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

June 17-19, 2008

Gas Technology Institute (GTI)

Des Plaines, Illinois

AGENDAS

Call-In Number: 877-691-9300
Pass Code: 7680530

NOTE: On June 18, 2008 the USNWG will tour GTI from 8:30 a.m. to 11:00 a.m (CT). Times are approximate for coverage of issues.

This meeting is 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) is meeting 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 equipment used in hydrogen measurements for vehicle and other refueling applications.

ATTACHMENTS:

Appendix A Summary of the March 2008 USNWG Meeting
Appendix B USNWG Guidelines – Final Draft
Appendix C USNWG Agenda Submission Form
Appendix D Draft 3.0 of NIST Handbook 44 Gas Meters Code
Appendix E The Starting Point: A Discussion Paper Describing a Proposed Method of Sale and Quality Specification for Hydrogen Vehicle Fuel

AGENDA – DAY 1

DEVICE STANDARDS AND TEST PROCEDURES SUBCOMMITTEE (DSTPS) MEETING
Tuesday, June 17, 2008, 8:30 a.m. – 5:00 p.m. (CT)
Gas Technology Institute (GTI), 1700 South Mount Prospect Road, Conference Rooms 126-1 and 126-2
Des Plaines, Illinois
Chair – Kristin Macey (CDFA/DMS)
Technical Advisor – Juana Williams (NIST WMD)

8:30 - 8:45 **(1) Welcome and Introductions**
The DSTPS participants are welcomed in-person and on audio conference, the meeting is called to order, and its purpose reviewed. The collaborative work by the meeting's sponsors will be recognized. Participants will be briefed on the facilities available at GTI, the schedule of events, meeting procedures, and materials. Participants will be invited to provide their name, affiliation, and state their specific area of interest in the work to develop hydrogen measurement standards.

8:45 10:00 **(2) Administrative Business**
The DSTPS will discuss and decide on procedures for managing and documenting its technical work. The following items will be addressed:

(a) Approve the Summary of the March 2008 USNWG Meeting

(b) Approve the USNWG Guidelines

10:00 - 10:15 Break – coffee, tea, juice, and pastries

12:15 - 1:30 Lunch – On your own. Invitational travelers should see NIST representatives for transportation.

1:30 - 3:00 **(3) Development of Device Standards and Test Procedures for Commercial Hydrogen Measurement**

(a) Device Standards
The DSTPS will have the opportunity to review and approve a final Draft Version 3.0 of the NIST Handbook 44 Hydrogen Gas Meters Code. This latest version of the draft code is the result of work by the DSTPS at its March 2008 meeting.

A well developed draft code that receives support of the USNWG may be submitted to regional and/or other technical committees as early as fall 2008 to be introduced into the weights and measures standards development process. In the interim the code should be applied to hydrogen refueling equipment to ensure the development of text that includes appropriate design, performance, installation and use requirements for hydrogen applications. The code will be the basis for test procedures.

(b) Test Procedures
In October 2007 the USNWG agreed that equipment test procedures should be developed simultaneously as work progresses on the code. In March 2008 the

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DSTPS agreed to recognize three test methods to verify the performance of equipment. The DSTPS will discuss the response to its request for input on documented test procedures and test equipment specifications for gravimetric, volumetric, and transfer standard test methods.

(c) Test Data
The DSTPS will discuss the response to its request for test data on the performance of hydrogen refueling equipment that demonstrates these systems can attain the 1.5 % tolerance proposed in the Draft Hydrogen Gas Meters Code.

3:00 - 3:15 Break – coffee, tea, soda, and pastries

3:15 - 5:00 **(3) Development of Device Standards and Test Procedures for Commercial Hydrogen Measurement (Continued)**

Meeting adjourns and reconvenes on June 18, 2008 at 8:30 a.m. (CT)

AGENDA – DAY 2

DEVICE STANDARDS AND TEST PROCEDURES SUBCOMMITTEE MEETING
Wednesday, June 18, 2008, 8:30 a.m. – 5:00 p.m. (CT)
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Chair – Kristin Macey (CDFA/DMS)
Technical Advisor – Juana Williams (NIST WMD)

8:30 - 11:00 **Gas Technology Institute Tour**

11:00 - 11:15 Break - coffee, tea, juice, and pastries

11:15 - 12:15 **(3) Development of Device Standards and Test Procedures for Commercial Hydrogen Measurement (Continued)**

