for discussion whether or not to add a definition or more text to clarify the intent of the paragraph. Due to time limitations during the April 27 meeting the DSS Technical Advisor

ratio shall not differ by more than 0.1 %.		change accuracy of the measuring instrument. This change was to align the wording with that in corresponding paragraphs in other measuring devices codes.	will email a ballot to the USNWG for its final position on the Group [2] items.
[2] **SWMA # 16 - T.3. Repeatability. -** When multiple tests are conducted at approximately the same flow rate and draft size, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance and the results of each test shall be within the applicable tolerance. See also **N.6.1.1. Repeatability Test. -** … controlled conditions where variations in factors are reduced to minimize the effect on the results obtained …	Specify test conditions in which no variation is permitted and those that are possible in a field evaluation. Specify that "the tolerance value shall apply only for type evaluation"	During the August 2009 USNWG meeting the group agreed not to list specific factors that might affect the test results. The rationale was "The dynamics of these dispensing systems with the effects of heating and high pressures and extreme changes in flow rates, the user of test equipment should attempt to reduce to the greatest extent possible all factors likely to introduce errors into the test results." ►Should these factors be listed to ensure these devices have the best circumstances for a fair test? ►Should this paragraph be consistent with corresponding paragraphs in other HB 44 Measuring Devices Code Sections (3.30-3.38)? Input from an official who has performed both field and type evaluation tests includes a recommendation for the text to be consistent in listing these influence factors. The official cited all of the Measuring Devices Codes as good examples of the language needed in the draft code. In particular the official noted HB 44 Section 3.32 LPG paragraph N.4.1.2. Repeatability Tests. –…same size and be conducted under controlled conditions where variations in factors <u>such as temperature, pressure, and flow rate</u> are reduced to the extent that they will not affect the results obtained.	Due to time limitations during the April 27 meeting the DSS Technical Advisor will email a ballot to the USNWG for its final position on the Group [2] items.

Due to time limitations during the April 27 meeting the DSS Technical Advisor will email a ballot to the USNWG for its final position on the Group [2] items.

- May 25th to address Comments in Group [4] where A USNWG Response Requires Further Research and Work

Step 2:
For Comments in Group [LOD] that were left open for USNWG discussion. The USNWG will examine whether or not these requirements, which also exist in corresponding measuring devices codes, are necessary for hydrogen dispensers. To expedite the USNWG review process the three Comments in the [LOD] Group became part of Comments in Group [4], which require further research and will be the focus of the May 25th meeting.

Step 3:
For Comments in Group [3] where Suggested Modifications to HB44 were developed in December 2009, the USNWG will address by email one comment every seven business days. Then the Technical Advisor will poll the USNWG membership to determine if there is a consensus for the suggested changes to the draft code. This will allow the USNWG membership time to consult within their agencies/organizations and associations on the proposed changes to the August 2009 Draft 5.0 of the HB44 code. Should the review of multiple items become too complex for email communications the USNWG might explore the option of a third (or fourth) meeting in 2010.

(5) Next Steps/Tasks
The USNWG intends to address comments on the draft hydrogen codes, other upcoming related events, and the next steps in the weights and measures standards development process that might affect its work to fully develop hydrogen measurement standards and test procedures. Projects, strategies, and target dates identified to ensure that the USNWG meets its goals are listed in the table below:

Task List (based on the April 27, 2010 USNWG Meeting)			
Agenda Item	**Task**	**Responsible Parties**	**Deadline**
(2)(b)(i)	USNWG members working with equipment measurement standards (development and regulation) and/or having type evaluation laboratory experience were requested to volunteer time for a review and then comment on Dr. Van Putten's concept for an Instrumentation Billing Method.	Dan Reiswig, Norm Ingram, Van Thompson and Kristin Macey all with DMS; Tina Butcher, Diane Lee, Ralph Richter, Lisa Warfield, and John Wright (all with NIST); Steve Malone (NB), and Ken Ramsburg (MD)	May 19, 2010
(3)(a)	The USNWG will contact organizations serving large numbers of stakeholders, such as the California Fuel Cell Partnership, to make	DSS Technical Advisor	None Established

	everyone aware of the status of the hydrogen codes and to encourage their input in the process.		
(4)(a)	Develop language to clarify that dispensers using the Pressure-Volume-Temperature (PVT) methodology should be designed so as to (1) not facilitate diversion of product during a delivery of hydrogen gas into a vehicle's storage tank and (2) use certified values in the calculation of the mass quantity in a delivery.	Marc Buttler (Micro Motion), Joe Cohen (APCI), Dan Reiswig (DMS), Maurice Van Putten (VPGEO), and Juana Williams (NIST)	None Established
(4)(a)	Due to time limitations during the April 27 meeting the DSS Technical Advisor will email a ballot to the USNWG for its final position on the Group [2] items, where possible moderate change to the draft code might be warranted.	DSS Technical Advisor	None Established
(4)(a)	For Comments in Group [3] where Suggested Modifications to HB44 were developed in December 2009, the USNWG will address by email one comment every seven business days.	DSS Technical Advisor	Weekly emails to the USNWG

(6) Next Meeting

The USNWG has no in-person meetings scheduled for 2010, but will hold a tele/web conference from 3:00 p.m. to 4:30 p.m. on Tuesday, May 25, 2010. The USNWG may discuss the necessity of a face-to-face session before July 2010 on May 25th.

4:45 P.M. (ET) Meeting Adjourns

Appendix E				
Attendee List-April 27, 2010 **Meetings of the USNWG Hydrogen Device Standards and Fuel Specifications Subcommittees**				
Name	Agency	Device Standards Subcommittee (DSS) Member Yes (Y)	Fuel Specifications Subcommittee (FSS) Member Yes (Y)	Attended Yes (Y)
Marc Buttler	Micro Motion/Emerson Process Management	Y	Y	Y
Joe Cohen	Air Products and Chemicals, Inc.	Y	Y	Y
Norm Ingram	CA – Food and Ag. Div. of Measurement Standards	Y	Y	Y
Kristin Macey Chair DSS	CA – Food and Agriculture, County/State Liaison Office	Y	Y	Y
Dan Reiswig	CA – Food and Ag. Div. of Measurement Standards	Y	Y	Y
Lisa Warfield	NIST – TS WMD	Y	Y	Y
Juana Williams	NIST – TS WMD	Y	Y	Y
Guests				
Van Thompson	CA-Food and Ag. Div. of Measurement Standards			Y
Maurice Van Putten	Van Putten-Blue Energy Observatories, Inc.			Y