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**National Institute of
Standards and Technology**
U.S. Department of Commerce

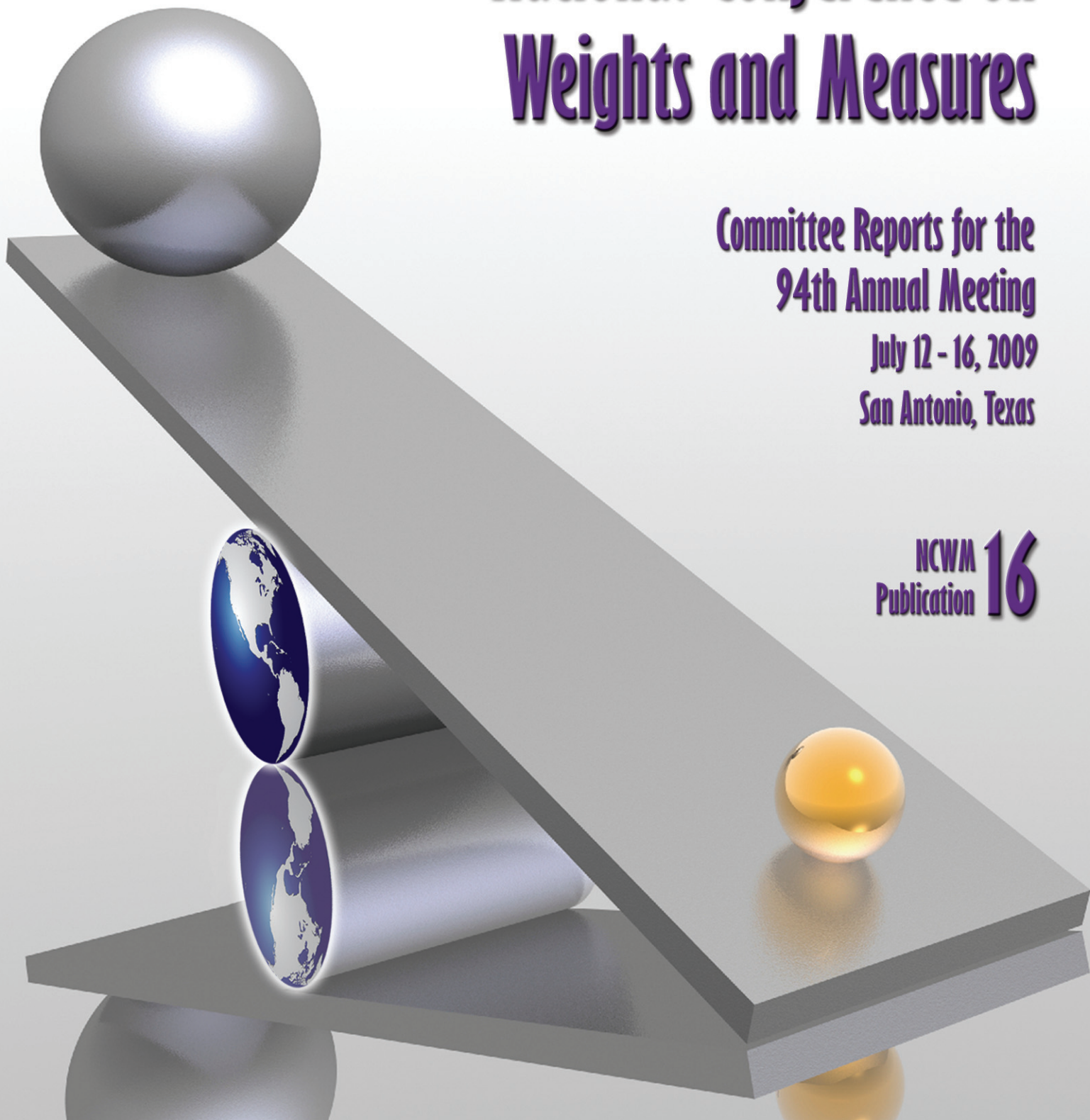
National Conference on Weights and Measures

**Committee Reports for the
94th Annual Meeting**

July 12 - 16, 2009

San Antonio, Texas

**NCWM
Publication 16**



National Conference on Weights and Measures Overview

The National Conference on Weights and Measures, Inc. is a standards development organization for weights and measures regulatory agencies of the states, counties, and cities of the United States, as well as for federal agency use. The Annual Meeting of the Conference brings together government officials and representatives of business, industry, trade associations, and consumer organizations for the purpose of hearing and discussing subjects that relate to the field of weights and measures technology and administration.

The programs of the National Conference on Weights and Measures and its committees explore the broad area of this economically important segment of governmental regulatory service. The Conference develops and recommends laws and regulations, technical codes for weighing and measuring devices used in commerce, test methods, enforcement procedures, and administrative guidelines for adoption by regulatory agencies in the interest of promoting uniformity of requirements and methods among state and local jurisdictions.

A major objective of the National Conference on Weights and Measures is to foster understanding and cooperation among weights and measures officials and all industrial, business, and consumer interests. The Conference has been cited on numerous occasions for its outstanding success.

The National Institute of Standards and Technology (NIST) has statutory responsibility for “cooperation with the states in securing uniformity of weights and measures laws and methods of inspection.” In partial fulfillment of this responsibility, the Institute is pleased to publish this document for the Conference.

The policy of NIST is to use metric units of measurement in all of its publications; however, in this publication, recommendations received by the NCWM technical committees have been printed as they were submitted and, therefore, may contain references only to inch-pound units. Opinions expressed in non-NIST papers are those of the authors and not necessarily those of NIST. Non-NIST contributors are solely responsible for the content and quality of their material.



Committee Reports for the 94th National Conference on Weights and Measures

*Prepared in coordination and cooperation with the NIST Weights and Measures Division and
the National Conference on Weights and Measures 2009*

Editors

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Steven Cook
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U.S. Department of Commerce
Gary Locke, Secretary

**National Institute of
Standards and Technology**
Patrick D. Gallagher, Deputy Director

NCWM Publication **16**
March 2009

The National Conference on Weights and Measures is supported by the National Institute of Standards and Technology and is attended by officials from various states, counties, cities, as well as representatives from U.S. Government, other nations, industry, and consumer organizations.

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National Conference on Weights and Measures

Annual Meeting of the 94th NCWM

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National Conference on Weights and Measures
"That Equity May Prevail"

Getting Involved, Making a Difference

It is my pleasure to invite you to the 94th Annual Meeting of the National Conference on Weights and Measures, which will be held July 12 - 16, 2009, at the Marriott Plaza Hotel in San Antonio Texas.

As always, the issues that will be before us are many and varied, price posting at retail, Handbook 130 tare issues, glazed seafood, and inspector training modules from the Professional Development Committee are just a sampling.

Tuesday there will be several training sessions. Presentations have been scheduled on Investigatory Techniques, Fuel Volatility and Blending and a session on Diesel Exhaust Fluid (DEF) Marketing and Enforcement.

Additionally, a number of agenda items that have been in the works for several years will be presented for vote at this meeting with Automatic Temperature Compensation (ATC) for retail sales of motor fuel being at the forefront. The Laws & Regulations Committee will be bringing their Method of Sale item forward for a vote while the Specifications & Tolerances Committee will also have ATC items on their voting agenda.

In an attempt to negate the "Dull Boy" syndrome, Don Onwiler and his staff, with some help from the Texas contingent, have put together few fun events as well. I've heard rumors of an authentic Tex-Mex feast with music, followed by boat rides on the San Antonio River for our outing Wednesday evening. Additionally, the location of the hotel lends itself quite well to a number of self-guided sightseeing venues such as the River Walk and the Alamo.

So join me this July in Texas where we can all get involved and make a difference.

See you in San Antonio.

Jack Kane
NCWM Chairman

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Past Chairmen of the Conference

44 th	1959	C. M. Fuller, CA	69 th	1984	Sam F. Hindsman, AR
45 th	1960	H. E. Crawford, FL	70 th	1985	Ezio F. Delfino, CA
46 th	1961	R. E. Meek, IN	71 st	1986	George E. Mattimoe, HI
47 th	1962	Robert Williams, NY	72 nd	1987	Frank C. Nagele, MI
48 th	1963	C. H. Stender, SC	73 rd	1988	Darrell A. Guensler, CA
49 th	1964	D. M. Turnbull, WA	74 th	1989	John J. Bartfai, NY
50 th	1965	V. D. Campbell, OH	75 th	1990	Fred A. Gerk, NM
51 st	1966	J. F. True, KS	76 th	1991	N. David Smith, NC
52 nd	1967	J. E. Bowen, MA	77 th	1992	Sidney A. Colbrook, IL
53 rd	1968	C. C. Morgan, IN	78 th	1993	Allan M. Nelson, CT
54 th	1969	S. H. Christie, NJ	79 th	1994	Thomas F. Geiler, MA
55 th	1970	R. W. Searles, OH	80 th	1995	James C. Truex, OH
56 th	1971	M. Jennings, TN	81 st	1996	Charles A. Gardner, NY
57 th	1972	E. H. Black, CA	82 nd	1997	Barbara J. Bloch, CA
58 th	1973	George L. Johnson, KY	83 rd	1998	Steven A. Malone, NE
59 th	1974	John H. Lewis, WA	84 th	1999	Aves D. Thompson, AK
60 th	1975	Sydney D. Andrews, FL	85 th	2000	G. Weston Diggs, VA
61 st	1976	Richard L. Thompson, MD	86 th	2001	Lou Straub, MD
62 nd	1977	Earl Prideaux, CO	87 th	2002	Ron Murdock, NC
63 rd	1978	James F. Lyles, VA	88 th	2003	Ross J. Andersen, NY
64 th	1979	Kendrick J. Simila, OR	89 th	2004	Dennis Ehrhart, AZ
65 th	1980	Charles H. Vincent, TX	90 th	2005	G. Weston Diggs, VA
66 th	1981	Edward H. Stadolnik, MA	91 st	2006	Don Onwiler, NE
67 th	1982	Edward C. Heffron, MI	92 nd	2007	Michael Cleary, CA
68 th	1983	Charles H. Greene, NM	93 rd	2008	Judy Cardin, WI

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**National Conference on Weights and Measures, Inc. (NCWM)
Organization Chart
2008/2009**

NCWM Board of Directors			
Office Representation		Name/Affiliation	Term Expires
Chairman:		Jack Kane, MT*	2009
Chairman-Elect:		Randy Jennings, TN*	2009
NTEP Committee Chair:		Judy Cardin, WI*	2009
Treasurer:		Will Wothlie, MD	2009
Active Membership/Northeastern:		Charles Carroll, MA*	2009
Active Membership/Central:		Steven Malone, NE*	2010
Active Membership/Southern:		Stephen Benjamin, NC	2013
Active Membership/Western:		Kirk Robinson, WA	2012
At-Large:		Stephen Langford, Cardinal Scale	2013
At-Large:		Tim Tyson, KS	2011
Associate Membership:		Robert Murnane, Seraphin Test Measure	2012
*National Type Evaluation Program (NTEP) Committee Member			
Honorary NCWM President:		Dr. Patrick D. Gallagher, NIST Deputy Director	
NCWM Executive Secretary:		Carol Hockert, Chief, NIST W&M Division	
NCWM Executive Director:		Don Onwiler, NCWM Headquarters	
BOD Advisor:		Gilles Vinet, Measurement Canada	
NTEP Administrator:		Jim Truex, NCWM Headquarters*	
NCWM Committees			
<i>Laws & Regulations Committee</i>		<i>Specifications & Tolerances Committee</i>	
Position	Name/Affiliation (Term Ends)	Position	Name/Affiliation (Term Ends)
Chair:	Joe Gomez, NM (2009)	Chair:	Todd Lucas, OH (2009)
Members:	Joe Benavides, TX (2011) Terence McBride, Memphis, TN (2010) John Gaccione, Westchester County, NY (2012) Jonelle Brent, IL (2013)	Members:	Brett Saum, CA (2010) Kristin Macey, CO (2011) Steve Giguere, ME (2012) Ken Ramsburg, MD (2013)
Associate Member Rep:	Rob Underwood, Petroleum Marketers Association		
Canadian Tech Advisor:	Doug Hutchinson	Canadian Tech Advisor:	Ted Kingsbury
NIST Tech. Advisors:	Kenneth Butcher Lisa Warfield	NIST Tech. Advisors:	Tina Butcher Steven Cook
Fuels and Lubricants Subcommittee:	Ron Hayes, Chairman, MO		

NCWM Committees (continued)	
<i>Professional Development Committee</i>	
Position	Name/Affiliation (Term Ends)
Chair:	Ross Andersen, NY (2010) Richard Cote, NH (2009)
Members:	John Sullivan, MS (2011) Stacy Carlsen, CA (2012) Julie Quinn, MN (2013)
Tech Advisor:	Vacant
Safety Liaison:	TBD
Associate Member Rep:	Steven Grabski, Walmart Stores, Inc.
<i>Nominating Committee</i>	
Chair:	Judy Cardin, WY
Members:	Ross Andersen, NY Dennis Ehrhart, AZ Thomas Geiler, MA Maxwell Gray, FL Steve Malone, NE
<i>Credentials Committee</i>	
Chair:	Raymond Johnson, NM (2009)
Members:	Dave Pfahler, SD (2010) Kim Connor, Barnstable, MA (2011)
Coordinator:	Thomas Geiler, Barnstable, MA
<i>Appointed Officers</i>	
Parliamentarian:	Lou Straub, Fairbanks Scales
Chaplain:	Stephen Langford, Cardinal Scale Manufacturing Company
Sergeants-at-Arms:	Dudley Allen, TX Sterling Smith, TX
Presiding Officers:	Tim Chesser, AR Ivan Hankins, IA Kirk Robinson, WA Jack Walsh, Framingham, MA
<i>Associate Membership Committee</i>	
Chair:	Paul Lewis, Rice Lake Weighing Systems (2009)
Vice Chair:	Michael Gaspers, Farmland Foods, Inc. (2013)
Secretary/Treasurer:	TBD
Members:	Christopher Guay, Procter and Gamble (2010) Rob Underwood, Petroleum Marketers (2009) Thomas Herrington, Nestle USA (2010) Doug Biette, Sartorius North America (2012) Paul Hoffman, Kraft (2013) Darrell Flocken, Mettler-Toledo (2013)

National Type Evaluation Technical Committees (NTETC)	
<i>NTETC Weighing Sector</i>	<i>NTETC Measuring Sector</i>
<p>Chair: Darrell Flocken, Mettler-Toledo</p> <p>Technical Advisor: Steven Cook, NIST/WMD</p> <p>Public Sector Members: Cary Ainsworth, GIPSA Ross Andersen, NY William Bates, GIPSA Luciano Burtini, Measurement Canada Tina Butcher, NIST/WMD Dan Reiswig, CA Terry Davis, KS Ken Jones, CA Jack Kane, MT Todd Lucas, OH Ronald Rigdon, MN Juana Williams, NIST/WMD</p> <p>Private Sector Members: Steven Beitzel, Systems Associates, Inc. Doug Biette, Sartorius North America Neil Copley, Thurman Scale Co. Mitchell Eyles, Flintec, Inc. Robert Feezor, Norfolk Southern Corp. Scott Henry, NCR John C. Hughes, Avery Weigh-Tronix Rafael Jimenez, Association of American Railroads Stephen Langford, Cardinal Scale Mfg. Paul Lewis, Rice Lake Weighing Systems Thomas Luna, Scales Unlimited, Inc. L. Edward Luthy, Brechbuhler Scales, Inc. Nigel Mills, Hobart Corporation Stephen Patoray, Consultants on Certification, LLC Louis Straub, Fairbanks Scales, Inc. Jerry Wang, A&D Engineering, Inc. William West, Consultant Nathaniel Wieselquist, Sick, Inc. Walter Young, Emery Winslow Scale</p>	<p>Chair: Michael Keilty, Endress & Hauser Flowtec AG</p> <p>Technical Advisor: Tina Butcher, NIST/WMD</p> <p>Public Sector Members: Ross Andersen, NY Jerry Butler, NC Mike Frailer, MD Steve Hadder, FL Dennis Beattie, Measurement Canada Todd Lucas, OH John Makin, Measurement Canada Dan Reiswig, CA Richard Wotthlie, MD</p> <p>Private Sector Members: Marc Buttler, Emerson Process Management - Micro Motion Joe Buxton, Daniel Measurement & Control Rodney Cooper, Actaris Neptune Maurice Forkert, Tuthill Transfer Systems Mike Gallo, Clean Fueling Technologies Paul Glowacki, Murray Equipment Alex Gutierrez, MEGGITT Fueling Products, Whittaker Controls Gordon Johnson, Gilbarco, Inc. Yefim Katselnik, Dresser Wayne, Inc. Douglas Long, RDM Industrial Electronics Wade Mattar, Invensys/Foxboro Daniel Maslowski, LTS Sales Richard Miller, FMC Measurement Solution Andre Noel, Neptune Technology Charlene Numrych, Liquid Controls Johnny Parrish, Brodie Meter Company, LLC Stephen Patoray, Consultants on Certification, LLC David Rajala, Veeder-Root Company Richard L. Tucker, RL Tucker Consulting</p>

National Type Evaluation Technical Committees (NTETC) (continued)	
<i>NTETC Software Sector</i>	<i>NTETC Grain Analyzer Sector</i>
<p>Co-Chairs: Norm Ingram, CA James Pettinato, FMC Technologies</p> <p>Technical Advisor: Doug Bliss, Mettler-Toledo</p> <p>Secretary: Teri Gulke, Liquid Controls LLC</p> <p>Public Sector Members: Dennis Beattie, MC Bill Fishman, NY Mike Frailer, MD Todd Lucas, OH John Roach, CA Ambler Thompson, NIST/WMD</p> <p>Private Sector Members: John Atwood, Tyson Foods Cassie Eigenmann, DICKEY-john Corp. André Elle, Endress & Hauser Flowtec AG Travis Gibson, Rice Lake Weighing Systems Keith Harper, Gencor Industries, Inc. Tony Herrin, Cardinal Scale Mfr. Co. Robert Hoblit, IBM Gordon Johnson, Gilbarco, Inc. Paul Lewis, Rice Lake Weighing Systems Mike McGhee, Actaris US Liquid Measurement Richard Miller, FMC Measurement Solutions Charlene Numrych, Liquid Controls, LLC Michael Parks, Vulcan Materials Co. Stephen Patoray, Consultants on Certification, LLC Steve J. Pollmann, Tyson Foods Mike Roach, Verifone Robin Sax, CompuWeigh Corp. Mark Schwartz, Accu-Sort Scott Szurek, Emerson Process Management David Vande Berg, Vande Berg Scales Roland Wagner, Flow Measurements & Engineering GmbH Nathaniel Wieselquist, Sick, Inc.</p>	<p>Chair: Cassie Eigenmann, DICKEY-john Corp.</p> <p>Technical Advisors: G. Diane. Lee, NIST/WMD John Barber, J. B. Associates</p> <p>Public Sector Members: Randy Burns, AR Tina Butcher, NIST/WMD Karl Cunningham, IL Todd Lucas, OH Richard Pierce, GIPSA Edward Szesnat, Jr., NY Cheryl Tew, NC</p> <p>Private Sector Members: James Bair, NA Miller’s Association Martin Clements, The Steinlite Corp. Victor Gates, Shore Sales Company Andrew Gell, Foss North America Charles Hurburgh, Jr., Iowa State University David Krejci, Grain Elevator & Processing Society Jess McCluer, National Grain & Feed Association Thomas Runyon, Seedboro Equipment</p>

National Type Evaluation Technical Committees (NTETC) (continued)	
<i>NTETC Belt Conveyor Sector</i>	
Chair:	Bill Ripka, Thermo Electron
Technical Advisor:	John Barton, NIST/WMD
Public Sector Members:	Tina Butcher, NIST/WMD Ken Jones, CA
Private Sector Members:	R. Jimenez, Association of American Railroads L. Marmsater, Merrick Industries S. Patoray, Consultants on Certification, LLC P. Sirrico, Thayer Scale - Hyer Industries, Inc. T. Vormittag, Sr., SGS Minerals Services

Regional Weights and Measures Associations	
<i>Regional Weights and Measures Contacts</i>	
Northeastern Weights and Measures Association (NEWMA): Annual Meeting 2009: May 11 - 14 Wyndham Portland Airport Hotel Portland, Maine Interim Meeting 2009: October 14 - 15 Location TBD	James Cassidy (617) 349-6133 jcassidy@cambridgema.gov Charles Carroll (617) 727-3480 ext. 21131 Charles.Carroll@state.ma.us
Southern Weights and Measures Association (SWMA): Annual Meeting 2009: October 4 - 7 (Tentative) Hilton Clearwater Beach Resort (Tentative) Clearwater, Florida	Steve Hadder Florida Department of Agriculture & Consumer Services (850) 487-2634 hadders@doacs.state.fl.us
Central Weights and Measures Association (CWMA): Annual Meeting 2009: May 3 - 6 Millennium Hotel St. Louis St. Louis, Missouri Interim Meeting 2009: September 13 - 16 Holiday Inn Rock Island, Illinois	Steve Gill Missouri Department of Agriculture (573) 751-4278 steve.gill@mda.mo.gov
Western Weights and Measures Association (WWMA): Annual Meeting 2009: September 20 - 24 Hotel Encanto de Las Cruces Las Cruces, New Mexico	Joe Gomez New Mexico Department of Agriculture (575) 646-1616 jgomez@nmda.nmsu.edu

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NCWM 94th Annual Meeting

July 12 - 16, 2009

Marriott Plaza San Antonio • San Antonio, Texas

Schedule of Events

(as of 04/20/09 – final schedule to be distributed on-site)

Saturday, July 11, 2009

8:30 a.m. - 5:00 p.m.