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12:15	-	1:30	Lunch – On your own. Invitational travelers should see NIST representatives for transportation.
1:30	-	3:00	**(3) Development of Device Standards and Test Procedures for Commercial Hydrogen Measurement (Continued)**
3:00	-	3:15	Break – coffee, tea, soda, and pastries
3:15	-	3:45	**(3) Development of Device Standards and Test Procedures for Commercial Hydrogen Measurement (Continued)** **(4) Upcoming NIST WMD Outreach Projects** **(a) NIST WMD Hydrogen Web Page** **(b) Weights and Measures Administration Workshops**
3:45	-	4:15	**(5) Next Steps/Tasks** The DSTPS will discuss ideas for how the work should progress to develop hydrogen measurement standards and test procedures. Project work and target dates will also be identified.
4:15	-	5:00	**(6) Next Meeting** At the conclusion of the June 18 meeting the DSTPS will have a better understanding of the work ahead to develop hydrogen measurement standards and test procedures. Some tasks may be completed by conference calls and email, while others may require an in-person meeting of the DSTPS. Two additional meetings are tentatively planned for August 2008 and the fifth is to be determined. It is anticipated that there may be a need to dedicate an entire meeting to one specific standards' related project that is identified by the USNWG. Future meeting locations will be based on logistics and technical tasks that the USNWG must accomplish. The USNWG will make every effort to avoid scheduling conflicts with upcoming events and meetings in the weights and measures and hydrogen communities. **Meeting Adjourned**

AGENDA – DAY 3

FUEL SPECIFICATIONS SUBCOMMITTEE (FSS) MEETING
Thursday, June 19, 2008, 8:30 a.m. – 12 noon (CT)
Gas Technology Institute (GTI), 1700 South Mount Prospect Road, Conference Rooms 126-1 and 126-2
Des Plaines, Illinois
Chair – Vacant
Moderator/Technical Advisor – Kenneth Butcher (NIST WMD)

NOTE: In addition to Items (3) and (4) see Appendix E "The Starting Point: A Discussion Paper Describing a Proposed Method of Sale and Quality Specification for Hydrogen Vehicle Fuel" which provides a more detailed discussion, analysis, and graphics on the method of sale and fuel quality issues for hydrogen refueling applications.

8:30 - 8:45 **(1) Welcome and Introductions**
The Moderator welcomes the participants and calls the meeting to order, and covers its purpose. The collaborative work by the meeting's sponsors will be recognized. Participants will be briefed on the facilities available at GTI, the schedule of events, and materials. Participants will be invited to provide their name, affiliation, and state their specific area of interest in the work to develop a hydrogen fuel specification.

8:45 - 9:00 **(2) Administrative Business**
The FSS will discuss and decide on procedures for managing and documenting its technical work. The following items will be addressed:

(a) Approve the Summary of the March 2008 USNWG Meeting

(b) Approve the USNWG Guidelines

(c) Elect a Chair

9:00 9:15 **(3) Method of Sale for Hydrogen Dispensing Applications**
The FSS is asked to consider proposals to amend NIST Handbook 130 to recognize hydrogen refueling applications to address (1) the method of sale, (2) define what products fall under this application, (3) sales to the end user on the basis of mass (kilogram) in whole cents, and (4) device labeling for hydrogen dispensers and advertisements. The proposals were modified to reflect recommendations made by the FSS at the March 2008 meeting

Proposals to modify NIST Handbook 130 Section IV. Uniform Regulations Part B. Uniform Regulations for the Method of Sale of Commodities Section 2 Non-food Products would reads as follows:

2.XX. Retail Sales of Hydrogen Fuel.

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2.XX.1. Definition.

2.XX.1.1. Hydrogen Fuel. - A fuel composed of the chemical hydrogen intended for consumption in an internal combustion engine or fuel cell.

2.XX.2. Method of Retail Sale.

2.XX.2.1. Method of Retail Sale. – All hydrogen fuel kept, offered, or exposed for sale and sold at retail must be in terms of the kilogram.

2.XX.2.2. Retail Dispenser Labeling

(a) All retail hydrogen fuel dispensers must display the unit price in whole cents on the basis of price per kilogram.

(b) The service pressure(s) of the dispenser must be conspicuously shown on the user interface in terms of bar

2.XX.2.3. Street Sign Prices and Advertisements

When the unit price for hydrogen fuel is shown on street signs or in advertisements:

(a) The unit price must be in terms of price per kilogram in whole cents (e.g., "$3.49 per kg" not "$3.499 per kg").

(b) The sign or advertisement must include the service pressure(s) at which the dispenser(s) delivers hydrogen fuel.

Although a definition for hydrogen fuel is proposed for the method of sale requirements a corresponding definitions is also proposed for NIST Handbook 130 Section IV. Uniform Regulations Part G. Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulations Section 1. Definitions to include a definition for the term hydrogen fuel that reads as follows:

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1.XX. Hydrogen Fuel. – a fuel composed of the chemical hydrogen intended for consumption in an internal combustion engine or fuel cell.

Additional proposed new definitions for the following related terms would read as follows:

1.XX Fuel Cell. – an electrochemical device used to convert hydrogen and oxygen into electrical energy to power a motor vehicle.

1.XX Internal Combustion Engine. - a device used to ignite hydrogen in a confined space to create mechanical energy to power a motor vehicle.

