

## **Developing Proposal to Change NIST Handbook 130 To Address Hydrogen Refueling Applications**

Currently, the U.S. National Work Group (USNWG) for the Development of Commercial Hydrogen Measurement Standards is working to fully develop new method of sale and engine fuel quality requirements for NIST Handbook 130 (H130) to address gaseous hydrogen refueling applications. There is also a corresponding proposal to add a Draft Hydrogen Gas Measuring Devices Code to NIST Handbook 44. The draft codes and definitions address legal metrology requirements for the newly emerging hydrogen refueling technology. The USNWG believes the code has merit and wants to provide the weights and measures community with this information since 18 states now have hydrogen refueling stations in operation. The weights and measures community must have time to consider requirements for hydrogen-refueling dispensers before this application is available for public access at corner service stations.

The USNWG began work on this project in October 2007. Draft 2.2 of the H130 Code shown below is the result of work by the USNWG Fuel Specifications Subcommittee (FSS) at its August 2008 meeting. Draft 2.2 was further reviewed and revised by the FSS at its December 2008 meeting. The FSS plans to have Draft 2.3 available for distribution in January 2009.

An in-depth summary of L&R issues is available in the paper titled “The Starting Point: A Discussion Paper Describing a Proposed Method of Sale and Quality Specification for Hydrogen Vehicle Fuel” developed by Ken Butcher, past NIST Technical Advisor to the USNWG Fuel Specifications Subcommittee.

More information on the discussion paper and work by the USNWG is available on the NIST WMD web site at <http://ts.nist.gov/WeightsAndMeasures/index.cfm>, under the W&M Resources link to “Developing Commercial Hydrogen Measurement Standards.” To comment on this proposal, contact Lisa Warfield, NIST WMD, at [lisa.warfield@nist.gov](mailto:lisa.warfield@nist.gov), by telephone at (301) 975-3308, by fax at (301) 975-8091 or by postal mail at NIST WMD, 100 Bureau Drive, MS 2600, Gaithersburg, MD 20899-2600.

**Recommendation:** Add a Developing Item proposing new method of sale requirements for NIST Handbook 130 Section IV. Uniform Regulations Part B. Uniform Regulations for the Method of Sale of Commodities Section 2 Non-food Products to address gaseous hydrogen refueling applications as follows:

### **Section 2. Non-food Products** <sup>[Note 1, page 103]</sup>

#### **2.XX. Retail Sales. - Hydrogen Fuel (H).**

##### **2.XX.1. Definitions – Hydrogen Fuel (H).**

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

**The symbol for hydrogen vehicle fuel shall be the capital letter "H" (the word Hydrogen may also be used.)**

**2.XX.2. Method of Retail Sale and Dispenser Labeling. - All hydrogen fuel kept, offered, or exposed for sale and sold at retail shall be in terms of the kilogram.**

**2.XX.3. Retail Dispenser Labeling.**

**2.XX.3.1. A computing dispenser must display the unit price in whole cents on the basis of price per kilogram.**

**2.XX.3.2. The service pressure(s) of the dispenser must be conspicuously shown on the user interface in bar or the SI Unit of Pascal (Pa) (e.g., MPa).**

**2.XX.3.3. The product identity must be shown in a conspicuous location on the dispenser.**

**2.XX.3.4. NFPA labeling requirements also apply.**

**2.XX.4. Street Sign Prices and Advertisements.**

**2.XX.4.1. 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).**

**2.XX.4.2. The sign or advertisement must include the service pressure(s) at which the dispenser(s) delivers hydrogen fuel (e.g., H35 or H70<sub>MPa</sub>).**

**Recommendation:** Add a Developing Item to the L&R Agenda proposing new definitions for NIST Handbook 130 Section IV. Uniform Regulations Part G. Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulations Section 1. Definitions to address gaseous hydrogen refueling applications to 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. Hydrogen Fuel. - a fuel composed of the chemical hydrogen intended for consumption in an internal combustion engine or fuel cell.**

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

Cite the appropriate reference for the hydrogen fuel quality standard below that was developed by the California Division of Measurement Standards in NIST Handbook 130 Section IV. Uniform Regulations

Part G. Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulations Section 2. Standard Fuel Specifications as follows:

<b>Table 1. Hydrogen Fuel Quality Specification</b>					
	<b>Property</b>	<b>Value</b>	<b>Unit</b>	<b>Limit</b>	<b>Test Method(s)</b>
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	Particulates Size	10	µm	Maximum	to be specified
12	Total Gases	300	ppm v/v (c)	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

Footnotes to Table 1 - a. Hydrogen fuel index is the value obtained with the value of total gases (%) subtracted from 100%. b. Particulate Concentration is stated as µg/L@NTP = micrograms per liter of hydrogen fuel at 0 °C and at 1 atmosphere pressure (1 bar). 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.

The USNWG Fuel Specifications Subcommittee (FSS) did not agree on all of the properties contained in the DMS proposal because there was either not enough research data or test methods available to support a decision (see items 1, 2, 3, 4, 5, 10, 11, 13, and 15 which are highlighted in yellow) in Table 1 below. These and perhaps other properties will receive further consideration by the FSS and may be added to the quality standard in the future when such action is supported by research.

The FSS identified several quality criteria where there was tentative agreement with their associated values (see items 6, 7, 8, 9, 12, 14, and 16 which are highlighted in green) in the proposed Table 1. Hydrogen Fuel Quality Specification.

The FSS agreed to move forward with the interim fuel quality specifications in the table. However, the FSS agreed to revisit the interim standard should a different fuel quality specification be published by a nationally recognized standards body.