NCWM Board of Directors Meeting

Location

Latienda

Sunday, July 12, 2009

8:00 a.m. - 5:00 p.m.

Meter Manufacturers Association Meeting

Conference Center B

11:30 a.m. - 5:00 p.m.

Registration and Table-top Exhibits

Hidalgo Foyer

12:30 p.m. - 1:00 p.m.

Joint Meeting – All Standing Committees

Cavalier

1:00 p.m. - 5:00 p.m.

Standing Committees' Agenda Review

Board of Directors/NTEP Committee

Cavalier

Professional Development Committee

Conference Center C

Specifications & Tolerances Committee

Conference Center E

Laws & Regulations Committee

Conference Center D

1:00 p.m. - 2:45 p.m.

Followed by **Moisture Loss Work Group**

Conference Center D

2:45 p.m. - 5:00 p.m.

Chairman's Reception

Conference Center
Courtyard

Monday, July 13, 2009

7:00 a.m. - 9:00 a.m.

Continental Breakfast

Conference Center
Porches

7:00 a.m. - 5:00 p.m.

Registration and Table-top Exhibits

Hidalgo Foyer

7:30 a.m. - 8:30 a.m.

Industry Committee on Packaging & Labeling

Primavera

8:00 a.m. - 8:30 a.m.

Orientation for New Members

This session is designed to help new members become acquainted with the organization and procedures of the National Conference on Weights and Measures.

Hidalgo Ballroom

Presiding Officer:

Ivan Hankins

Iowa Department of Agriculture & Land Stewardship

Jack Kane, NCWM Chair

*Deputy Administrator, Montana Department of Labor &
Industry, Business Standards Division
Helena, MT*



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Schedule of Events

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Monday, July 13, 2009 (continued)

Location

8:00 a.m. - 8:30 a.m.

Paul Lewis, Associate Membership Committee Chair
Compliance Engineer
Rice Lake Weighing Systems, Inc.,
Rice Lake, WI

Hidalgo Ballroom

Carol T. Hockert, Executive Secretary
Chief, Weights and Measures Division, NIST
Gaithersburg, MD

8:30 a.m. - 5:00 p.m.

Official Session – Open Hearings

Hidalgo Ballroom

Note: Times of each hearing are not firm; when one Committee finishes, the next Committee will begin.

Joint Session of the L&R and S&T Committees

Specifications & Tolerances Committee

Todd Lucas, Committee Chair
Inspection Manager, Ohio Department of Agriculture,
Reynoldsburg, OH

Laws & Regulations Committee

Joe Gomez, Committee Chair
Director, Standards & Consumer Services Division,
New Mexico Department of Agriculture
Las Cruces, NM

Board of Directors

Jack Kane, NCWM Chair
Deputy Administrator, Montana Department of Labor &
Industry, Business Standards Division
Helena, MT

NTEP Committee

Judy Cardin, Committee Chair
Chief, Weights & Measures, Wisconsin Department of
Agriculture,
Madison, WI

Professional Development Committee

Ross Andersen, Committee Chair
New York Bureau of Weights & Measures
Albany, NY



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Monday, July 13, 2009 (continued)

		Location
12:00 noon. - 1:30 p.m.	Associate Membership Committee	Primavera
12:00 noon - 1:30 p.m.	Lunch (<i>on your own</i>)	
1:30 p.m. - 5:00 p.m.	Committee Work Sessions <i>Please check with the Committee Chair to reconfirm time of your work session.</i>	
	Board of Directors Meeting/NTEP Committee	Cavalier
	Laws & Regulations Committee	Conference Center D
	Professional Development Committee	Conference Center C
	Specifications & Tolerances Committee	Conference Center E

Tuesday, July 14, 2009

7:00 a.m. - 9:00 a.m.	Continental Breakfast	Conference Center Porches
7:00 a.m. - 4:00 p.m.	Registration and Table-top Exhibits	Hidalgo Foyer
8:00 a.m. – 12:00 p.m.	Official Session – Open Hearings (<i>continued as necessary</i>) Presiding Officer: Kirk Robinson <i>Program Manager, Washington Department of Agriculture, Weights & Measures Olympia, WA</i>	Hidalgo Ballroom
	General Session Pledge of Allegiance & Invocation Stephen Langford , Conference Chaplain <i>Vice President of Engineering Services, Cardinal Scale Manufacturing Co. Webb City, MO</i>	Hidalgo Ballroom
	President's Address Dr. Belinda Collins <i>Director, Technology Services, NIST Gaithersburg, MD</i>	



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Tuesday, July 14, 2009 (continued)

8:00 a.m. - 12:00 noon

OIML Strategy and Recognition Systems

Jean-François Magana, Director
International Bureau of Legal Metrology
Régine Gaucher, MAA Project Leader
International Bureau of Legal Metrology

Location

Hidalgo Ballroom

Chairman's Address

Jack Kane, NCWM Chair
*Deputy Administrator, Montana Department of Labor
& Industry, Business Standards Division,
Helena, MT*

Hidalgo Ballroom

Awards Ceremony

12 noon - 1:30 p.m.

Lunch (*on your own*)

12 noon - 1:30 p.m.

International Luncheon (by invitation only)

TBD

Technical Sessions

1:30 p.m. - 2:15 p.m.

Criminal, Civil, & Administrative Investigation Techniques

Michael Cleary, Special Assistant
California Department of Food and Agriculture

Hidalgo Ballroom

2:15 p.m. - 3:00 p.m.

Fuel Volatility and Ethanol Blending

Jim E. McGetrick, Technical Service Engineer Supervisor
BP Products North America

3:00 p.m. - 3:15 p.m.

Break

3:15 p.m. - 4:00 p.m.

Diesel Exhaust Fluid (DEF) Marketing and Enforcement

Gordon Johnson, *Gibarco*
Randy Moses, *Dresser Wayne*

Hidalgo Ballroom

After 8:00 p.m.

Addendum Sheets will be available in the Registration area no later than 8:00 p.m.



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Wednesday, July 15, 2009

		Location
7:00 a.m. - 9:00 a.m.	Continental Breakfast	Conference Center Porches
7:00 a.m. - 3:30 p.m.	Registration and Table-top Exhibits	Hidalgo Foyer
9:00 a.m. - 12 noon	Regional Association Meetings	
	Northeastern Weights and Measures Association	Conference Center B
	Southern Weights and Measures Association	Conference Center D
	Central Weights and Measures Association	Conference Center C
	Western Weights and Measures Association	Conference Center E
12 noon - 1:00 p.m.	Lunch (<i>on your own</i>)	
1:00 p.m. - 4:30 p.m.	General Voting Session	Hidalgo Ballroom
	<i>The Voting Sessions are held Wednesday afternoon through Thursday morning. Committee Chairs reserve the right to group items and select their sequence for presentation on voting. There will be no break between committee reports; registrants should plan to attend an entire voting session to ensure their presence when items of interest are likely to be under consideration.</i>	
	Presiding Officer:	
	Tim Chesser <i>Assistant Deputy Director, Arkansas Bureau of Standards Little Rock, AR</i>	
	Parliamentarian:	
	Louis Straub <i>Regulatory Affairs Consultant, Fairbank Scales, Inc. Southport, NC</i>	
	Voting on Committee Reports	
	Professional Development Committee	
	Ross Andersen , Committee Chair <i>Director, New York Bureau of Weights & Measures Albany, NY</i>	



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Schedule of Events

(as of 04/20/09 – final schedule to be distributed on-site)

Wednesday, July 15, 2009 *(continued)*

Location

1:00 p.m. - 4:30 p.m.

General Voting Session *(continued)*

Hidalgo Ballroom

Specifications & Tolerances Committee

Todd Lucas, Committee Chair

*Inspection Manager, Ohio Department of Agriculture
Reynoldsburg, OH*

Voting on Committee Reports

Laws & Regulations Committee

Joe Gomez, Committee Chair

*Director, Standards & Consumer Services Division, New
Mexico Department of Agriculture
Las Cruces, NM*

6:00 p.m. - 9:00 p.m.

NCWM Night at La Villita

Guests will make their way on foot to the charming and historic La Villita, located adjacent to the hotel, for authentic Tex-Mex food, beverage, music, and fun. Dinner will be followed with boat tours of the famous San Antonio Riverwalk departing from La Villita at 8:00 p.m. and returning at 8:45 p.m.

Thursday, July 16, 2009

7:00 a.m. - 9:00 a.m.

Continental Breakfast

Conference Center
Porches

7:00 a.m. - 10:00 a.m.

Registration

Hidalgo Foyer

9:00 a.m. - 12 noon

General Voting Session

Hidalgo Ballroom

Presiding Officer:

Jack Walsh

*Framingham Weights & Measures
Framingham, MA*

Parliamentarian:

Louis Straub

*Regulatory Affairs Consultant, Fairbanks Scales, Inc.
Southport, NC*



NCWM 94th Annual Meeting

July 12 - 16, 2009

Marriott Plaza San Antonio • San Antonio, Texas

Schedule of Events

(as of 04/20/09 – final schedule to be distributed on-site)

Thursday, July 16, 2009 *(continued)*

Location

9:00 a.m. - 12 noon

General Voting Session *(continued)*

Hidalgo Ballroom

Voting on Committee Reports

NTEP Committee

Judy Cardin, Committee Chair
Chief, Weights & Measures
Wisconsin Department of Agriculture & Consumer
Protection
Madison, WI

Board of Directors

Jack Kane, NCWM Chair
Deputy Administrator, Montana Department of Labor &
Industry, Business Standards Division
Helena, MT

Nominating Committee

Judy Cardin, Committee Chair
Chief, Weights & Measures
Wisconsin Department of Agriculture & Consumer
Protection
Madison, WI

Closing Ceremony

Passing of the Gavel

Jack Kane, Outgoing Chair

New Chairman's Address

Randy Jennings, NCWM Chair
Petroleum Administrator
Tennessee Department of Agriculture
Nashville, TN

Benediction

Stephen Langford, Conference Chaplain
Vice President of Engineering Services, Cardinal Scale
Manufacturing Co.
Webb City, MO

12 noon

Adjourn



NCWM 94th Annual Meeting

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(as of 04/20/09 – final schedule to be distributed on-site)

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General Conference Information

Purpose

The purpose of the Annual Meeting is to provide:

- (1) All members the opportunity to offer comments to the committees on items printed in the Interim Reports.
- (2) All voting delegates an opportunity to vote on committee recommendations.

Orientation for First-time Attendees

Monday, July 13, 2009
8:00 a.m. - 8:30 a.m.

All attendees, particularly those participating for the first time, are encouraged to attend the orientation meeting on Monday. This session acquaints attendees with the organization and procedures of the Conference and is open to all registered attendees.

Guide to the Interim Committee Reports

The Interim Committee Reports are provided in order for members to know the recommendations of Committees prior to the Annual Meeting. The Reports include Reference Key numbers for the following Committees:

Committee Reference Keys

Board of Directors	100 series
Laws and Regulations Committee	200 series
Specifications and Tolerances Committee	300 series
Professional Development Committee	400 series
National Type Evaluation Program Committee	500 series
Nominating Committee	800 series

The Committee Reports contain recommendations and information on items discussed at the Interim Meeting held during the week of January 11 - 14, 2009, in Daytona Beach, Florida. These reports form the basis for conduct of the committee meetings. Each committee will discuss the items in its report during the committee sessions beginning Sunday, July 12, 2009.

Item Categories

The items contained in the Committee Reports are organized into four major categories:

1. **Information Items** report on subjects and/or actions under consideration by the committee but not proposed for voting. An "I" follows the item number.
2. **Voting Items** are items for which the committee is making recommendations requiring voting by the Active Members. The recommended language to be voted on is in **bold face type**. A "V" follows the item number.

Some voting items are considered individually; the remainder may be grouped in a "Consent Calendar." **Consent Calendar Items** are voting items that the committees, just prior to the voting sessions, assemble as a single voting item on the assumption that they are non-controversial. The voting items that have been grouped into the Consent Calendar Items will be listed on the Addendum Sheets; they are designated only as voting items in this book.

General

3. **Developing Items** have the designation “D” to indicate an item has merit; however, the item was returned to the submitter for further development before any action can be taken at the national level.
4. **Withdrawn Items.** Item numbers track those assigned in the Interim Agenda. Items that the committee has withdrawn from the report are marked with a “W.”

Each committee reserves the right to shift items among the four categories (voting, information, developing, and withdrawn), except that items which are marked information, developing, or withdrawn are not shifted to the voting category. Prior to making a motion for a vote, a committee may move selected items from the Consent Calendar to be voted on individually. However, any change from the Interim Report (as contained in this document) or from what appears on the Addendum Sheets will be explained to the attendees prior to a motion and will be acted upon by the membership prior to calling for the vote.

Modifications to Committee Reports will be documented in the form of Addendum Sheets prepared by the committees following the general sessions and will be available to the attendees no later than 8:00 p.m. on Tuesday, July 14. Committee Reports may be further modified as a result of actions taken by the membership at the voting sessions on July 15 - 16, 2009.

Written Comments or Oral Statements

Any person or organization wanting to present a prepared statement at one of the committee sessions should make the request in writing to the Executive Secretary. Reasonable limitations on time allotted for presentations will be imposed. (**Note:** Only registered attendees may make presentations.)

Written comments, suggestions, and data relative to these reports must be received by the Executive Secretary or appropriate Technical Advisor by June 5, 2009. Address all comments to the National Institute of Standards and Technology, Weights and Measures Division, 100 Bureau Drive, STOP 2600, Gaithersburg, MD 20899-2600.

Final Report

Final Committee Reports will be prepared by the committees and published in the Report of the 94th Annual Meeting of the National Conference on Weights and Measures, 2009. Each member of the National Conference on Weights and Measures will receive a copy of this publication; other interested parties can receive a copy by request to the Executive Secretary.

All Meetings are Open Unless Posted

On Sunday, Committees review their agendas. All sessions of Conference meetings are normally open to members of the Conference. If a committee must discuss any issue that involves proprietary information (e.g., NTEP appeals) or other confidential material, that portion of the session dealing with the special issue may be closed provided that: (1) the Conference Chairman or, in his absence, the Chairman-Elect approves; (2) the Executive Secretary is notified; and (3) an announcement of the closed meeting is posted on or near the door to the meeting session and on the announcement board at the registration desk. If at all possible, the posting will be done at least a day prior to the planned closed session. Please note that a one-day notice will not be possible if a closed meeting is called on Sunday. Since participants may make their travel reservations in order to attend agenda reviews scheduled for Sunday, every effort will be made to limit any required closed meetings to only part of Sunday.

Board of Directors Interim Report

Jack Kane
Deputy Administrator
Business Standards Division – Montana Department of Labor and Industry

Reference
Key Number

100 INTRODUCTION

The Board of Directors held its quarterly meeting on Friday and Saturday, January 9 - 10, 2009, and continued meeting during work periods throughout the remainder of the Interim Meetings. The Board of Directors and NTEP Committee invited members to dialogue with the Board on the following issues: conformity assessment, improving efficiency and effectiveness, the National Training Program, marketplace surveys, membership, the newsletter and website, strategic planning, and participation internationally, i.e., International Organization on Legal Metrology (OIML), the OIML Mutual Acceptance Arrangement (MAA), the Canadian Forum on Trade Measurement (CFTM), the Asia-Pacific Legal Metrology Forum (APLMF), and U.S. National Work Groups (USNWG).

Table A identifies the agenda items in the Report by reference key number, item title, and page number. An item marked with an “I” after the reference key number is an informational item. An item marked with a “V” after the reference key number is a voting item. Table B lists the appendices to the Report.

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**Details of all Items
(In order by Reference Key Number)**

1. I NCWM Automatic Temperature Compensation Steering Committee

The ATC Steering Committee was formed in 2007 to assist NCWM in forming a consensus on issues before the Specifications and Tolerances Committee and the Laws and Regulations Committee. The Board receives quarterly activity reports from the Chair of the ATC Steering Committee. In addition, they review future Steering Committee activities and related NCWM work on this issue.

To date, the Steering Committee has forwarded numerous recommendations to the standing committees to assist them in the development of their respective agenda items. Following the 2008 Annual Meeting, the Steering Committee was asked to provide responses to comments and questions that were received by the Specifications and Tolerances Committee during its open hearings. The responses were provided to the Specifications and Tolerances Committee for consideration at the January 2009 NCWM Interim Meeting.

The Board of Directors has chosen to continue the support of this committee through the 2009 NCWM Annual Meeting and will reassess the need for ongoing activity at that time.

2. I Marketplace Surveys Update

At the 2009 Interim Meeting, the Board of Directors selected a subject for a new marketplace survey. This survey is now in the planning stages to take place during the 2009 - 2010 year. The survey protocol adopted by NCWM in 1999 will provide the guidelines to be followed in this survey.

3. I Membership and Meeting Attendance

The Board continues to assess avenues for improving membership and participation at Annual and Interim Meetings. Membership and attendance are driven to some degree by the items on our agendas and by the economy. It is important that NCWM be active in notifying potential stakeholders of agenda items that may be of interest and warrant their attention. This effort will have an impact on both membership and attendance.

The following is a comparison of NCWM membership levels for the past 6 years.