(4) Engine Fuel Quality
The FSS will discuss the latest updates on hydrogen fuel quality standards and recent work to measure hydrogen fuel properties. At its March 2008 meeting, the FSS indicated that there was tentative agreement with the values for Items 6, 7, 8, 9, 12, 14, and 16. The FSS also agreed that it could not support the values listed under Items 1, 2, 3, 4, 5, 10, 11, 13 and 15 in Table because there was either not enough research data or test methods available to support a decision. Table 1 once adopted would be added to NIST Handbook 130 Section IV. Uniform Regulations Part G. Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulations Section 2. Standard Fuel Specifications.

Table 1. Hydrogen Fuel Quality Specification					
	Property	**Value**	**Unit**	**Limit**	**Test Method(s)**
1	**Ammonia**	**0.1**	**ppm v/v**	**Maximum**	**To be Specified**
2	**Carbon Dioxide**	**2**	**ppm v/v**	**Maximum**	**To be Specified**
3	**Carbon Monoxide**	**0.2**	**ppm v/v**	**Maximum**	**To be Specified**
4	**Formaldehyde**	**0.01**	**ppm v/v**	**Maximum**	**To be Specified**
5	**Formic Acid**	**0.2**	**ppm v/v**	**Maximum**	**To be Specified**
6	**Helium**	**300**	**ppm v/v**	**Maximum**	**To be Specified**
7	**Hydrogen Fuel Index**	**99.97**	**% (a)**	**Minimum**	**To be Specified**
8	**Nitrogen and Argon**	**100**	**ppm v/v**	**Maximum**	**To be Specified**
9	**Oxygen**	**5**	**ppm v/v**	**Maximum**	**To be Specified**
10	**Particulate Concentration**	**1**	**µg/L @ NTP (b)**	**Maximum**	**To be Specified**
11	**Particulate Size**	**10**	**µm**	**Maximum**	**To be Specified**
12	**Total Gases**	**300**	**ppm v/v ©**	**Maximum**	**To be Specified**
13	**Total Halogenated Compounds**	**0.05**	**ppm v/v**	**Maximum**	**To be Specified**
14	**Total Hydrocarbons**	**2**	**ppm v/v (d)**	**Maximum**	**To be Specified**
15	**Total Sulfur Compounds**	**0.004**	**ppm v/v**	**Maximum**	**To be Specified**
16	**Water**	**5**	**ppm v/v**	**Maximum**	**To be Specified**
(a) The Hydrogen Fuel Index is the value obtained with the value of total gases (%) **(b) Particulate Concentration µg/L @ NTP = micrograms per liter of hydrogen fuel at 0 EC and 1 atmosphere pressure** **(c) Total Gases = Sum of all impurities listed on the table except particulates** **(d) Total Hydrocarbons may exceed 2 ppm v/v only due to the presence of methane, provided that the total gases do not exceed 300 ppm v/v.**					

(5) Laboratory Manual

The FSS will discuss ongoing work to ensure fuel quality laboratories perform measurements that are traceable to recognized national standards. The FSS will work to promote the establishment of documented laboratory practices and procedures that encompass:

(**a) Test Methods and Reproducibility Limits**

(b) Equipment (minimum and recommended) Source and Cost

(c) Documentation (e.g., Standard Operating Procedures)

(d) Handling and Storage of Hydrogen Fuel

(e) References and Good Laboratory Practices

(f) Minimum Training Standards for Laboratory Personnel

(g) Facilities

(h) Safety

10:30 - 10:45 Break – coffee, tea, juice, and pastries

10:45 **(5) Field Sampling Procedures**

The USNWG anticipates there are two separate tests that will need to be performed by weights and measures/fuel quality officials. The first is an accuracy test of the dispenser system and the second is sampling hydrogen for compliance with quality specifications.

The FSS may wish to consider work to establish field sample procedures to provide uniform inspection, sampling, and enforcement procedures to promote the protection of consumers (vehicles) and businesses from economic loss resulting from substandard product and to encourage safe practices by officials conducting inspections. It is recommended that these procedures/guidelines address:

(a) Equipment/Source/Cost

(b) Good Sampling Practice

(c) Handling, storage, and transportation

(d) Minimum Training Standards for Field Officials

11:30 - 11:45 **(6) Next Steps**

The FSS may wish to consider how future work should progress to determine the appropriate hydrogen fuel quality standards. Project work and target dates will also be identified.

11:45 - 12:00 **(7) Next Meeting**

At the conclusion of this meeting the FSS will have a better understanding of the work ahead to develop fuel quality sampling and test procedures for hydrogen used to refuel internal combustion engines and fuel cell vehicles. Some of the ground work might be accomplished through conference calls and email. Two additional meetings are tentatively planned for August 2008 and the fifth is to be determined. It is anticipated that there may be a need to dedicate an entire meeting to one specific standards' related project that is identified by the USNWG. Future meeting locations will be based on logistics and technical tasks that the USNWG must accomplish. The USNWG will make every effort to avoid scheduling conflicts with upcoming events and meetings in the weights and measures and hydrogen communities.

Meeting adjourned

CONTACTS

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