NCWM Membership Report						
	12/08	12/07	12/06	12/05	12/04	12/03
Associate	777	807	804	783	784	780
Foreign Assc	47	53	49	51	33	34
Federal Gov't	10	9	9	13	13	18
NIST	13	14	14	10	8	14
State Gov't	668	814	794	791	826	804
Local Gov't	522	548	547	465	453	515
Int'l Gov't	23	22	29	21	29	18
Retired	216	222	221	221	224	226
Total	2276	2489	2467	2355	2370	2409

4. I NCWM Newsletter and Website

The Board is continuing to look for ways to monitor and improve the content of the newsletter and website. The first issue of the newsletter for 2009 was published in February rather than January. This allowed timelier reporting

from the Board and Standing Committee Chairs on progress made on various agenda items during the January Interim Meeting. Members are encouraged to bring ideas and articles forward for inclusion in newsletters. Of particular interest are articles that would strike a chord with field inspectors and service industry.

Lindsay Hier, Project Coordinator for NCWM, is our webmaster. She has the expertise to make some improvements and enhancements to the site, some of which have already taken place. Approved meeting minutes from the Board of Directors quarterly meetings have been added to the "Members Only" portion of our website. This will allow membership insight into the work of the Board and its decision making. Soon, NCWM will be including the NCWM Policies on its website.

Comments and suggestions for improvements to our newsletters and website should be directed to NCWM Headquarters at (402) 434-4880 or via e-mail at info@ncwm.net.

5. I Members-Only Access to NTEP Database

The Board is considering ways to add value to the NCWM membership. One proposal being considered is allowing "Members Only" access to the searchable NTEP database. Non-members would still be able to download PDF listings of certificate holders, certificate numbers, and models covered, but they would not be able to enter the searchable Certificates of Conformance database to view the certificates.

During the 2009 Interim Meeting, several concerns were brought to the Board. Manufacturers currently have the ability to direct customers to the NCWM website to view certificates. If the general public no longer has access, manufacturers may choose to post searchable NTEP databases on their own websites. The effect would be less exposure for NCWM as fewer people visit our website. Another concern was for companies who employ large numbers of service agents or inspectors. The cost of providing that many memberships can be prohibitive, but those individuals need access to the certificates. One suggestion is to create corporate or organizational memberships, but the Board will be cautious of any policy that could actually reduce membership.

6. I Meetings Update

Interim Meetings

January 24 - 27, 2010	Hilton Nashville Downtown, Nashville, Tennessee
January 23 - 26, 2011	The Fairmont Dallas, Dallas, Texas

Annual Meetings

July 12 - 16, 2009	Marriott Plaza Hotel, San Antonio, Texas
July 11 - 15, 2010	Crowne Plaza St. Paul Hotel, St. Paul, Minnesota
July 2011	Locations are under consideration in Montana

The 2011 Annual Meeting will be held in the Western Region. The WWMA Board of Directors provided proposals to the Board of Directors for consideration in California and Montana. The Board is currently exploring opportunities for a site in Montana.

The 2012 Annual Meeting will be in the Northeast Region. The Board of Directors asks that members of NEWMA submit proposals to the Board of Directors for consideration. It is not necessary for members to enter into negotiation with hotels. Members may obtain site selection criteria from Don Onwiler, Executive Director at (402) 434-4880 or e-mail to don.onwiler@ncwm.net.

7. I Participation in International Standard Setting

Chuck Ehrlich and other NIST Weights and Measures Division (WMD) staff will brief the NCWM Board and NCWM members on key activities of OIML and regional legal metrology organizations during our open hearings (see Appendix A).

8. I Efficiency and Effectiveness

The Board is examining cost efficiency measures to control meeting and administrative costs. We welcome member feedback on this topic and any ideas to increase the effectiveness of the Conference.

Web Site

Regional Website Hosting: Two regional association websites are hosted through the NCWM website. In the past, regional associations have paid NCWM for updates to these websites on an hourly rate. This has caused the regional associations to economize by requesting updates to information posted on their sites only once or twice per year. The Board of Directors is considering a new plan for hosting that would require a reasonable flat rate annual fee to NCWM for hosting and updating regional websites. The purpose would be to keep the service affordable for the regions and promote keeping the information on the regional sites up to date.

2009 Interim Meeting: The SWMA and the CWMA have expressed interest in the new flat-rate annual fee approach. The Board further developed a proposed policy for this approach. It is important to include a system of periodic reminders to regional associations. The Board is reviewing fees assessed to the SWMA and CWMA over the past couple years. This information in combination with input from the regions will be used to establish an annual fee.

Proposal: Implement a policy for the NCWM hosting of regional websites to include the following elements:

1. NCWM will invoice the Treasurers of participating regional associations annually on January 1 in the amount of \$XXX for hosting and maintaining regional association websites.
2. Hosting fees will pertain to any website maintenance and updates that are performed in-house by NCWM staff.
3. Additional costs for services from NCWM's web host will be assessed to the regional association.
4. NCWM will contact the Chair for each participating regional association on a quarterly basis requesting any updates to their respective web pages.

Staffing

NCWM Staff: The recent transition in NCWM management has provided an opportunity for significant cost savings to NCWM. However, this transition must not sacrifice service to the NCWM stakeholders or our mission. It is the hope of the Board of Directors that, in fact, the cost savings will enable NCWM to enhance its level of service and effectiveness.

Meetings: The Board is implementing a plan whereby members may volunteer for meeting staffing. This will reduce meeting staffing costs and possibly provide local officials, who may not otherwise be able to attend, the opportunity to participate. Staffing needs will be assessed on an ongoing basis to ensure successful events for our members.

2009 Interim Meeting: All four members of NCWM staff attended the 2009 Interim Meeting. Vicky Dempsey, Montgomery County, Ohio, provided volunteer assistance for a portion of the week. NCWM staff will also attend the 2009 Annual Meeting in San Antonio, Texas. An invitation has been extended to the Texas Department of Agriculture to provide one or two volunteers that week. The level of attendance by NCWM staff for future meetings will be determined by the Board based on cost and necessity.

Travel

Travel Policy: The NCWM Travel Policy applies to any person traveling at NCWM expense. The policy will be amended to clarify that meals occurring before departure on the first day of travel and after return on the last day of travel do not qualify for reimbursement.

2009 Interim Meeting: The Board reviewed the NCWM Travel Policy and made the following amendments to take affect at the conclusion of that meeting.

Approved Travel Policy Changes:

- Maintain \$45 per day for meals and clarify that this includes tips,
- Reimburse breakfast if departing before 6 a.m. and lunch if departing before 11 a.m.,
- Reimburse lunch if returning after 2 p.m. and dinner if returning after 7 p.m.
- Reference “current” federal per diem for mileage and provide the website for accessing the rate, and
- Note on the expense form that there are no reimbursements for additional tips or phone calls.

9. W Bylaws Amendment: Article IX, Section 4 – Ad Hoc Committees, Subcommittees, Task Forces, and Study Groups

This item was withdrawn following the 2009 Interim Meeting.

Proposal: Amend Article IX, Section 4 as follows:

Ad hoc committees, subcommittees, task forces, and study groups are appointed by the Corporation Chairman from the active, advisory, ~~or~~ associate membership, **or NCWM staff** in any combination, as the need arises or the Corporation requests. All committees are subject to an annual review by the Board.

Discussion: The Board recognizes that full-time staff dedicated to NCWM could provide beneficial support and participation in the activities of special work groups. Currently, the bylaws may not provide the flexibility for use of NCWM staff in this manner.

2009 Interim Meeting: Comments from the open hearings did not support this item. Members deemed it unnecessary, stating that the current bylaws do not prohibit the Chairman from appointing NCWM staff to ad hoc committees, subcommittees, task forces, and study groups. The Board discussed potential future conflicts with current bylaws beyond the possibility of using NCWM staff. For example, there might be an opportunity to utilize the expertise of a person who is not a member of NCWM. An example might be legal support from our law firm.

The Board withdrew the proposal recognizing that there is a lot of talent in our membership, and we can draw on that.

10. I Strategic Planning

Now that the management transition to NCWM employees is complete, the Board of Directors is reassessing its short-term and long-term goals. The Board will use this opportunity to review and update its Strategic Plan to ensure the organization is moving forward and in the right direction.

2009 Interim Meeting: The Board dedicated the first day of its quarterly meeting to strategic planning. A new Strategic Plan is now in the draft and development stage. Some primary elements of the draft Strategic Plan include goals to:

1. Enhance the National Conference on Weights and Measures as a national and international resource for measurement standards development.
2. Promote uniform training for individuals involved in weights and measures.
3. Continue to improve the National Type Evaluation Program.
4. Continue to expand the role of the Conference in national legal metrology and as a resource in international legal metrology.
5. Generate support for state and local weights and measures programs.
6. Ensure financial stability of NCWM.

The Board is continuing to refine the strategies and measurements for meeting these goals. One of the strategies for the second goal is the implementation of a National Certification Program for weights and measures officials. This

strategy has been placed as a top priority. The Board is working closely with the Professional Development Committee (PDC) to achieve implementation in the very near future. More details are available in the PDC report.

Another strategy of high priority is to maintain viable support for NTEP laboratories under the third goal. The Board will be monitoring the number of FTE's associated with the authorized laboratories and will continue to track evaluation time and backlog statistics to ensure that NTEP evaluations can be completed in a timely manner.

11. I Financial Report

The NCWM operates on a fiscal year of October 1 through September 30. Last year, NCWM underwent a management transition from contracting professional association management services to opening its own office with full-time employees. This transition was complete as of October 1, 2008. The cost of the management transition as of September 30, 2008, was approximately \$155,000. This cost included obtaining office space, furniture, computers and other equipment, office supplies, salaries, etc. Anticipating a cost savings going into the new fiscal year, the budget for October 1, 2008, through September 30, 2009, projects net revenue of approximately \$102,000. This budget included funding for five staff positions, but only four have been necessary. Based on this, it is quite possible that NCWM can recover the total cost of transition in its first year under the new management structure. This ongoing cost savings should provide exciting opportunities for enhancing service and effectiveness in the near future.

The following is the balance statement as of March 31, 2009.

ASSETS	<u>March 31, 2009</u>
Current Assets	
Checking/Savings	
Associate Member Fund	12,196.19
Certificates of Deposit	611,174.96
Checking	22,307.86
Savings	199,405.36
Total Checking/Savings	<u>845,084.37</u>
Accounts Receivable	3,302.95
Other Current Assets	<u>62,428.89</u>
TOTAL ASSETS	<u>910,816.21</u>
LIABILITIES & EQUITY	
Liabilities	
Other Current Liabilities	<u>2,736.64</u>
Total Liabilities	2,736.64
Equity	
Unrestricted Net Assets	-19,348.05
Opening Balance Equity	-92,738.10
Retained Earnings	688,607.06
Net Income	331,558.66
Total Equity	<u>908,079.57</u>
TOTAL LIABILITIES & EQUITY	<u>910,816.21</u>

Jack Kane, Montana, NCWM Chairman
Randy Jennings, Tennessee, Chairman-Elect
Judy Cardin, Wisconsin, NTEP Chairman
Will Wotthlie, Maryland, Treasurer
Charles Carroll, Massachusetts, Northeastern Regional Representative
Steven Malone, Nebraska, Central Regional Representative
Stephen Benjamin, North Carolina, Southern Regional Representative
Kirk Robinson, Washington, Western Regional Representative
Stephen Langford, Cardinal Scale, At-Large
Tim Tyson, Kansas, At-Large
Robert Murnane, Seraphine Test Measure, Associate Membership
Don Onwiler, NCWM, Executive Director
Jim Truex, NTEP, Administrator
Carol Hockert, Chief, NIST, Weights and Measures Division, Executive Secretary

Board of Directors

Appendix A

Report on the Activities of the International Organization of Legal Metrology (OIML) and Regional Legal Metrology Organizations

Weights and Measures Division, NIST

INTRODUCTION

The Weights and Measures Division (WMD) of the National Institute of Standards and Technology (NIST) is responsible for coordinating U.S. participation in the International Organization of Legal Metrology (OIML) and other international legal metrology organizations. Learn more about OIML at the website www.oiml.org and about NIST Weights and Measures Division at the WMD website www.nist.gov/owm. Dr. Charles Ehrlich, Group Leader of the International Legal Metrology Group (ILMG), can be contacted at charles.ehrlich@nist.gov or at (301) 975-4834 or by fax at (301) 975-8091.

Please note: OIML publications are available without cost at <http://www.oiml.org>.

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Table B
Glossary of Acronyms

BIML	International Bureau of Legal Metrology	IR	International Recommendation
B	Basic Publication	IWG	International Work Group
CD	Committee Draft ¹	MAA	Mutual Acceptance Arrangement
CIML	International Committee of Legal Metrology	MC	Measurement Canada
CPR	Committee on Participation Review	OIML	International Organization of Legal Metrology
D	Document	R	Recommendation
DD	Draft Document ²	SC	Technical Subcommittee
DR	Draft Recommendation ²	TC	Technical Committee
DoMC	Declaration of Mutual Confidence	WD	Working Draft ³
DV	Draft Vocabulary ²	USNWG	U.S. National Work Group
ILMG	International Legal Metrology Group		

¹ CD: a draft at the stage of development within a technical committee or subcommittee; in this document, successive drafts are numbered 1 CD, 2 CD, etc.

² DD, DR, and DV: draft documents approved at the level of the technical committee or subcommittee concerned and sent to BIML for approval by CIML.

³ WD: precedes the development of a CD; in this document, successive drafts are number 1 WD, 2 WD, etc.

Details of All Items
(In Order by Reference Key Number)

I. Report on the Activities of the OIML Technical Committees

This section reports on recent activities and the status of work in OIML technical committees (TCs) and technical subcommittees (SCs) of specific interest to members of the NCWM. Also included are schedules of future activities of the Secretariats, the U.S. National Work Groups (USNWGs), and the International Work Groups (IWGs) of the committees and subcommittees.

TC 3/SC 1 “Pattern approval and evaluation” (United States)

The Subcommittee approved the U.S. proposal for a combined revision of OIML D 19 “Pattern evaluation and pattern approval” and D 20 “Initial and subsequent verification of measuring instruments and processes” into a single document entitled “Principles of metrological control of measuring instruments: type approval and verification.” Key elements of OIML D 3 “Legal qualification of measuring instruments,” R 34 “Accuracy classes of measuring instruments,” and R 42 “Metal stamps for verification officers” will also be incorporated into the combined revision of OIML D 19 and D 20. The revised documents will incorporate recent developments such as the OIML certificate system, D 27 “Initial verification of measuring instruments utilizing the manufacturer’s quality management system,” and the “Framework for a mutual acceptance arrangement (MAA) on OIML type evaluations.” Consideration will be given to the appropriate conformity assessment options developed by the ISO Council Committee on Conformity Assessment (ISO CASCO), including quality systems, product certification, and accreditation. Consideration will also be given to information technology and statistical methods to increase or decrease verification intervals based upon proven instrument performance. For more information on this activity, contact Dr. Ambler Thompson at (301) 975-2333 or at ambler@nist.gov.

TC 3/SC 5 “Conformity assessment” (United States and BIML)

The Subcommittee held a meeting in May 2008 to discuss the revision of the documents B 3 (Certificate System) and B 10 (MAA). The meeting included discussion of a WD of a new document on the incorporation of measurement uncertainty into conformity assessment decisions in legal metrology. For more information on this activity, contact Dr. Charles Ehrlich at (301) 975-4834 or at charles.ehrlich@nist.gov.

TC 5/SC 2 “Software” (Germany and BIML)

The new OIML Document D 31 “General requirements for software-controlled measuring instruments” was approved by the CIML in October 2008 and will serve as guidance for software requirements in International Recommendations by OIML technical committees. The United States participated in the technical work on this document and submitted votes and comments on several drafts of the document. A new project on software verification was also approved by the CIML in October 2008. The ILMG participated in NCWM Software Sector meetings in Columbus, Ohio, in March 2009. Please contact Dr. Ambler Thompson at (301) 975-2333 or at ambler@nist.gov if you would like to discuss OIML software efforts.

TC 6 “Prepackaged products” (South Africa)

In September 2007, NIST hosted the OIML TC 6 at NIST in Gaithersburg, Maryland. There was continued discussion on the issue of an OIML International Quantity Mark, referred to as an IQ Mark. The IQ Mark, designed to eliminate trade barriers, would be a program that would allow for an international system of acceptance of prepackaged goods. Receiving countries want imported packages to meet all requirements and packers in exporting countries want to ensure prepackages will not be rejected after arriving in the destination country. Such a program would also require that participants meet specific requirements in order to participate in a program for quantity control and marking of prepackaged goods.

The United States is participating in a work group that is developing guidelines on good manufacturing practices and additional documentation for selected criteria that would be used in the IQ Mark’s accreditation programs. It was agreed that all members of the TC 6 would send out a questionnaire to all current stakeholders, including industry, and federal and state agencies seeking input to specific questions. NIST WMD surveyed U.S. industry, including the largest manufacturers of packaged goods, in April 2008 and found no support for the IQ Mark effort. The United States believes the effort to manage and certify quality control systems will add costs to all participating suppliers. Even though there is significant opposition to the IQ Mark effort from several countries (including the United States), the technical committee continues to move forward with this project. A TC 6 meeting is scheduled for March 2009 in South Africa. Please contact Ken Butcher at (301) 975-4859 or at kenneth.butcher@nist.gov if you would like more information about the work of this subcommittee or to participate in any of these projects.

TC 8/SC 1 “Static volume and mass measurement” (Austria and Germany)

Two revised Recommendations, OIML R 71 “Fixed storage tanks” and R 85 “Automatic level gages for measuring the level of liquid in fixed storage tanks,” received final approval in October 2008. The United States, however, had serious opposition to the inclusion of specialized tanks (including pressurized tanks and non-vertical tanks) in the scope statements of both R 71 and R 85 because the requirements in the Recommendations did not fully reflect this inclusion. The United States has agreed to chair a work group that will draft the separate sections or separate appendices of R 71 and R 85 that will include the specific requirements for specialized tanks. The postal ballot review period for OIML R 80 “Road and rail tankers” was completed in January 2009, and final approval is expected in October 2009. Please contact Ralph Richter at (301) 975-3997 or at ralph.richter@nist.gov if you would like copies of the documents or to participate in any of these projects.

TC 8/SC 3 “Dynamic volume and mass measurement for liquids other than water” (United States and Germany)

OIML R 117-1 “Dynamic measuring systems for liquids other than water, Part 1: Metrological and technical requirements” has undergone an extensive revision. The Recommendation obtained 100 % international “yes” votes and final CIML approval in October 2007 and was published in March 2008. The revision incorporates new instrument technologies and includes a merger with OIML Recommendations R 86 “Drum meters” and R 105 “Mass flowmeters.” The ILMG has worked closely with the USNWG, Germany, and the Netherlands on this effort. Meetings of the USNWG on flowmeters were held during the NCWM Annual Meeting in July 2007 in Utah and the NCWM Annual Meeting in July 2008 in Burlington, Vermont. Measurement Canada has also been a strong contributor to this effort. Subcommittee work on the development of R 117-2 “Test methods” and R 117-3 “Test report format” has begun. A meeting of the IWG for R 117-2 was held in Paris in November 2008 and the next

meeting is planned for Vienna, Austria, in April 2009. If you have any questions or would like to participate in the next phases of this project, please contact Ralph Richter at (301) 975-3997 or ralph.richter@nist.gov.

TC 8/SC 5 “Water Meters” (UK)

OIML, ISO, and CEN are working together to harmonize requirements for water meters, using OIML R 49 “Water meters intended for the metering of cold potable water and hot water” parts 1, 2, and 3 as the base document. A new working draft is expected early in 2009, and a joint meeting of the three organizations is scheduled in May 2009 in Ottawa, Canada. Please contact Ralph Richter at (301) 975-3997 or at ralph.richter@nist.gov if you would like copies to participate in this project.

TC 8/SC 6 “Measurement of cryogenic liquids” (United States)

The Secretariat (United States) requested that Participating Members and U.S. stakeholders decide if there was sufficient justification for opening a new project to revise R 81 “Dynamic measuring devices and systems for cryogenic liquids.” The response received by the Secretariat indicated that a revision of R 81 was justified to update: (1) electronic tests in accordance with the latest edition of OIML D 11 (2004) and/or the latest IEC and ISO standards, (2) technical requirements to include new developments in hydrogen measurements, (3) Annex C to include current recommendations for density equations, and (4) existing sections into three distinct parts similar in format to recently-developed OIML Recommendations. The Secretariat will ask members of TC 8/SC 6 to review and formally comment on R 81. The Secretariat is also forming a national work group to establish a U.S. position on the appropriate updates to the document. To obtain more information or to participate in this project, please contact Juana Williams at (301) 975-3989 or juana.williams@nist.gov.

TC 8/SC 7 “Gas metering” (Netherlands)

In October 2007, the CIML approved the merger of TC 8/SC 7 (with France and Belgium as Co-secretariats) and TC 8/SC 8 “Gas meters” (with Netherlands as Secretariat). The Netherlands has assumed responsibility of this newly merged technical subcommittee. In October 2007, the CIML approved a new Recommendation R 139 “Compressed gaseous fuel measuring systems for vehicles.” The United States voted “no” on this document at the CIML meeting because some of the systems testing requirements were considered to be excessive and very expensive, and there are presently no testing facilities anywhere in the world that can fully perform all of the tests. The Recommendation and the excessive testing requirements are currently being reviewed by the new Secretariat and TC 8/SC 7. A request for comments from interested parties in the United States concerning the revision of R 139 was sent out in January 2009. Another new Recommendation R 140, “Measuring systems for gaseous fuel” also received CIML approval in October 2007. This Recommendation is intended for large pipelines with large flow rates and high operating pressures.

OIML R 137-1 “Gas meters” was published in 2007. It combines and replaces three old Recommendations: R 6 “General provisions for gas volume meters,” R 31 “Diaphragm gas meters,” and R 32 “Rotary piston gas meters and turbine gas meters.” Development of R 137-2 “Test methods” is now underway. Please contact Ralph Richter at (301) 975-3997 or ralph.richter@nist.gov if you would like to obtain a copy of any of these gas measurement documents or if you would like to participate in future work of this subcommittee.

TC 9 “Instruments for measuring mass” (United States)

At the 43rd CIML meeting in October 2008, the CIML approved a new work item to begin revision of OIML R 60:2000 “Metrological regulation for load cells.” It is anticipated that this revision will cover everything from the basic principles of R 60 (e.g., tolerances and accuracy classes) to exploring the addition of new requirements. For more information on these efforts, please contact John Barton at (301) 975-4002 or john.barton@nist.gov.

TC 9/SC 1 “Nonautomatic weighing instruments” (Germany and France)

The revision of R 76 “Non-automatic weighing instruments” is of major importance to U.S. interests because the Recommendation serves as the foundation for a majority of the laws and regulations that govern weighing instruments around the world. The revision includes new language addressing metrological controls for type evaluations, conformity, initial and subsequent inspections, suitability of separable components and requirements for metrological software. The USNWG was consulted concerning proposals to harmonize NIST Handbook 44 and R 76. Most recently, the United States voted “yes” on R 76-2 “Test report format,” and it was published in December 2007. For more information on these efforts, please contact Steve Cook at (301) 975-4003 or steven.cook@nist.gov.

TC 9/SC 2 “Automatic weighing instruments” (United Kingdom)

The Recommendation R 134-1 “Automatic instruments for weighing road vehicles in motion – total load and axle weighing” has been approved by CIML and published. U.S. comments concerning terminology and document scope were incorporated in the document. The test report format of this document, R 134-2, has been approved by the Subcommittee and is going through a final editorial process at the BIML.

The 3 CD of R 106 Parts 1 and 2, “Automatic rail-weighbridges” were distributed by the Secretariat to members of TC 9/SC 2 in September 2007. In distributing the 3 CD, the Secretariat commented that although the 2 CD achieved majority approval, there were substantial comments and some amendments to the technical requirements of the 2 CD. Comments and a U.S. “yes” vote on the 4 CD of R 106-1 were sent in July 2008, and it is anticipated that this document will receive final CIML approval in 2009.

The Subcommittee approved a revision of R 107 “Discontinuous totalizing automatic-weighing instruments (totalizing hopper weighers),” and final approval was granted in October 2007 by the CIML. However, the Secretariat first accommodated U.S. concerns by inserting into the document that national legislation will dictate whether the automatic zero-tracking feature is allowed in a country. If you would like to receive copies of these documents or work on these projects, please contact Richard Harshman at (301) 975-8107 or at harshman@nist.gov and John Barton at (301) 975-4002 or john.barton@nist.gov.

TC 17/SC 1 “Humidity” (China and United States)

The Co-secretariats (China and the United States) are working with a small IWG to revise OIML R 59 “Moisture meters for cereal grains and oilseeds.” All drafts have been distributed to the USNWG, which for the most part is a subset of the NTEP Grain Sector. A TC 17/SC 1 meeting was hosted by NIST in September 2007 to discuss the comments to the 4 CD. At the TC 17/SC 1 September 2007 meeting, the Subcommittee also discussed harmonization of the Recommendation for moisture with the TC 17/SC 8’s Recommendation for protein. In October 2008, the Secretariat of TC 17/SC 1 was jointly allocated to China and the United States. The 5 CD of OIML R 59 was distributed to the Subcommittee in February 2009. Please contact Diane Lee at (301) 975-4405 or at diane.lee@nist.gov if you would like to participate in this work group.

TC 17/SC 8 “Quality Analysis of Agricultural Products” (Australia)

This subcommittee was formed to study the issues and write a working draft document “Measuring instruments for protein determination in grains.” Australia is the Secretariat. A work group meeting was held in September 2006 in Ottawa, Canada, to discuss comments on the 1 CD. A TC 17/SC 8 meeting was hosted by NIST in September 2007 to discuss the 2 CD. At the September 2007 meeting, the TC 17/SC 8 also discussed comments concerning the maximum permissible errors (MPEs) and harmonization of the TC 17/SC 8 Recommendation for protein with the TC 17/SC 1 Recommendation for moisture. Please contact Diane Lee at (301) 975-4405 or at diane.lee@nist.gov if you would like to participate in this work group.

OIML Mutual Acceptance Arrangement (MAA)

Note: The report on the OIML Mutual Acceptance Arrangement (MAA) has moved. It can now be found in the NTEP section of Publication 16. For further information on the MAA and its implementation, please contact Dr. Charles Ehrlich at charles.ehrlich@nist.gov or at (301) 975-4834 or by fax at (301) 975-8091.

II. Report on the 43rd CIML Meeting in Sydney, Australia, October 2008

The International Committee of Legal Metrology (CIML) opened with addresses given by Mr. Alan E. Johnston, CIML President.

The Committee welcomed Montenegro as a new Corresponding Member and expressed its appreciation for the growing interest shown by many countries in joining the OIML. The Committee instructed its President and the Bureau to continue to raise the level of awareness of the advantages of OIML membership in order to encourage the widest possible participation in the International Legal Metrology System.

The Committee took note of the ongoing work on the revision of the MoUs with ISO and the IEC and instructed the Bureau to pursue this revision, taking into consideration the specific aspects of importance to legal metrology and to the OIML.

The Committee noted the importance given to OIML publications and conformity assessment and certification systems in the implementation of the World Trade Organization/Technical Barriers to Trade (WTO/TBT) Agreement. It instructed the CIML President and the BIML Director to continue to cooperate with the WTO and to promote the OIML as an organization facilitating compliance with the WTO/TBT Agreement.

The Committee emphasized the importance of maintaining close relations with organizations representing legal metrology stakeholders and encouraged them to participate in OIML work. It instructed the CIML President and the BIML Director to continue to identify such stakeholder organizations and to raise their awareness of OIML work.

The CIML decided that a new or revised draft OIML document or recommendation that has received CIML approval shall be available on the OIML website immediately after approval. This will allow manufacturers and OIML issuing authorities to begin preparing to issue Certificates before the document completes the final editing process and is actually published. However, OIML Basic Certificates will not be allowed until the date of final publication. The date from which an OIML MAA Certificate can be issued is specified in the corresponding DoMC.

As soon as an OIML Recommendation including the Test Report Format is published, the relevant OIML Recommendation is automatically included in the OIML Basic Certificate System. The Bureau will publish the appropriate information on the website. If a new version of an OIML Recommendation is published, the earlier version is maintained in the OIML Basic Certificate System or in the relevant OIML DoMC together with the new version.

The CIML discussed several issues concerning the OIML Mutual Acceptance Arrangement (MAA); information concerning these discussions and the committee's resolutions can be found in the NTEP section of Publication 16.

The Committee expressed its appreciation to the BIML staff for providing the first training session to TC/SC Secretariats in April 2008 and instructed the BIML to extend and update this training to those Secretariats that did not participate in the first session.

The CIML approved the following publications in Australia:

- R 85-3:2008 “Automatic level gauges for measuring the level of liquid in stationary storage tanks, Part 3: Report format for type evaluation,”
- R 99-3:2008 “Instruments for measuring vehicle exhaust emissions, Part 3: Report Format,”
- D 29:2008 “Guide for the application of ISO/IEC Guide 65 to assessment of measuring instrument certification bodies in legal metrology,”
- D 30:2008 “Guide for the application of ISO/IEC 17025 to the assessment of testing laboratories involved in legal metrology testing,” and
- D 31:2008 “General requirements for software controlled measuring instruments.”

The CIML decided to disband OIML TC 10/SC 5 “Hardness standardized blocks and hardness testing machines” (in favor of using ISO hardness standards) and approved the withdrawal of the following OIML hardness publications:

- V 3 “Hardness testing dictionary (quadrilingual),”
- R 9 “Verification and calibration of Brinell hardness standardized blocks,”
- R 10 “Verification and calibration of Vickers hardness standardized blocks,”

- R 11 “Verification and calibration of Rockwell B hardness standardized blocks,”
- R 12 “Verification and calibration of Rockwell C hardness standardized blocks,”
- R 36 “Verification of indenters for hardness testing machines,”
- R 37 “Verification of hardness testing machines (Brinell system),”
- R 38 “Verification of hardness testing machines (Vickers system),” and
- R 39 “Rockwell hardness machines.”

The CIML also approved the withdrawal of the following publications:

- R 121 “The scale of relative humidity of air certified against saturated salt solutions,” and
- D 15 “Principles of selection of characteristics for the examination of measuring instruments.”

The CIML approved the following new work items:

- Revision of V 1:2000 “International Vocabulary of Legal Metrology,”
- Revision of R 16:2002 “Mechanical non-invasive sphygmomanometers,”
- Revision of R 18:1989 “Visual disappearing filament pyrometers,”
- Revision of R 49:2006 “Water meters intended for the metering of cold potable water and hot water,”
- Revision of R 60:2000 “Metrological regulation for load cells,”
- Revision of R 91:1990 “Radar equipment for the measurement of the speed of vehicles,”
- Revision of the requirements in R 138 on measuring container bottles by TC 6,
- Revision of D 1:2004 “Elements for a Law on Metrology,”
- Revision of D 11:2004 “General requirements for electronic measuring instruments,” and
- New project: Document “Software – Methods and means of verification.”

The Committee allocated the Secretariats of the following Technical Committee and Subcommittees:

- TC 7/SC 4 “Measuring instruments for road traffic” allocated to the United States,
- TC 12 “Instruments for measuring electrical quantities” allocated to Australia, and
- TC 17/SC 1 “Humidity” allocated jointly to China and the United States.

The Committee voted to renew the contract of Mr. Ian Dunmill, Assistant Director of the Bureau.

III. Report on the 13th International Conference on Legal Metrology in Sydney, Australia, October 2008

The Conference made the recommendation that CIML members make their regulatory requirements available to the public on the Internet and that they update their Member State data on the OIML website with links to these national websites.

The Conference made the recommendation that CIML members complete the inquiry on the implementation of OIML Recommendations as accurately as possible and as soon as possible and further made the recommendation that Member States update it each time a new or revised national regulation is adopted.

The Conference made the recommendation to CIML members to keep their other governmental agencies informed of OIML work and invite them to contribute to this work.

In order to better assist developing countries, the Conference considered it important that OIML D 1 “Elements for a law on metrology” be revised to take account of the latest developments in world trade, such as conformity assessment, certification, and globalization. The Conference instructed the CIML to start a revision of OIML D 1.

The Conference sanctioned the following publications previously approved by the Committee and made the recommendation that Member States use them as the basis for their national regulations as far as possible:

- R 21:2007 “Taximeters,”
- R 35-1:2007 “Material measures of length for general use, Part 1: Metrological and technical requirements,”
- R 49-1:2006 “Water meters intended for the metering of cold potable water and hot water, Part 1: Metrological and technical requirements,”
- R 49-2:2006 “Water meters intended for the metering of cold potable water and hot water, Part 2: Test methods,”
- R 51-1:2006 “Automatic catchweighing instruments, Part 1: Metrological and technical requirements, Tests,”
- R 65:2006 “Force measuring system of uniaxial material testing machines,”
- R 76-1:2006 “Non-automatic weighing instruments, Part 1: Metrological and technical requirements, Tests,”
- R 82:2006 “Gas chromatographic systems for measuring the pollution from pesticides and other toxic substances,”
- R 83:2006 “Gas chromatograph/mass spectrometer systems for the analysis of organic pollutants in water,”
- R 107-1:2007 “Discontinuous totalizing automatic weighing instruments (totalizing hopper weighers), Part 1: Metrological and technical requirements – Tests,”
- R 116:2006 “Inductively coupled plasma atomic emission spectrometers for the measurement of metal pollutants in water,”
- R 117-1:2007 “Dynamic measuring systems for liquids other than water,”
- R 134-1:2006 “Automatic instruments for weighing road vehicles in motion and axle-load measuring, Part 1: Metrological and technical requirements – Tests,”

- R 137-1:2006 “Gas Meters, Part 1: Requirements,”
- R 138:2007 “Vessels for commercial transactions,”
- R 139:2007 “Compressed gaseous fuel measuring systems for vehicles,” and
- R 140:2007 “Measuring systems for gaseous fuel.”

The Conference directly sanctioned the following publications (without prior CIML approval) and made the recommendation that Member States use them as the basis for their national regulations as far as possible:

- R 56:2008 “Standard solutions reproducing the electrolytic conductivity,”
- R 71:2008 “Fixed storage tanks, General requirements,”
- R 85:2008 “Automatic level gauges for measuring the level of liquid in stationary storage tanks,”
- R 99-1:2008 “Instruments for measuring vehicle exhaust emissions, Part 1: Metrological and technical requirements,”
- R 99-2:2008 “Instruments for measuring vehicle exhaust emissions, Part 2: Metrological controls and performance tests,”
- R 141:2008 “Procedure for calibration and verification of the main characteristics of thermographic instruments,” and
- R 142:2008 “Automated refractometers: Methods and means of verification.”

The Conference took note of the comments made by some Member States regarding the necessity of revising the following publications as soon as possible:

- R 71:2008 “Fixed storage tanks, General requirements,”
- R 85:2008 “Automatic level gauges for measuring the level of liquid in stationary storage tanks,” and
- R 139:2007 “Compressed gaseous fuel measuring systems for vehicles.”

The Conference sanctioned the withdrawal of the OIML hardness publications listed in the CIML section of this report and also the following publications:

- R 74 “Electronic weighing instruments,” and
- R 121 “The scale of relative humidity of air certified against saturated salt solutions”

The Conference encouraged Member States to actively participate in the development and revision of OIML mutual acceptance and recognition systems. Member States were encouraged to participate in these systems, to actively promote them to all concerned parties, and to help make them acceptable in their countries.

The Conference approved the latest draft of the OIML Strategic Plan and instructed the CIML to implement it and to report on the progress in its implementation at the 14th Conference.

IV. Future OIML Meetings

The 44th CIML meeting will be held in Kenya in October 2009. The Committee thanked the United States for inviting the CIML to hold its 45th meeting in the United States in 2010 and accepted this invitation.

V. Regional Legal Metrology Organizations

Meeting of the SIM General Assembly and SIM Legal Metrology Work Group (LMWG)

The SIM General Assembly was held in San Pedro, Honduras during the first week of October 2008. Dr. Humberto S. Brandi, Director of Scientific and Industrial Metrology (SIM) at INMETRO Brazil, is the SIM President (elected last year). Marcos Senna (senna@inmetro.rs.gov.br), also of INMETRO in Brazil serves as the new Chairman of the SIM Legal Metrology Work Group (LMWG). A meeting of the SIM LMWG was held in March 2008. Topics that were discussed at the meeting included composition of the SIM Legal Metrology Work Group, SIM Legal Metrology directory, survey on training needs and their implementation, events organization costs (translation, mikes, data-show, etc.), events calendar (dates, venue, organization committee, instructors, etc.), budget for 2008 - 2009, and correspondence/communications in LMWG. Please contact Dr. Ambler Thompson at (301) 975-2333 or at ambler@nist.gov for more information.

Asia-Pacific Legal Metrology Forum (APLMF) Meeting

The 15th APLMF meeting was held October 22 - 24, 2008, in the Hunter Valley, Australia (two hours north of Sydney). The Peoples Republic of China holds the Presidency and Secretariat of the APLMF. The United States was represented by Dr. Charles Ehrlich, who serves as Chairman of the APLMF Work Group on Mutual Recognition Arrangements. APLMF activities are facilitated through its seven work groups. The most active is the work group on Training Coordination, chaired by Australia. There were three training courses and a workshop given by APLMF this year. The training courses were offered primarily to assist the developing countries in APLMF, covering requirements in the following OIML Recommendations: automated sphygmomanometers (blood pressure instruments), water meters, and a train-the-trainer course on scales. The workshop was on Metrology in Food Safety, Agricultural Products, and Product Safety. Future priorities for APLMF training courses were identified as OIML R 117 (flowmeters for liquids other than water, for which the United States is now Co-secretariat), OIML R 46 (Electricity Meters), and Traffic Safety OIML R 126 (Breathalyzers) and R 91 (Radar Devices). The next meeting of the APLMF will be in Thailand (date and venue are yet to be decided).

Appendix B

Associate Membership Committee (AMC) Agenda July 2009

- Call to Order
- Approval of January 11, 2009, AMC Minutes
- Financial Condition
- NCWM Industry Rep Reports
 - Board of Directors Report (Bob Murnane)
 - Professional Development Report (Steve Grabski)
 - Laws & Regulations Report (Rob Underwood)
- AMC Fund Disbursement Requests
 - 2008 Training Funds Report
 - New Training Requests
 - 2009 Special Event
- Old Business
- New Business
- Adjournment

Paul Lewis, Rice Lake Weighing Systems, Chair (2009)
Michael Gaspers, Farmland Foods, Inc, Vice Chair (2013)
Tom Herrington, Nestlé Foods, Secretary/Treasurer (2010)

Rob Underwood, Petroleum Marketer's Assoc. (2009)
Chris Guay, Procter & Gamble, Chair (2010)
Dave Wankowski, Kraft Foods (2012)
Doug Biette, Sartorius North America (2012)
Darrell Flocken, Mettler-Toledo (2013)
Paul Hoffman, Kraft Foods (2013)

Associate Membership Committee

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Minutes
NCWM Associate Member Committee
January 11, 2009
Daytona Beach, Florida

The following individuals were in attendance:

Steve Beitzel	Systems Associates, Inc
Darrell Flocken	Mettler-Toledo
Steven Grabski	Walmart
Chris Guay	Procter & Gamble
Carolyn Hall	Foster Farms
Ann Hines	Arkansas Oil Marketers Association, Inc.
Dennis Kolsun	H.J. Heinz Co
Stephen Langford	Cardinal Scale MFG. Co
Paul Lewis	Rice Lake Weighing Systems
Robert Murnane	Seraphin Test Measures
John Myers (Doug)	Wal-Mart
Henry Oppermann	Weights & Measures Consulting, LLC
Steve Patoray	Consultants on Certification, LLC
Lou Straub	Fairbanks Scales
Rob Underwood	Petroleum Marketers Ass
Lisa Weddig	National Fisheries Institute

Members of the NCWM Staff were also present.

Chairman Paul Lewis called the meeting to order at 10:30 a.m.

MINUTES

The minutes of the July 2008 meeting were approved.

FINANCIAL CONDITION

Chairman Lewis reported on expenses and our current balance. A copy of the financial report can be obtained by contacting the Committee Chairman or the NCWM.

BOARD OF DIRECTORS REPORT

Robert Murnane, the Associate Membership Representative on the NCWM Board of Directors gave a report about board activities:

- AMC funds have been separated from NCWM funds and placed in its own interest-bearing account. This action was done to allow the NCWM to be more open in its budgeting activity and funds usage.
- The NCWM Board of Directors began work on a new strategic plan. The plan includes six key points. Additional information on the new plan will be presented in the open hearings of the NCWM Annual Meeting.
- The Board reported that the majority of the feedback received was positive regarding the transition of NCWM management from Management Solutions to the new internal staff. Steve Langford reported that he was pleased with the transition of NTEP responsibilities.
- VCAP has been added to the review and appeals process in Publication 14.
- The Board is looking for ways to add more value to NCWM membership; one item discussed was to limit access to the full NTEP Certificates of Conformance to members only. The Board is looking for input on this idea.

- Robert reported that while the AMC agreed during the July 2007 meeting to increase associate members' dues by \$10 for this year, the increase did not happen. As the initial reason for the dues increase was to increase the AMC funding level for the special outing and this use of funds has been stopped; the question was raised as to the need to continue with the dues increase. It was moved, seconded, and approved to maintain the current AMC dues level.

AMC FUND DISBURSEMENT REPORTS

Robert Murnane suggested that AMC consider providing a lump sum to the four regional weights and measures associations to be used to support their regional meeting activities. A question was raised regarding the restriction on the use of these funds as stated in the bylaws. A work group consisting of Steve Patoray, Chris Guay, Bob Murnane, and Darrell Flocken was formed to review the bylaws and make a recommendation for changes that would be needed to support this use of AMC funds.

As the committee does not know at this time what funds will be available each year to support this activity, it was agreed that the amount would be determined annually at the January meeting.

Chris Guay made the motion to make available up to \$2000 of AMC funds in 2009 to each of the four weights and measures regions with the stipulation that the funds be used within the guidelines and restrictions currently stated in the AMC bylaws.

TRAINING REQUEST

The committee received four training requests:

1. Charles Carroll, State of Massachusetts requested \$1000 for room rental, printing for training materials and instructor fee. The training will be held for 60 to 70 state and local weights and measures officials on February 10, 2009, in Marlboro, Massachusetts. This request was approved.
2. Steve Bornmann, State of Colorado requested \$1000 for a book, DVD, and CD on a topic. Note: The application did not say what the topic(s) were. The committee felt that clarification of funds usage was needed before a final decision could be made. Paul Lewis was going to communicate this to the submitter.
3. Maryland requested funds to pay for an industry member to travel to Maryland for Point of Sale training. This request was initially denied but additional information would be requested from the submitter.
4. Michael Tang from the Measurement Standards Laboratory in Honolulu, Hawaii, wanted to know if the AMC funds would be available for metrology training. The committee decided that funds would be available as long as it was not for state-mandated training but was for additional training. Paul Lewis will communicate this to Mr. Tang.

OLD BUSINESS

During the July 2008 AMC meeting, a bylaws work group was formed to revise the current bylaws to remove reference to the AMC contribution for the NCWM outing. It was agreed that this work group would join the newly formed work group and address both the outing contribution and funds usage at the same time. The work group is requested to have their recommendation for bylaw changes ready for the July 2009 meeting.

NEW BUSINESS

Steve Grabski, Wal-Mart, agreed to serve a one-year term on the PDC beginning at this conference.

Because of the lack of training fund requests, the question was asked if the request form and guideline document were easy to find on the NCWM website. The discussion led to the fact that these documents are in the Members Only section of the website. Robert Murnane was going to mention this in the next Board meeting to see if others feel this is an acceptable location or if they should be made easier to locate.

Paul Lewis showed sample drawings of the proposed NCWM membership pin. A motion was made, seconded, and approved for Paul to purchase 500 pins.

ADJOURNMENT

The meeting was adjourned at 12:14 p.m.

Respectfully submitted,
Paul Lewis, Chairman, AMC

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Laws and Regulations Committee Interim Report

Joe Gomez, Chairman
Las Cruces, New Mexico

Reference
Key Number

200 INTRODUCTION

The Committee on Laws and Regulations (hereinafter referred to as the “Committee”) submits its Interim Report for consideration by the National Conference on Weights and Measures (NCWM). This report contains the items discussed and actions proposed by the Committee during its Interim Meeting in Daytona Beach, Florida, January 11 - 14, 2009.

Table A identifies the agenda items in the Report by reference key number, item title, and page number. The item numbers are those assigned in the Interim Meeting agenda. A voting item is indicated with a “**V**” after the item number. An item marked with an “**I**” after the reference key number is an information item. An item marked with a “**D**” after the key number is a developing item. The developing designation indicates an item has merit; however, the item is returned to the submitter for further development before any action can be taken at the national level. An item marked with a “**W**” was withdrawn by the Committee. An item marked with a “**W**” generally will be referred to the regional weights and measures associations because it either needs additional development, analysis, and input or does not have sufficient Committee support to bring it before the NCWM.

This agenda contains recommendations to amend National Institute of Standards and Technology (NIST) Handbook 130, “Uniform Laws and Regulations,” (2009), and NIST Handbook 133, “Checking the Net Contents of Packaged Goods,” (2005) 4th Edition. Revisions proposed for the handbooks are shown in **bold face print** by ~~crossing out~~ information to be deleted and underlining information to be added. Additions proposed for the handbooks are designated as such and are shown in **bold face print**. Proposals presented for information only are designated as such and are shown in *italic type*. “SI” means the International System of Units. “FPLA” means the Fair Packaging and Labeling Act. The section mark, “§,” is used in some references in the text; however, in most cases section is spelled out and is then followed by the section number and title, (for example, Section 1.2. Weight). When used in this report, the term “weight” means “mass.”

Note: The policy of NIST is to use the International System of Units (SI) in all of its publications; however, recommendations received by the NCWM technical committees have been printed in this publication as they were submitted and, therefore, may contain reference to inch-pound units.

Subject Series

INTRODUCTION	200 Series
NIST Handbook 130 – General	210 Series
Uniform Laws.....	220 Series
Weights and Measures Law (WML)	221 Series
Weighmaster Law (WL).....	222 Series
Engine Fuels and Automotive Lubricants Inspection Law (EFL).....	223 Series
Uniform Regulations	230 Series
Packaging and Labeling Regulation (PLR).....	231 Series
Method of Sale Regulation (MSR).....	232 Series
Unit Pricing Regulation (UPR)	233 Series

Voluntary Registration Regulation (VRR)..... 234 Series
 Open Dating Regulation (ODR)..... 235 Series
 Uniform National Type Evaluation Regulation (UNTER)..... 236 Series
 Engine Fuels and Automotive Lubricants Regulation (EFR)..... 237 Series

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232-3	V Method of Sale for Fireplace and Stove Wood, Flavoring Chips and Packaged Natural Wood.....	15
237	ENGINE FUELS AND AUTOMOTIVE LUBRICANTS INSPECTION REGULATION	16
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Table B
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Table C
Glossary of Acronyms

API	American Petroleum Institute	L&R	Laws & Regulations Committee
ASTM	American Society for Testing and Materials International	NCWM	National Conference on Weights & Measures
ATC	Automatic Temperature Compensation	NIST	National Institute of Standards and Technology
ATCSC	Automatic Temperature Compensation Steering Committee	MLWG	Moisture Loss Work Group
BOBs	Blend Stock for Oxygenate Blending	NCWM	National Conference on Weights & Measures
CEC	California Energy Commission	NEWMA	Northeast Weights & Measures Association
CWMA	Central Weights & Measures Association	NTEP	National Type Evaluation Program
FALS	Fuels and Lubricants Subcommittee	S&T	Specifications & Tolerances Committee
FDA	Food and Drug Administration	SI	International System of Units
FPLA	Fair Packaging and Labeling Act	SWMA	Southern Weights & Measures Association
FSS	Fuel Specifications Subcommittee	UPLR	Uniform Packaging and Labeling Regulation
FTC	Federal Trade Commission	USDA	U.S. Department of Agriculture
GAO	Government Accountability Office	USNWG	U.S. National Work Group
HB 44	NIST Handbook 44	WG	Work Group
HB 130	NIST Handbook 130	WMD	NIST Weights & Measures Division
HB 133	NIST Handbook 133	WWMA	Western Weights & Measures Association

Details of all Items
(In order by Reference Key Number)

232 METHOD OF SALE REGULATION

Background and Discussion for Items 232-1 & 232-2 Method of Sale Regulation

Note: This or similar proposals, which have been on the Committee’s agenda for several years, were reviewed by each of the regional weights and measures associations. The review process resulted in the submission of several different proposals and numerous comments and suggestions for the Committee to consider. Everyone expressed concern over the scope, cost, and impact of establishing a method of sale for petroleum products which required temperature compensation. This subject was widely discussed by the NCWM at public forums dating back more than 30 years. A similar proposal was made by NEWMA as recently as 2000, but the Committee withdrew it in

2001. NEWMA noted at that time that Pennsylvania, New Hampshire, Maine, and Canada permit temperature-compensated sales of products like home heating fuel and retail gasoline. Additional historic and background information is available in previous editions of the Committee's agenda. For recent discussions on this subject, see Item 232-1 in the report of the 93rd NCWM Annual Meeting (2008) (also available at www.nist.gov/owm). This information is also available from NIST WMD on a searchable DVD, NIST Special Publication 979 "Reports of the National Conference on Weights and Measures 1905 to 2007," (Spring 2008).

Background/Discussion: At the 2007 Annual Meeting, the Committee received 18 comments regarding this proposal requesting it to be made Informational to allow the Committee time for additional study and deliberation. The Committee believed the concerns of the commentators were valid, but these issues needed to be addressed by the S&T and NTEP Committees. Additional studies of the method of sale proposal would not bring anything new to the current recommendation that could not be addressed through further revisions next year. The Committee believed adopting this proposal would provide guidance to policymakers and others currently considering action on temperature compensation at the national, state, or local level. Jurisdictions opposing the proposal because their state laws or their policies prohibited ATC would not be affected by the adoption of this method of sale. The implementation of temperature compensation will be a slow process primarily because there is not an existing nationally approved temperature-compensation device, and NIST HB 44 must be revised to set forth the specifications, tolerances, and other technical requirements for this technology. NTEP will then need to undertake this work, where needed. The Committee acknowledged that some states may move ahead with their own type approvals (i.e., California) to allow for temperature compensation. The majority of the Committee believed the proposed method of sale was ready for NCWM adoption as there was not a reasonable justification for delaying the adoption of the proposal as presented. Therefore, the Committee recommended adoption of this item. This item was subjected to a lengthy discussion at the general voting session and several issues were raised along with calls for further study. The vote in the House of Representatives was 23 yeas and 16 nays while the vote in the House of Delegates was 24 yeas and 16 nays; therefore, the item did not garner enough support to pass. When an item does not clearly pass or fail under NCWM procedures, it is carried forward for reconsideration by the appropriate committee.

At the 2008 Interim Meeting in Albuquerque, New Mexico, the Committee considered the recommendations and comments received from the consumer groups, petroleum marketers associations, and independent business operators on this issue. The Committee received numerous written comments (refer to L&R Appendix A within the report of the 93rd NCWM Annual Meeting [2008]). During the open hearings, the Committee received comments, opinions, and concerns from more than 36 attendees. Opponents of the regulation argue that it may put the small business owners out of business due to the cost to retrofit their older equipment. A majority of the opposing comments argued that consumers would pay more for fuel at the pump to cover the implementation of ATC and these consumers would receive no benefit from the change in methods of sale. The comments also expressed concern that weights and measures officials would burden their already strained resources because of the additional time that would be needed to test pumps equipped with ATC. There was a recommendation that, if the proposed method of sale were adopted, an exemption be included for the small business owner. Several speakers said the only winners in ATC are the equipment and testing companies, lawyers, and lobbyists.

Supporting comments were received from a few state and local officials, an organization of independent truckers and a consumer advocacy group. Supporters argued that consumers obtaining gas in "hot spots" are not getting what they pay for when they purchase fuel. A few jurisdictions requested that the NCWM act to provide a uniform national standard should retailers begin selling on the basis of temperature compensated deliveries in states where the practice is permissive. Concern was voiced over the possibility that national uniformity in the method of sale of fuels at retail will diminish if some jurisdictions allow temperature compensation at retail stations while others do not. It was decided to make this item Informational, so that additional information and data could be received.

At the 2008 Annual Meeting in Burlington, Vermont, it was reported that the California Energy Commission (CEC) is conducting a study entitled "AB868 Fuel Delivery Temperature Study." One of the goals of this study will be to determine what impact ATC will have on consumers, businesses, agencies, and the marketplace within the State of California. The CEC advisory panel held three public meetings prior to the NCWM Annual Meeting in July.

2009 Activities and the Interim Meeting

The final AB868 Fuel Delivery Temperature Study report was released for review on January 30, 2009, and is scheduled to be delivered on March 11, 2009, to the California Legislature. The finalized report can be viewed at www.energy.ca.gov/2009publications/CEC-600-2009-002/CEC-600-2009-002-CTF.PDF.

In September 2008, the Government Accountability Office (GAO) published a report to the Chairman of the Committee on Science and Technology; House of Representatives on Motor Fuels “Stakeholder Views on Compensating for the Effects of Gasoline Temperature on Volume at the Pump” (refer to Appendix A of this report or view online at www.gao.gov/new.items/d081114.pdf). The GAO report summarizes that there is technology available to compensate for the effects of temperature on gas volume but the costs to implement ATC remains unclear. Benefits of ATC reflect improved measurement accuracy and greater equity between retailers and consumers. For those that oppose ATC it is argued that the cost to upgrade existing equipment would pose an economic hardship on retailers and there would be an increase in inspection and maintenance costs.

During open hearings at the 2009 Interim Meeting in Daytona Beach, Florida, a trade association expressed concern that the cost estimates in the CEC report are grossly understated. A California Agriculture Commissioner clarified that within the CEC report there is no reference to the “hot fuel myth.” A weights and measures official commented that temperatures do vary in regards to distribution points and refinery locations. A member of the Meter Manufacturing Association recommended to the Committee that the reference to 15.56 °C be removed or revised for technical reasons. The Committee believes that the U.S. petroleum industry will continue to use 60 °F for the foreseeable future and that if it changes to SI, that it will likely follow the international practice of using temperature adjustment tables based on 15 °C.

This item has been on the agenda for several years and deserves reconsideration by the full membership of the NCWM. The Committee members reviewed available information and testimony and decided that the NCWM is now in a position to make an informed decision on this issue. This is also a decision on which the entire membership must have an opportunity to vote. The Committee decided that NCWM should provide a model law to the states that allows ATC under existing laws. The Committee felt that presenting both the ATC Steering Committee (ATCSC) proposal and the original 2007 proposal to the states was the best way to move forward. There was limited attendance of fewer than 25 state representatives at the Interim Meeting. The Committee felt strongly that each state should be involved with any action or vote taken on this proposal.

The Committee is recommending adoption of one of the proposals presented below. If Item 232-1 is adopted then Item 232-2 will be withdrawn by the Committee. If Item 232-1 is not adopted, then Item 232-2 will be recommended for adoption.

The first proposal is Item 232-1, which is the proposed method of sale, developed by the ATCSC (refer to L&R pages 4 and 8 for additional background/discussion) and modified by the Committee. This proposal will permit the use of ATC on a voluntary basis for 10 years and impose specific requirements on sellers who choose that option. At the end of 10 years the proposal will require ATC to be used in all transactions. The 10-year delay will allow industry flexibility in obtaining and using the equipment. This could potentially allow for a lower cost technology to be introduced.

The second proposal, Item 232-2, which is the original proposal (refer to L&R pages 4 and 10 for additional background/discussion), was first voted on in July 2007. This proposal will permit the use of ATC on a voluntary basis if permitted by existing state laws and does not include any mandatory deadline.

The Committee learned from its Canadian Technical Advisor that international petroleum measurement is typically conducted using 15 °C. The Committee believes that the U.S. Petroleum industry will continue to use 60 °F for the foreseeable future, and, if the U.S. Petroleum industry changes to SI, it will follow the international practice of using temperature adjustment tables based on 15 °C, so the SI values have been changed to 15 °C. In the following proposals, values are given at 15 °C and the customary units are given at 60 °F to recognize current practices in the sale of petroleum. The word “permissive” was also stricken from the second proposal.

232-1 V ATC Method of Sale Proposal Developed by the NCWM ATCSC

Committee Recommendation: Amend the Method of Sale of Commodities Regulation in HB 130 by adding a new Section 2.32. Engine Fuels and Non-Engine Fuels (refer to L&R pages 4 and 8 for background/discussion).

2.32. Engine Fuels and Non-Engine Fuels.

2.32.1. Definitions.

2.32.1.1. Engine fuel – any liquid or gaseous matter used for the generation of power in an internal combustion engine.

2.32.1.2. Non-engine fuel. – any liquid or gaseous matter used for the generation of heat, power, or similar uses.

2.32.1.3. Temperature correction. – the process of correcting volume measurements at any temperature to an equivalent volume at a reference temperature.

2.32.1.4. Net volume. – the volume after temperature correction.

2.32.1.5. Gross volume. – a volume measurement that has not been subject to temperature correction.

2.32.2. Quantity.

2.32.2.1. Quantity, Wholesale Transactions.

- (a) **Effective January 1, 2010, where not in conflict with other statutes or regulations all engine fuels and non-engine fuels shall may be sold, offered, or exposed for sale to wholesale customers either in terms of liquid volume in liters or gallons or barrels, or in terms of liquid volume automatically temperature corrected to 15 °C (60 °F) (15.56 °C)-in liters or gallons or barrels.**
- (b) **Effective January 1, 2020, where not in conflict with other statutes or regulations all engine fuels and non-engine fuels shall be sold, offered, or exposed for sale to wholesale customers in terms of liquid volume automatically temperature corrected to 15 °C (60 °F) (15.56 °C)-in liters or gallons or barrels.**
- (c) **When engine fuels and non-engine fuels are sold temperature corrected to wholesale customers:**
 - (1) **Correction shall be made automatically for the fuel temperature either based on the fuel standard density and reference tables specified in Table 2.32.1. or based on the actual measured density of the fuel and using reference tables specified in Table 2.32.1.**
 - (2) **If using a measured density, the seller shall maintain records of the density determination for one year and shall make those records available for inspection by a weights and measures official on request during normal business hours.**
 - (3) **All primary indications of net volume quantities on measuring devices and all receipts, invoices, bills of lading, and other transfer documents shall clearly and conspicuously identify net volume quantities with the unit of measure and the terms “Volume corrected to 15 °C” (60 °F) or “Volume corrected to 15.56 °C.”**

- (4) Unless otherwise agreed to by both the buyer and seller in writing, engine fuels and non-engine fuels sold temperature corrected shall be sold in that manner over at least a consecutive 12-month period.

2.32.2.2. Quantity, Retail Transactions.

- (a) Effective January 1, 2010, where not in conflict with other statutes or regulations, all engine fuels and non-engine fuels identified in Table 2.32.1. may ~~shall~~ be sold, offered, or exposed for sale to retail customers either in terms of liquid volume in liters or gallons, or in terms of liquid volume automatically temperature corrected to 15 °C (60 °F) ~~(15.56 °C)~~ in liters or gallons.
- (b) Effective January 1, 2020, where not in conflict with other statutes or regulations, all engine fuels and non-engine fuels identified in Table 2.32.1. shall be sold, offered, or exposed for sale to retail customers in terms of liquid volume automatically temperature corrected to 15 °C (60 °F) ~~(15.56 °C)~~ in liters or gallons.
- (c) When engine fuels and non-engine fuels are sold temperature corrected to retail customers:
- (1) Correction shall be made automatically for the fuel temperature based on the fuel standard density and reference table in Table 2.32.1.
 - (2) All primary indications on measuring devices and all receipts, invoices, and other transfer documents shall clearly and conspicuously identify net volume quantities with the unit of measure and the terms “Volume corrected to 15 °C” or “Volume corrected to 60 °F.” ~~or “Volume corrected to 15.56 °C.”~~
 - (3) If a fuel is sold temperature corrected from a measuring device at a business or fleet location, all sales of the same fuel from that business or fleet location shall be sold temperature corrected over at least a consecutive 12-month period.
 - (4) All unit price advertisements shall be clearly and conspicuously marked with the term “ATC.”

Table 2.32.1. Reference Tables and Fuel Densities for Temperature Correction		
Fuel	Reference Table for Wholesale or Retail Temperature Correction	Standard Fuel Density for Retail Transactions (optional density for wholesale transactions)
<u>Gasoline, gasoline-oxygenate blends (3.7 mass percent oxygen, maximum), gasoline ethanol blends (10 volume percent maximum)</u>	<u>API Table 6b</u>	<u>62 API (730 kg/m³)</u>
<u>Diesel Fuel (grade 2-D), biodiesel blends (20 volume percent biodiesel, maximum)</u>	<u>API Table 6b</u>	<u>37 API (840 kg/m³)</u>
<u>Other fuels TBD</u>	-	-

(Added 2009)

Discussion/Background for 232-1 Automatic Temperature Compensation Steering Committee (ATCSC) Background and Recommended Method of Sale

Background: The ATCSC held a meeting August 27 - 29, 2007, in Chicago, Illinois, to address issues associated with potential implementation of ATC for retail motor fuel. Valuable input was received during that meeting from marketers, manufacturers, consumers, and regulatory officials. Following the meeting, the ATCSC continued to receive input from the four regional weights and measures associations.

It is not the charge of the ATCSC to endorse or oppose the implementation of ATC at retail. The ATCSC is tasked with addressing issues associated with the implementation of ATC to assist the NCWM membership in coming to a consensus on the issue. The proposals of the ATCSC reflect the Committee's opinion on the best approach to ATC if NCWM votes to implement it.

The ATCSC developed discussion points in forming a proposal for the Method of Sale Regulation. The discussion points are documented in the report of the 93rd Annual Meeting (2008).

Discussion (ATCSC): The ATCSC believes that if temperature compensation is adopted for the retail sales of refined petroleum products, then the ultimate goal is to have mandatory use of ATC to provide a single method of sale. The time period before the mandatory use of ATC is a debatable point. The ATCSC recommends that 10 years after the adoption of an ATC method of sale, using temperature compensation should be mandatory. During the first 7 years after adoption, the use of ATC should be controlled by the individual states based upon existing state laws and regulations. A relatively short period of time (2 years) is suggested during which new dispensers must be equipped with ATC capability before permissive use of ATC would be permitted. This will allow station owners to decide, based on their business needs and plans, when to buy dispensers equipped with ATC and this limits the time period during which they could not use the feature after being purchased. This requirement should be placed in NIST HB 44, as a nonretroactive requirement, to address this design requirement.

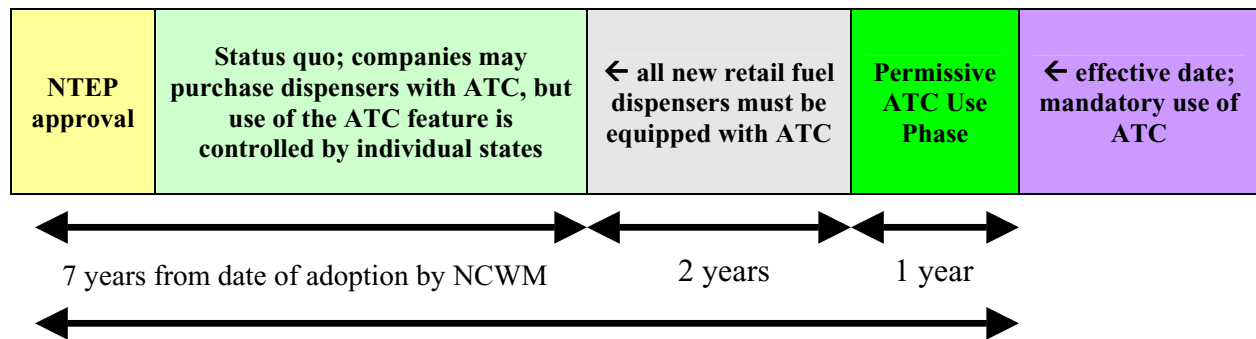
The time period for the permissive use of ATC should be kept reasonably short to reduce the potential confusion that may exist in the marketplace when both compensated and uncompensated sales occur. One year is a recommended time period for the permissive use of ATC. The ATCSC discussed whether to have different implementation dates for large and small service stations based upon throughput. The ATCSC recommends a single implementation date for all service stations to reduce the time period during which gasoline and diesel fuel will be sold in compensated

and uncompensated volumes. A short time period must be provided for the permissive use of ATC, since time is needed to activate the ATC equipped dispensers and to allow service companies and weights and measures officials to test the accuracy of ATC dispensers.

Under this implementation plan, there will be a 7-year period of continued uncertainty regarding the legal method of sale of these products. Some have argued that the lack of definitive language in setting a method of sale means that any volume unit is acceptable, compensated or uncompensated. This is based on the principle that laws proscribe activity. All other activities, not proscribed, are legal. Another interpretation is the broad policy change made by the NCWM in 1969 and 1970 in adopting specific language on ATC use. Language in NIST HB 44 was clear and directed specifically, and solely, to wholesale sales of petroleum products and for both wholesale and retail sales of LPG products. The ATCSC believes that inevitably each state will have to resolve this issue, unless it is resolved for us through currently pending federal class action suits.

10 years from date of adoption by NCWM

Implementation Option:



232-2 V Original Recommendation for a Method of Sale Proposal for ATC Developed by the 2007 Committee

Committee Recommendation: Amend the Method of Sale of Commodities Regulation in HB 130 by adding a new Section 2.32. Refined Petroleum Products (refer to L&R pages 4 and 10 for background/discussion).

2.32. Refined Petroleum Products – Permissive Temperature Compensation.

2.32.1. Where not in conflict with other statutes or regulations, these products may be sold on the basis of temperature-compensated volume.

2.32.2. When products are sold on the basis of temperature-compensated volume:

- (a) **All sales shall be in terms of liters or gallons with the delivered volume adjusted to 15 °C or of liters or gallons with the delivered volume adjusted to 15 °C (60 °F);**
- (b) **Temperature compensation must be accomplished through automatic means.**

2.32.3. Full Disclosure Requirements.

2.32.3.1. The primary indicating elements of measuring devices, recording elements, and all recorded or display representations (e.g., receipts, invoices, bills of lading, etc.) shall be clearly and conspicuously marked to show that the product was delivered on the basis of temperature-compensated volume;

2.32.3.2. When a product is offered for sale on the basis of temperature-compensated volume, street signs or other advertisements of its unit price must clearly and conspicuously indicate that the volume is temperature compensated.

2.32.4. Other Provisions.

2.32.4.1. At a business location all sales on a temperature-compensated basis shall be made continuously and for a period of not less than 12 months (e.g., a person may not engage the automatic temperature compensator on a device only during certain times of the year to prevent the person from taking advantage of temperature compensation).

2.32.4.2. At a business location which offers products for sale on the basis of a temperature-compensated volume, all measuring devices shall dispense on the basis of temperature-compensated volume (e.g., a person must not operate some devices at a location with automatic temperature compensators and others without compensators to prevent them from taking advantage of temperature variations).

Annotations:

- 1. As defined in Handbook 130 Engine Fuels, Petroleum Products, and Automotive Lubricants Inspection Law, refined petroleum products are products obtained from distilling and processing of petroleum (crude oil), unfinished oils, recycled oils, natural gas liquids, refinery blend stocks, and other miscellaneous hydrocarbon compounds as well as biofuels such as E85 and biodiesel at various blends.**
- 2. ~~A temperature compensated liter is defined as having a reference temperature of 15 °C and A~~ temperature compensated gallon is defined as 231 in³ at a reference temperature of 15 °C (60 °F);**
- 3. When a product is sold on the basis of a temperature-compensated volume, it is typically called “net” or “net volume,” whereas the volume before compensation is called the “gross” or “gross volume.”**
- 4. The metric units are shown solely for the purpose of showing metric equivalents in this uniform regulation in this NIST handbook. There is no requirement that dual units be shown in any full disclosure information required under this section.**
- 5. Temperature Compensation may be abbreviated (e.g., “Temp Comp,” or “Compensated to 60 °F”) in the interest of space as long as its meaning is clear.**
- 6. The seller is not prohibited from providing both gross and net gallons on receipts, invoices, bills of lading or other documentation as long as it is not misleading or deceptive.**
- 7. A “business location” means a single outlet and should not be interpreted to mean all of the outlets or locations that a business or company operates in a jurisdiction.**

Discussion/Background for 232-2: Temperature Compensation for Refined Petroleum Products and Other Fuels Background and Discussion

Sources: The Southern Weights and Measures Association (SWMA), the Western Weights and Measures Association (WWMA), and the Central Weights and Measures Association (CWMA).

Background: At its 2007 Interim Meeting, the Committee received correspondence from consumer groups and other organizations and heard testimony from weights and measures officials, the petroleum industry (including the American Petroleum Institute (API)), consumers and others regarding temperature compensation of refined petroleum products. The Committee appreciates all of the data, discussion, and especially the high level of interest. The Committee acknowledges the media attention this item has drawn, and the members were pleased to learn that some agricultural commissioners and other policy makers, as well as some governors and state attorneys general, have expressed interest in temperature compensation.

Proponents for the item spoke for a need to improve the accuracy of measurements of petroleum products because of their cost and of the need to improve accountability. Opponents spoke to the cost of implementing temperature compensation and the potential for confusion in the marketplace. The Committee was made aware of legislation under consideration in Missouri and Texas that would establish different definitions for a gallon based on the ambient temperature in various areas of their states. The Committee was especially sensitive to concerns expressed by weights and measures inspectors about the potential cost and increased inspection time they may expend if temperature compensation is allowed in all applications, especially at the retail level.

Comments Reviewed by the Committee at the 2007 Annual Meeting

- a. The Committee noted if the temperature compensation proposal was adopted at the 2007 Annual Meeting, it would go into effect January 1, 2008, in the 18 jurisdictions that indicated they automatically adopt that regulation by reference or citation (see 2008 Edition of NIST HB 130, "Uniformity of Laws and Regulations" (page 9) for a list of those states). The Committee recognized that if the recommendation was adopted in July 2007, some jurisdictions might want to delay its implementation or exempt that particular section from being automatically adopted. Since typically, rulemaking takes longer than six months to complete, the Committee debated whether or not it should include a delayed effective date of July 1, 2009, for this regulation but took no action on this issue.
- b. The Committee discussed the subject of unscrupulous retailers artificially heating fuels and that this deceptive practice has occurred from time to time. The State of Arizona actually forbids the practice; however, the Committee did not address that issue in the following recommendation. The Committee considered if a prohibition on the artificial heating of fuels for the purpose of increasing volume at the time of sale should be added to the recommendation but no action was taken on this issue.
- c. The Committee asked to receive comments on whether or not the recommendation should allow the state director to grant (and, when justified, revoke) written waivers to some provisions if sufficient justification was provided by the business owner. The Committee discussed whether or not the requirement that all devices that dispense product at a single location might result in a hardship for some retailers or difficulties in implementing the new method of sale for specific customers (e.g., over-the-road truckers). For example, if a station decided to sell gasoline and diesel fuel on a temperature-compensated basis but also had a dispenser for K-1 Kerosene, from which limited sales were made, a waiver from the temperature-compensation requirement on all dispensers could be justified. Likewise, if a chain of truck stops decided to sell diesel fuel on a temperature-compensated basis through its high-output dispensers to truckers (e.g., its prime customers), but did not want to implement temperature-compensated sales through its gasoline dispensers, a waiver could also be justified. The purpose of the requirement that all devices at a single location be temperature compensated or not was to prevent a retailer from selling through the compensated or uncompensated dispensers when it benefited the seller. The Committee agreed flexibility was warranted and could make acceptance of the method of sale easier to implement but took no action on this issue.

The Committee duly considered the presentations, discussions, letters, data, media stories, comments received at public hearings and in hallways, and the proposed legislation. The NCWM has posted this information and information on the activities of its ATCSC at www.ncwm.net.

Following is a list of justifications for adopting a standard that will facilitate the implementation of an orderly yet permissive approach to allowing broader use of temperature compensation in the marketplace:

- Cost of fuel has led to increased consumer and business interest in better methods of measurement, inventory control, and accountability. By now, everyone has realized or should realize that ambient temperatures are but one factor which impacts the volume of any liquid. Thus, basing a state's temperature-compensation program on regional ambient temperatures is not a technically valid approach to addressing the issue.
- The use of dual-wall storage tanks and deliveries of fuel directly from refineries result in higher temperature product.

- Awareness and concerns over the impact of temperature on the cost of fuel has come about at the same time advances in technology such as electronics and software have made compensation possible in both new and existing measuring devices at lower costs.
- Increased consumer requests that temperature compensation be used, especially in high volume deliveries, for improved measurement accuracy.
- The dramatic growth of public interest in recent years is evidenced by articles in many newspapers and widely-read magazines such as *Scientific America*. This national conversation about energy has led to greater consumer awareness, as well as interest on the part of political leaders, of energy issues and has contributed to creating an opportunity for change.

After a thorough discussion and polling by its chairman, the Committee was unanimous that it would recommend to the NCWM the adoption of a method of sale for refined petroleum products and other fuels. This would allow industry the option of selling these products on the basis of temperature-compensated sales. The decision to submit the permissive temperature-compensated method of sale for NCWM consideration was unanimous, the representative from the CWMA supported going forward with the recommendation but did not agree with including retail sales in the scope of the regulation. The Committee ultimately decided it was in the best interest of the U.S. commercial measurement system if the NCWM adopted a standard that would provide guidance to states considering legislation in this area; thus, supporting the work of the Specifications and Tolerances Committee, the National Type Evaluation Program (NTEP), and others to develop technical requirements and test procedures for both type approval and field testing for devices equipped with temperature compensation. The Committee believed those efforts were critical to facilitating the introduction of temperature compensation to the marketplace, especially in NTEP states as the NCWM learned there were no retail motor-fuel dispensers available with Certificates of Conformance that included temperature compensation functions.

At the 2009 Interim Meeting the L&R Committee dealt with various topics and considerations when addressing the development of this proposal. These items are documented in the 93rd Annual Meeting Publication 16 (2008). The Committee agreed that the metric equivalent reference temperature of 15.56 °C would be changed to 15 °C and the word “permissive” would be stricken from the proposal.

Information on the consideration of this item by the Regional Associations is presented below. Items are broken out by region with the earliest information appearing first in the report.

Central Weights and Measures Association (CWMA): This is an excerpt from the report of the CWMA’s Laws and Regulations Committee, which considered this item at its 2007 Interim Meeting in Bettendorf, Iowa, on September 16 - 19, 2007. (Full report is available at www.ncwm.net/central/lr/lr_2007_interim.doc.)

The CWMA L&R Committee reported that it received:

...considerable testimony both in support and opposition of the Temperature Compensation proposal during the open hearings. Many industry representatives opposed the item due to the anticipated cost of equipment and the lack of data that supports whether a better system of measurement is worth the cost. The CWMA L&R Committee cannot support the item as proposed due to the considerable opposition to the permissive language. Several state regulators feel that if permissive is adopted, it will be implemented in the northern states, not in the southern states where there appears to be more pressure to implement temperature compensation. A good example of this was given that in Canada where temperature compensation is allowed, it is not widely used in areas west of the Rockies where the climate is more temperate. The Committee further feels that making the item “Informational” will not resolve the issue. The most requested information of a cost-benefit analysis is not currently being conducted by any organization. Although several statements were made that temperature compensation may be a more equitable method of sale, many stated that it is not “perfect” nor will it resolve current issues of fraud such

as artificial heating of fuel. To address the concern of “hot spots,” the Committee discussed the option of amending the proposal to exclude sales at retail based upon the flow rate of dispensers as previously proposed. The Committee feels that another potential solution for a more equitable method of sale is to formulate an alternate proposal to change the method of sale to mass. Technology exists to sell motor fuel through mass flow meters. This method of sale would be more equitable for all types of fuel including alternative fuels which would allow consumers to make value comparisons. The Committee expects that the ATC Steering Committee will provide more information which will provide direction to the conference on this issue. We look forward to their information which will provide answers to many questions. Based upon the testimony heard, the Committee recommends that the item be Withdrawn. Note: In response to the ATC Steering Committee request, the CWMA L&R Committee suggests that if this proposal goes forward as a Voting item, that there be a mandatory implementation date with little to no permissive period as a transition.

At the CWMA 2008 Annual Meeting, the L&R Committee recommended that this item continue to remain Informational. They heard from an industry representative that this item does not resolve the issue of consumers being shorted at the pump. This representative further commented that there are alternative methods for measuring BTU contents, but does not support these alternative methods. A regulatory official opposed the word “permissive.”

During the CWMA Interim Meeting held September 14 - 17, 2008, in Rock Island, Illinois, the CWMA L&R Committee continued to oppose the word “permissive” in the current language of this proposal. In addition, they would like to review the GAO and CEC reports to assess their relevance.

Northeastern Weights and Measures Association (NEWMA): This is an excerpt from the report of the Laws and Regulations Committee meeting held at that association’s 2007 Interim Meeting in Springfield, Massachusetts, on October 9 - 10, 2007.

It is clear from the majority of comments received (both in written and oral form) that strong opposition exists to the item as proposed, especially the inclusion of permissive ATC sales. NEWMA could not support an item which allowed for two methods of sale. Confusion would be widespread. Additionally, the item raises far too many questions and uncertainties that to date have not been answered. Further research must be conducted to answer those questions. The National Conference on Weights and Measures is an organization made up of weights and measures officials and industry representatives that consistently over the years has worked as a consensus organization. A consensus on this item does not exist and the item should be Withdrawn. Making the item “Informational” would not bring us to the needed consensus.

At the 2008 NEWMA Annual Meeting this issue was discussed extensively. NEWMA would like to see wording developed in the method of sale to assist states where ATC is prohibited by state law or regulation. In the past, NEWMA had recommended a method of sale of gross gallons at retail only. They would like to have further development of the method of sale of gross gallons at retail. This could possibly be reviewed as a separate item.

NEWMA held their 2008 Interim Meeting October 15 - 16 in Springfield, Massachusetts. Members discussed the viability of submitting a proposal to NCWM to mandate that all sales of retail motor fuel be sold by “gross gallons” (ambient temperature). This would counter the argument “if it is not prohibited, then it is permitted.” Also, it would exempt states which choose to permit ATC. The consensus of NEWMA is that ATC should be a “state issue.” Although the majority of members would be comfortable with this, it was debated whether the “timing” of such a proposal may be premature. The debate resulted with a consensus to develop the proposal and postpone any action with it until the California (CEC) study is complete.

The GAO report was released in October 2008, and after reviewing this report, NEWMA members were disappointed by its conclusion. Comments within the report included “the continued uncertainties outlined by the GAO support the argument that no action be taken to adopt Automatic Temperature Compensation.” NEWMA recommends that this item remain Informational.

Western Weights and Measures Association (WWMA): The WWMA had an Annual Meeting September 9 - 13, 2007, in Lake Tahoe, Nevada. It voted to recommend that the Committee move a modified version of the original proposal forward as a Voting item at the 2008 NCWM Annual Meeting. The WWMA recommended removal of the term “Permissive” from the title in Section 2.30. *Refined Petroleum Products – Permissive-Temperature Compensation*. The full report is available from NIST WMD.

The WWMA met in Anchorage, Alaska, September 7 - 11, 2008. It recommended that this item continue to remain Informational. The WWMA would like to review the CEC report. It was requested from an industry representative that NCWM work on developing a temperature statistical analysis and to define “what is the problem” and “what is the solution” to this issue. Industry voiced concern on the cost of implementing ATC and how it will affect the retailers and consumers. On the other hand, a state W&M official expressed that something should be in place for when ATC does become available and used in the marketplace.

Southern Weights and Measures Association (SWMA): The SWMA held its Annual Meeting October 21 - 24, 2007, in Little Rock, Arkansas. It voted to recommend that the Committee move a modified version of the original proposal forward as a Voting item at the 2008 NCWM Annual Meeting. The amendments and other changes proposed by the SWMA are presented below. (The full report is available from the NIST L&R Technical Advisor.)

The SWMA L&R Committee heard opposition to permissive temperature compensation for retail and other meters during the open hearing primarily from industry representatives many of whom suggested that further study was needed to determine if the cost versus benefit justified adoption of the original proposal. The Committee agrees that more information would be helpful in determining the value of using ATC on retail motor-fuel dispensers that are marked to deliver less than 30 gal per minute. Several comments called for the withdrawal of the item but the Committee recognized that the item will be on the NCWM L&R Interim agenda in 2008 because it was carried over from the 2007 Annual Meeting and because the Western Weights and Measures Association supported adoption of the original item at its recent meeting. The Committee also believes that withdrawing this item as some regions have suggested would only delay consideration of this issue, which has been on the NCWM agenda in one form or another for almost a decade, because the item would likely be resubmitted by a regional association. There were other comments recommending that no further action be taken on this item or that it be tabled. One comment suggested that the original proposal be amended to limit the method of sale to Loading-Rack Meters, Vehicle-Tank Meters and Retail Dispensers which are marked to deliver 30 gal per minute or more (which are typically used in making larger quantity deliveries at truck stops). The Committee believes that separating large flow meters (some of which are already equipped with ATC) from the proposal may reduce the opposition to the proposed method of sale for ATC. A majority of the Committee recommends the following to the SWMA for adoption.

SWMA recommendation to the NCWM L&R Committee:

1. Remove the word “Permissive” from the title of the proposed method of sale for ATC.
2. Divide the item into two separate proposals.
 - a. For retail motor-fuel dispensers marked to deliver less than 30 gal/min, make it Developmental and recommend that the NCWM ATC Steering Committee lead or coordinate a study to determine if the cost/benefit justifies the implementation of ATC.

- b. For retail motor-fuel dispensers marked to deliver 30 gal/min or more, amend the method of sale proposal and establish a mandatory implementation date. The SWMA recommends that the NCWM L&R Committee move this item for adoption at the 2008 Annual Meeting with the following amendments:
 - i. Amend Section 2.30.2. to read: When products are sold on the basis of temperature-compensated volume through Loading-Rack Meters, Vehicle-Tank Meters and Retail Motor-Fuel Dispensers marked to deliver 30 gal/min or more.
 - ii. Add an implementation date of 10 years from date of adoption.

The SWMA held its Annual Meeting in Atlanta, Georgia, October 5 - 8, 2008. The SWMA Committee supports this item to remain Informational until they can review the CEC report that is to be released.

232-3 V Method of Sale for Fireplace and Stove Wood, Flavoring Chips and Packaged Natural Wood

Source: Southern Weights and Measures Association (SWMA)

Background: A state cited a company in violation of their net quantity contents labeling for flavoring chips. This citation also led to this company's product being removed from sale. The company was also advised to review all their packaging and labeling for compliance with NIST HB 130 regulations. The company requested assistance from NIST WMD on the appropriate unit of metric measure for their flavoring chip packaging. Upon review it became apparent that the regulation lacked clarity for the proper unit use of metric measure by volume. When a quantity statement for cubic meter is carried out to three decimal points it has limited meaning and is likely not useful in making value comparisons.

In HB 130, Method of Sale Regulation, Section 2.4.3.(d) states that flavoring chips shall be sold by volume, but it falls short of saying which volume units are required. Most packers also refer to Section 2.4.3. Quantity; where the guidance implies that it must be sold by the cubic meter. This permits the Method of Sale to be in conflict with Uniform Packaging and Labeling Regulation (UPLR) Declaration of Quantity for Consumer Packages Rule of 1000. Using cubic centimeters puts packers in conflict as well. Most states, if not all, give precedent to UPLR over the Method of Sale.

This item was presented at NCWM 2008 Annual Meeting and at all of the regional meetings.

At the 2009 Interim Meeting it was requested to add the words "up to one cubic foot" after the words cubic inches. The Committee agreed to modify the proposal and move it forward for a vote at the 2009 Annual Meeting.

Committee Recommendation: Amend Section 2.4.3. as follows:

2.4.3. Quantity. – Fireplace and stovewood - Shall be advertised, offered for sale, and sold only by measure, using the term "cord" and fractional parts of a cord or the cubic meter, except that:

- (a) Packaged natural wood. – Natural wood offered for sale in packaged form in quantities less than 0.45 m³ (1/8 cord or 16 ft³) shall display the quantity in terms of ~~cubic meters~~ liters, to include ~~decimal~~ fractions of cubic meters; or cubic feet **cubic inches up to one cubic foot**, to include fractions of **a cubic feet-foot**.
(Amended 200X)
- (b) Artificial compressed or processed logs. – A single fireplace log shall be sold by weight, and packages of such individual logs shall be sold by weight plus count.

- (c) Stove wood pellets or chips. – Pellets or chips not greater than 15 cm (6 in) in any dimension shall be sold by weight. This requirement does not apply to flavoring chips.
(Amended 1976 and 1991)
- (d) Flavoring chips. – ~~Flavoring chips shall be sold by volume.~~ **Flavoring chips offered for sale in packaged form in quantities less than 0.45 m³ (1/8 cord or 16 ft³) shall display the quantity in terms of liters, to include fractions of liters, cubic feet, or cubic inches up to one cubic foot, to include fractions of a cubic foot.**
(Added 1998) (~~Amended 200X~~)

Note: In determining the appropriate Method of Sale, a clear distinction must be made as to whether the wood is being sold primarily as fuel (some wood is sold as fuel but flavoring is a byproduct) or strictly a wood flavoring.

(Added 200X)

237 ENGINE FUELS AND AUTOMOTIVE LUBRICANTS INSPECTION REGULATION

237-1 V Revise Section 2.1. Gasoline and Gasoline-Oxygenate Blends

Source: Chairman, Fuels and Lubricants Subcommittee (FALS)/NIST Technical Advisor

Background: The original proposal of changes for Section 2.1. of the regulation was based on the belief by some members of the Subcommittee that there is ambiguity in the current regulation and a lack of acceptance of the current requirements by some states (refer to Item 237-2 in the report of the 93rd Annual Meeting in 2008). Some members of the Subcommittee believed that a uniform regulation should include a set of enforceable limits that provide consumer protection, yet build a bridge to the future predominance of blend stock use.

Discussion: The Fuel and Lubricants Subcommittee had met at the 2007 Interim Meeting in Jacksonville, Florida, to undertake a review of a number of significant issues related to fuel standards. One of their projects was to review and update the Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulation in NIST HB 130. The Subcommittee met at the 2007 NCWM Annual Meeting and continued its work on a number of items including a substantive revision of the fuel ethanol labeling requirement that the NCWM adopted at that meeting.

The Subcommittee met again on December 5, 2007, at the ASTM International (ASTM) meeting in Phoenix, Arizona, and considered proposed amendments to Section 2.1. as shown below but a consensus agreement could not be reached at that meeting. The Subcommittee held a conference call on January 15, 2008, to complete its work on the draft revisions of the law and regulation and to consider the proposed revisions to Section 2.1. After extensive deliberations a consensus agreement on the proposed revisions to Section 2.1. could not be obtained.

At the 2008 Interim Meeting, comments were made during the open hearings where stakeholders voiced their concerns that this item is not ready to move forward. Stakeholders would like this item to go back to FALS for additional work on the language. The L&R Committee voted to make this item Informational and requested that the Fuel and Lubricants Subcommittee reconsider this issue. If the Subcommittee can resolve its differences on the proposal, it can submit amendments to this section as part of the revision to the Engine Fuels and Automotive Lubricants regulation under Item 237-1 above (refer to L&R Appendix B from the report of the 93rd NCWM Annual Meeting (2008) for written comments received on this item). This item was sent to the full Laws and Regulations Committee for consideration at the 2008 Interim Meeting on the recommendation of NIST's Technical Advisor and with the agreement of the FALS Chairman. The section must be reviewed by the NCWM because the current language may be in conflict with federal fuel waiver provisions.

At the 2008 Annual Meeting in Burlington, Vermont, the Committee received one written comment (refer to L&R Appendix B from the report of the 93rd NCWM Annual Meeting (2008) for the written comment received on this item). This section will continue to remain Informational until additional information is received from the FALS.

At the CWMA 2008 Interim Meeting it was commented that the proposal needs clarification to identify that the regulation applies to blends containing up to 10 volume percent ethanol. They voiced this concern due to the emerging use of ethanol blends between 10 % and 70 %. The CWMA L&R Committee recommends this item remain Informational until the FALS can reach consensus.

At the 2009 Interim Meeting in Daytona Beach, Florida, Ron Hayes, the FALS Chairperson, provided a new proposal that was developed by the FALS. The differences in the proposal from that published in Publication 15 (2009) and the new proposal included in this publication are stated below:

- Incorporates the language provided by Lew Gibbs in order to remove any ambiguity regarding the applicability of the permanent 1 psi vapor pressure allowances for ethanol blends.
- Explicitly restricts this section to sub-similar fuels and existing EPA waived blends.
- Modifies Classes 1 - 5 minimum V/L values except for high elevation areas. High elevation areas are based on ASTM D4814 FIG. X1.2 Reduction in Vehicle Antiknock Requirements for Altitude.
- Provides the T50 and V/L offsets to all fuels containing ethanol, including refinery blends, CBOB, and sub-octanes. Note that the Class 5 minimum was raised from the previously published values of 37.0 °C (99 °F) to a more strict value of 39 °C (102 °F) as a compromise to negative votes.
- Sets a termination date of May 1, 2012, or when ASTM D4814 Distillation 50 % and V/L limits are amended to account for the volatility effects of up to 10 volume percent ethanol, whichever comes first, whereby all fuels must meet ASTM D4814 except the 1 psi additional vapor pressure allowance for ethanol blends will continue to be allowed.
- Places the emphasis on the finished blend rather than the gasoline portion of the blending materials. This preserves the current model regulation option of utilizing a blending stock material that does not meet ASTM D4814, e.g., a high T50, as long as the final blend parameters meet the requirements of the rule.
- Editorial work to remove redundancies and all ambiguity from the rule.

Comments were heard at the 2009 Interim Meeting that supported the proposal submitted by FALS. Many attendees commended Ron Hayes (Missouri) and Randy Jennings (Tennessee) for their hard work in preparing this proposal. Randy noted that this proposal is less ambiguous and it provides consumer protection and a bridge to the future. A state expressed concern for blends in the 30 to 40 % range. However, this proposal is only for blends up to 10 %.

Committee Recommendation: Amend Section 2.1. of the Uniform Engine Fuel, Petroleum Products, and Automotive Lubricants Regulation by replacing the current text with the following:

2.1. Gasoline and Gasoline-Oxygenate Blends

2.1.1. Gasoline and Gasoline-Oxygenate Blends – (as defined in this regulation) shall meet the most recent version of ASTM D4814 “Standard Specification for Automotive Spark-Ignition Engine Fuel” except for the permissible offsets for ethanol blends as provided in Section 2.1.3.

2.1.2. Gasoline-Oxygenate Blends shall contain no more than 10 volume percent ethanol. For other oxygenates, blends shall contain no more than 2.0 mass percent oxygen except fuels containing aliphatic ethers and/or alcohols (excluding methanol) shall contain no more than 2.7 mass percent oxygen.

2.1.3. When gasoline is blended with 1 to 10 volume percent ethanol, the ethanol shall meet the requirements of ASTM D4806 and the blend shall meet ASTM D4814 with the following permissible exceptions:

2.1.3.1. The maximum vapor pressure shall not exceed the D4814 limits by more than 1.0 psi for:

2.1.3.1.1. Only 9 to 10 volume percent ethanol blends from June 1 through September 15.

2.1.3.1.2. All blends of 1 to 10 volume percent ethanol from September 16 through May 31.

2.1.3.2. Until May 1, 2012, or until ASTM D4814 incorporates changes to the 50 volume percent evaporated point to account for the volatility effects of up to 10 volume percent ethanol, whichever occurs earlier, the distillation minimum temperature at the 50 volume percent evaporated point shall not be less than 66 °C (150 °F).

2.1.3.3. Until May 1, 2012, or until ASTM D4814 incorporates changes to the vapor lock protection minimum temperature for Classes 1 - 5 to account for the volatility effects of up to 10 volume percent ethanol, whichever occurs earlier, the minimum temperature for a Vapor-Liquid Ratio of 20 for the applicable vapor lock protection class for gasoline-ethanol blends shall be as follows:

Class 1 shall be 51.5 °C (125 °F)

Class 2 shall be 49.0 °C (120 °F)

Class 3 shall be 45.0 °C (113 °F)

Class 4 shall be 41.5 °C (107 °F)

Class 5 shall be 39.0 °C (102 °F)

Class 6 shall be 35.0 °C (95 °F)

All gasoline and gasoline-ethanol blends sold in Area V (as shown in ASTM D4814 Appendix Fig. X1.2) shall meet the vapor lock protection minimum temperatures in ASTM D4814.

For additional information contact: Ron Hayes, Chairperson FALS, phone: (573) 751-2922 or e-mail: ron.hayes@mda.mo.gov.

260 NIST HANDBOOK 133

260-1 V Guidance on Allowing for Moisture Loss and Other Revisions

(See Item 270-2 and 270-3 in the Report of the 93rd Annual NCWM Meeting in 2008)

Background: At the 2008 Interim Meeting in Daytona Beach, Florida, the NIST Technical Advisor gave a presentation to the moisture loss work group (MLWG) titled “NIST Handbook 133 Checking the Net Contents of Packaged Goods – An explanation of its statistical requirements and approaches to allowing for moisture loss from packaged goods.”

The MLWG also reviewed draft changes it has developed to revise and update the 4th Edition of NIST Handbook 133 “Checking the Net Contents of Packaged Goods” 2005. Some of the changes were developed to improve the guidance on making moisture allowances. Listed below is a table of proposed corrections and revisions for review. It was requested that comments or concerns regarding the draft changes be submitted into the NIST Technical Advisor. It was recommended that the states distribute this document to interested parties within their state for comment. The MLWG will meet Sunday, July 12, 2009, at the Annual Meeting in San Antonio, Texas, to consider any comments received prior to the meeting.

The United States Department of Agriculture (USDA), Food Safety and Inspection Service (FSIS) issued a final ruling on 9 CFR parts, 317, 381, and 442 (refer to Table B, Appendix B) “Determining Net Weight Compliance for Meat and Poultry Products” which state the procedures set forth for determining “net weight compliance.” This rule which requires the use of the 4th Edition of NIST HB 133 “Checking the Net Contents of Packaged Goods” for use in all inspections of packages of meat and poultry products subject to federal law and USDA regulations effective October 9, 2008. Therefore, the incorporated provisions of NIST Handbook 133 do not serve merely as compliance guidance, but are a part of the meat and poultry products inspection regulations.

To be consistent with this final rule, state and local officials must determine net weight compliance for meat and poultry products, including single-ingredient, raw poultry, in a manner that includes the free-flowing liquids as part of the product and not part of the tare weight.

The MLWG updated NIST HB 133 Section 2.3. “Basic Test Procedure” to be consistent with 9 CFR parts, 317, 381, and 442. That means removing any reference to the “wet tare” method for determining net weight of USDA restricted products, since FSIS considers free-flowing liquid to be part of the product.

Committee Recommendation: Amend the 4th Edition of NIST HB 133 by adopting corrections and revision listed in the table.

Handbook 133, 4th Edition (2005)		
Corrections and Revisions		
Chapter and Revision Number	Chapter, Section and Title	Action
1-1	Chapter 1. General Information	Replaced “standards” with “laws and regulations” for clarification.
1-2	Chapter 1. Section 1.2. Package Requirements, Inspection Lot	Replaced “this collection” with “the lot” for clarification.
1-3	Chapter 1. Section 1.2. Package Requirements, Individual Package Requirement	Added “for economic and other reasons” at the end of the last sentence to provide an example of at least one of the factors that packers consider in setting their filling targets. Other reasons can be aversion to risk; concern over the accuracy of nutritional information. Packers of industrial packages are especially concerned with overfilling because their packaged goods may be used in the production of other products where they are added to the process based on the package’s labeled quantity.
1-4	Chapter 1. Section 1.2. Package Requirements, Maximum Allowable Variation	Revised to improve clarity and to clarify that a package error that exceeds the Maximum Allowable Variation is an “unreasonable error.”
1-5	Chapter 1. Section 1.2. Package Requirements – Why do we allow for moisture loss or gain?	Added a paragraph explaining that moisture allowances can be made before or after determining package errors.
1-6	Chapter 1. Section 1.7. Good Measurement Practices, Certification Requirements for Standards and Test Equipment	Amended this section to refer users to NIST’s Calibration Procedures website that provides information on laboratory test procedures. Many of those on the website supersede those in NIST Handbook 145 which is cited in current text. The information presented at this URL is regularly updated by the Weights and Measures Division Metrology Group. State laboratories use it as one of their primary sources for calibration information. http://ts.nist.gov/WeightsAndMeasures/CalibrationProcedures.cfm

Handbook 133, 4th Edition (2005) Corrections and Revisions		
Chapter and Revision Number	Chapter, Section and Title	Action
2-1	Chapter 2. Basic Test Procedure, Section 2.2. Measurement Standards and Test Equipment – Which performance tests should be conducted to ensure the accuracy of a scale? – Shift Test	Amended this section to reflect the changes made in 2007 to the shift test procedures in NIST HB 44 in Section 2.20. Scales under N.1.3.7. All Other Scales.... The change in HB 44 reduced the test-load to $\frac{1}{3}$ maximum nominal capacity and amended the requirement on placement of the test load on the load receiving element. The test pattern in Diagram 1 has been changed to reflect the new requirement.
2-2	Chapter 2. Section 2.3. Basic Test Procedure – Where are Maximum Allowable Variations found?	Added a missing bullet and reference to Table 2-9. U.S. Department of Agriculture, Meat and Poultry Groups and Lower Limits for Individual Packages (Maximum Allowable Variations) to the entry for “packages bearing a USDA seal of inspection – Meat and Poultry.”
2-3	Chapter 2. Section 2.3. Basic Test Procedure, Tare Procedures – What types of tare may be used to determine the net weight of packaged goods? – Wet Tare	<p>Amended this section to reflect the USDA’s decision not to adopt the section on wet tare when it updated its regulations on net quantity of contents testing in September 2008. Effective October 9, 2008, wet tare procedures must not be used to verify the net weight of packages <u>subject to regulation by the United States Department of Agriculture</u>. The Food Safety and Inspection Service (FSIS) adopted specific sections of the 2005 printing of 4th Edition by reference but not the “wet tare” method for determining net weight compliance. FSIS considers the free-flowing liquids in packages of meat and poultry products, including single-ingredient, raw poultry products, to be integral components of these products (see Federal Register, September 9, 2008, (Volume 73, Number 175)] (Final Rule – pages 52189-52193)). Wet tare may be used for <u>non USDA-regulated products</u> but reasonable moisture allowances must be provided.</p> <p>California recommends sentence two should read as follows: Effective October 9, 2008, wet tare procedures must not be used to verify the labeled net weight of packages <u>packed at a subject to regulation by the United States Department of Agriculture (USDA) official establishment and bearing a USDA seal of inspection</u>.</p>
2-4	Chapter 2. Section 2.3. Basic Test Procedure – Tare Procedures – Used Dry Tare	<p>Within HB 133 3rd Edition, Section 3.12. Frozen Food and Other Frozen Products the following note was omitted from the 4th Edition print.</p> <p>Note: When testing frozen foods with the Used Dry Tare approach the frost found inside frozen food packages is included as part of the net contents.</p>

Handbook 133, 4th Edition (2005) Corrections and Revisions		
Chapter and Revision Number	Chapter, Section and Title	Action
2-5	Chapter 2. Section 2.3. Basic Test Procedure, Moisture Allowances – What moisture allowance is used with wet tare when testing packages bearing a USDA seal of inspection?	<p>Corrected a misprint in the moisture allowance for packages of fresh poultry to read 3 %.</p> <p>Amended this section to eliminate references to USDA-regulated products. This reflects the USDA’s decision not to adopt the section on wet tare when it updated its regulations on net quantity of contents testing in September 2008. Effective October 9, 2008, wet tare procedures must not be used to verify the net weight of packages <u>subject to regulation by the U.S. Department of Agriculture</u>. The Food Safety and Inspection Service (FSIS) adopted specific sections of the 2005 printing of 4th Edition by reference but not the “wet tare” method for determining net weight compliance. FSIS considers the free-flowing liquids in packages of meat and poultry products, including single-ingredient, raw poultry products, to be integral components of these products (see Federal Register, September 9, 2008, (Volume 73, Number 175)] (Final Rule – pages 52189-52193)). Wet tare may be used for products <u>not subject to USDA regulations</u> but reasonable moisture allowances must be provided.</p> <p>California recommends sentence two should read as follows: Effective October 9, 2008, wet tare procedures must not be used to verify the labeled net weight of packages <u>packed at a subject to regulation by the U.S. Department of Agriculture (USDA) official establishment and bearing a USDA seal of inspection.</u></p>
2-6	Chapter 2. Section 2.3. Basic Test Procedure, Determine the Nominal Gross Weight and Package Errors for a Tare Sample – What is a nominal gross weight?	<p>Reordered the second sentence to correct the guidance on using.</p> <p>Revised the directions for using the Nominal Gross Weight to determine package errors. It now reads “To obtain the package error, subtract the nominal gross weight from each package’s gross weight.”</p>
2-7	Chapter 2. Section 2.3. Basic Test Procedure, Moisture Allowances	Revised this section to include a table that collects the moisture allowances in one location in the handbook. Added guidance and examples explaining that allowances can be applied before or after the packages are tested.
2-8	Chapter 2. Section 2.4. Borax – How is the volume determined? – Example under 3.	Deleted 2530 cm ³ because that example caused confusion. The actual values on boxes of Borax vary with the package size, which may change frequently for marketing reasons.

Handbook 133, 4th Edition (2005)		
Corrections and Revisions		
Chapter and Revision Number	Chapter, Section and Title	Action
2-9	Chapter 2. Section 2.5. The Determination of Drained Weight	The AOAC (Association of Official Analytical Chemists) test procedure that FDA uses for drained weight determinations requires a different sieve size from what is required in the handbook to be used for canned tomatoes. A note was added to Handbook 133 so that the HB 133 requirement matches the sieve size for canned tomatoes in AOAC 968.30 "Canned Vegetables Drained Weight Procedure." That AOAC procedure specifies that a U.S. No. 11.3 mm ($\frac{7}{16}$ in) standard test sieve be used for canned tomatoes.
2-10	Chapter 2. Section 2.6. Drained Weight for Glazed and Frozen Foods	<p>2.6 Drained Weight for Glazed or Frozen Foods</p> <p>How is the drained weight of frozen shrimp (e.g., 2.27 kg [(5 lb)] blocks of shrimp) and crabmeat determined?</p> <p>When determining the net weight of frozen shrimp and crabmeat, use the test equipment and procedure provided below. Immerse the product (e.g., a block of frozen shrimp) directly in water in a mesh basket or open container to thaw (e.g., it is not placed in a plastic bag). Direct immersion does not result in the product absorbing moisture because the freezing process causes the tissue to lose its ability to hold water. Maintain the water temperature between 23 °C to 29 °C (75 °F to 85 °F). This is accomplished by maintaining a constant flow of warm water into the container holding the product (e.g., place a bucket in a sink to catch the overflow, and feed warm water into the bottom of the bucket through a hose). After thawing, drain the product on a sieve for 2 minutes and weigh it.</p> <p>Equipment</p> <ul style="list-style-type: none"> • Partial immersion thermometer or equivalent with 1 °C (2 °F) graduations and a -35 °C to +50 °C (-30 °F to +120 °F) accurate to ±1 °C (±2 °F) • Water source and hose with an approximate flow rate of 4 L to 15 L (1 gal to 4 gal) per minute for thawing blocks and other products • Sink or other receptacle (i.e., bucket with a capacity of approximately 15 L [4 gal]) for thawing blocks and other products • A wire mesh basket (used for testing large frozen blocks of shrimp) or other container that is large enough to hold the contents of 1 package (e.g., 2.27 kg or [5 lb] box of shrimp) and has openings small enough to retain all pieces of the product (e.g., an expanded metal test tube basket lined with standard 16 mesh screen) • Number 8 mesh, 20 cm (8 in) or 30 cm (12 in) sieve • Stopwatch <p>Test Procedure</p>

Handbook 133, 4th Edition (2005) Corrections and Revisions		
Chapter and Revision Number	Chapter, Section and Title	Action
		<p>Follow the Basic Test Procedure in Section 2.3. Define the inspection lot. Use a Category A or a Category B sampling plan in the inspection (depending on the location of test); select a random sample; then use the following test procedure to determine lot compliance.</p> <ol style="list-style-type: none"> 1. Place the unwrapped frozen shrimp or crabmeat in the wire mesh basket and immerse in a container of fresh water at a temperature between 23 °C to 29 °C (75 °F to 85 °F). Submerge the basket so that the top of the basket extends above the water level. 2. Maintain a continuous flow of water into the bottom of the container to keep the temperature within the specified range. 3. As soon as the product thaws, determined by loss of rigidity, transfer all material to a sieve (20 cm [8 in] for packages less than 453 g [1 lb] or 30 cm [12 in] for packages weighing more than 453 g [1 lb]) and distribute it evenly.
2-11	Chapter 2. Section 2.6. Drained Weight for Glazed and Frozen Foods	<p>Delete “Raw” from this test procedure because it can be applied to any glazed seafood or fish.</p> <p><i>How is the net weight of glazed seafood and fish determined?</i></p> <p>For glazed seafood and fish, determine the net weight after removing the glaze using the following procedure. Use this method for any frozen glazed food product.</p> <p>Test Procedures</p> <p>Follow the Basic Test Procedure in Section 2.3. Define the inspection lot. Use a Category A sampling plan in the inspection; select a random sample; and use the following test procedure to determine lot compliance.</p> <ol style="list-style-type: none"> 1. Fill out a report form and select the random sample. A tare sample is not needed. 2. Weigh sieve and receiving pan. Record this weight on a worksheet as “sieve weight.” 3. Remove each package from low temperature storage; open it immediately and place the contents under a gentle spray of cold water. Handle the product with care to avoid breakage. Continue the spray until all ice glaze that is seen or felt is removed. In general, the product should remain rigid; however, the ice glaze on certain products, usually smaller sized commodities, sometimes cannot be removed without defrosting the product. Nonetheless, remove the glaze, because it is a substantial part of the package weight.

Handbook 133, 4th Edition (2005) Corrections and Revisions		
Chapter and Revision Number	Chapter, Section and Title	Action
3-1	Chapter 3. Test Procedures – For Packages Labeled by Volume – Section 3.4. Other Volumetric Test Procedures	<p>The description of the plastic disks used in this procedure was revised to correct an omission from the description in 4.14.1. Equipment for this procedure in the 3rd Edition of HB 133 on page 4-36 of that handbook. The omitted text specified that the holes should be spaced 25 mm (1 in) around the periphery of the disc and 3 mm (¹/₈ in) from the outer edge.</p> <p>Updated the year (94) of approval and re-approval for ASTM E287-02 (2007), “Standard Specification for Laboratory Glass Graduated Burets.”</p> <p>Updated the year (94) of approval and re-approval for ASTM E969-02 (2007), “Standard Specification for Glass Volumetric (Transfer) Pipets.”</p> <p>Under the listing of Test Equipment added: Partial immersion thermometer (or equivalent) with a range of -35 °C to +50 °C (30 °F to 120 °F), at least 1 °C (1 °F) graduations, and with a tolerance of ±1 °C (±2 °F).</p> <p>Under the procedure to determine the volume of oils, syrups and other viscous liquids add the following sentence: Verify with a thermometer that the product has maintained the reference temperature.</p>
3-2	Chapter 3. Section 3.9. Testing Viscous Materials – Such As Caulking Compounds and Pastes – <i>How are viscous materials such as caulking compounds and paste tested?</i>	Updated the year (94) of approval and re-approval for ASTM E542-01 (2007), “Standard Practice for Calibration of Laboratory Volumetric Apparatus.”
3-3	Chapter 3. Section 3.10. Peat Moss – <i>How are packages of peat and peat moss labeled by uncompressed volume tested?</i>	Updated the year (90) of approval and re-approval for ASTM D2978-03, “Standard Method of Test for Volume of Processed Peat Materials.”

Handbook 133, 4th Edition (2005) Corrections and Revisions		
Chapter and Revision Number	Chapter, Section and Title	Action
3-4	Chapter 3. Section 3.11. – Mulch and Soils Labeled by Volume – What type of measuring equipment is needed to test packages of mulch and soil? – Table 3-4 Specifications for Test Measures for Mulch and Soils	The table's format was simplified and the SI units were changed to millimeters.
3-5	Chapter 3. Section 3.11. – Mulch and Soils Labeled by Volume – How are package errors determined?	Inserted a minus sign between Package Net Volume & Labeled Volume to correct an omission. Package Error = Package Net Volume - Labeled Volume
4-1	Chapter 4. Section 4.4. Packages Labeled by Count of More than 50 Items; Audit Procedure – Item 9 & Procedures to use if the inspector suspects the lot violates the package requirements – Item 7.	Added a minus symbol to the equation between Actual Package Gross Weight and Nominal Gross Weight.
4-2	Chapter 4. Section 4.6. Special Test Requirements for Packages Labeled by Linear or Square Measure (Area) – Are there special measurement requirements for packages labeled by dimensions?	Updated the year (97) of approval referenced in ASTM D 1907-07, "Standard Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method."

Handbook 133, 4th Edition (2005) Corrections and Revisions		
Chapter and Revision Number	Chapter, Section and Title	Action
4-3	Chapter 4. Section 4.7. Polyethylene Sheeting – Which procedures are used to verify the declarations on polyethylene sheeting and bags?	Updated the year (98) of approval referenced in ASTM Standard D 1505-03, “Standard Method of Test for Density of Plastics by the Density Gradient Technique.”
4-4	Chapter 4. Section 4.8. Packages Labeled by Linear or Square (Area) Measure; 11. Compute package errors according to the following formula:	Added a minus symbol to the equation between Package Gross Weight and Nominal Gross Weight.
4-5	Chapter 4. Section 4.9. Baler Twine – Test Procedure for Length; 4. Calculate the nominal gross weight and record.	Added a minus symbol to the equation between Package Gross Weight and Nominal Gross Weight.

270 OTHER ITEMS – DEVELOPING ITEMS

INTRODUCTION

The NCWM established a mechanism to disseminate information about emerging issues which have merit and are of national interest. Developing items have not received sufficient review by all parties affected by the proposals or may be insufficiently developed to warrant review by the NCWM L&R Committee. The Developing items listed are currently under review by at least one regional association, subcommittee, or work group (WG).

The Developing items are marked according to the specific NIST handbook into which they fall – HB 130 or HB 133. The Committee encourages interested parties to examine the proposals included in the appendices and to send their comments to the contact listed in each part.

The Committee asks that the regional weights and measures associations, subcommittees, and WGs continue their work to develop fully each proposal. Should an association, subcommittee, or WG decide to discontinue work on a Developing item, the Committee asks that it be notified. When the status of an item changes because the submitter withdraws the item, the item will be listed in a table below. For more details on items moved from the Developing items list to the Committee’s main agenda, refer to the new reference number in the main agenda.

270-1 I Amend Section 2.2.1. in Handbook 130, Uniform Engine Fuels Regulation – Premium Diesel Lubricity

Source: Southern Weights and Measures Association (SWMA) (See Item 270-5 in the Report of the 92nd Annual NCWM Meeting in 2006)

Background/ Discussion: (Refer to the NCWM 93rd Annual Meeting (2008) for background information on this Item.) A member of the petroleum industry believed the test and associated tolerances for lubricity on premium diesel specified in Section 2.2.1.(d) were inconsistent with that for regular diesel. Effective January 1, 2005, the test tolerance for regular diesel lubricity was the ASTM D6079 reproducibility of 136 μm (see ASTM D975-04b). The NCWM chose to accept the ASTM reproducibility limits for all diesel (D975) and gasoline (D4814) properties (see Section 7.2.2. Reproducibility), but chose a different reproducibility limit for premium diesel lubricity without providing any explanation as to why the ASTM reproducibility limit was insufficient. If the NCWM intended to impose a stricter lubricity requirement for premium diesel, it should have designated a tighter specification for this property, not a different test tolerance (e.g., for regular and premium gasoline, premium has a different octane specification than for regular, but the test tolerance is the same). ASTM reproducibility limits were, by definition, based on establishing a 95 % probability that product that should pass, will pass. Applying an average test as specified in Section 2.2.1.(d) reduced that probability to 80 %.

At the WWMA 2006 Annual Meeting, the WWMA L&R Committee received only one comment regarding this item, acknowledging the ongoing review by the Fuels and Lubricants Subcommittee (FALS). The WWMA noted that the NCWM L&R Committee forwarded the proposal for review by the Subcommittee and agreed this item should remain Developmental pending its recommendation.

At its 2006 Interim Meeting, the CWMA indicated the NCWM Fuel and Lubricant Subcommittee would make recommendations after ASTM improved the test method's precision and after the conclusion of other tests. The CWMA L&R Committee was awaiting the recommendation from the Subcommittee.

During the 2007 Interim Meeting, the Committee carried this item over as an Information item. The Committee sent this proposal to FALS and requested its recommendation on how to proceed with the issue. The FALS suggested this item remain on the agenda as an Information item until further notice and reported that the activities of ASTM International and the Coordinating Research Council were continuing.

At the 2008 Interim Meeting in Albuquerque, New Mexico, and the 2008 Annual Meeting in Burlington, Vermont, the Committee carried this item over as a Developing item. This proposal was sent to FALS for its recommendation on how to proceed with the issue. FALS suggested this item remain on the agenda as a Developmental item.

At the CWMA 2008 Interim Meeting the Committee requested that this item remain Informational pending release of the FALS recommendation, Coordinating Research council study and the ASTM Lubricity Test Method Task Force reports. At the NEWMA, WWMA and SWMA 2008 Annual Meetings the Committees recommended that this item remain Informational from FALS.

NEWMA held their Interim Meeting in October 2008 where they heard from a representative of the bio-diesel industry who briefed members on the newly adopted FTC standards regarding bio-diesel products, including the labeling of B-5, B-20, and B-100. One member expressed a concern regarding the "field testing" of bio-fuel blends and quality. This member also expressed that not enough testing occurs with regard to "octane quality" and that bio-blend testing would probably be conducted even less.

At the 2009 Interim Meeting in Daytona Beach, Florida, FALS reported to the Committee that they are awaiting development of items from ASTM.

Proposal: Amend Section 2.2.1. Premium Diesel Fuel in Handbook 130 Uniform Engine Fuels and Automotive Lubricants Regulation. The following reflects the current text as it was modified in 2003.

2.2.1. Premium Diesel Fuel. – All diesel fuels identified on retail dispensers, bills of lading, invoices, shipping papers, or other documentation with terms such as premium, super, supreme, plus, or premier must conform to the following requirements:

- (a) **Cetane Number.** – A minimum cetane number of 47.0 as determined by ASTM Standard Test Method D613.
- (b) **Low Temperature Operability.** – A cold flow performance measurement which meets the ASTM D975 tenth percentile minimum ambient air temperature charts and maps by either ASTM Standard Test Method D2500 (Cloud Point) or ASTM Standard Test Method D4539 (Low Temperature Flow Test, LTFT). Low temperature operability is only applicable October 1 - March 31 of each year.
- (c) **Thermal Stability.** – A minimum reflectance measurement of 80 % as determined by ASTM Standard Test Method D6468 (180 min, 150 °C).
- (d) **Lubricity.** – A maximum wear scar diameter of 520 µm as determined by ASTM D6079. If an enforcement jurisdiction's single test of more than 560 µm is determined, a second test shall be conducted. If the average of the two tests is more than 560 µm, the sample does not conform to the requirements of this part.

(Amended 2003)

For additional information, please contact Ron Hayes, FALS Chairman, (573) 751-2922 or ron.hayes@mda.mo.gov by e-mail.

270-2 I Fuels and Lubricants Subcommittee (FALS)

Background: The Subcommittee had met on January 24, 2007, at the 2007 NCWM Interim Meeting to undertake a review of a number of significant issues related to fuel standards. Their first project was to undertake a major review and update of the Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulation in HB 130. The Subcommittee also met at the 2007 Annual Meeting and continued its work on a number of items in addition to preparing a major revision of the Fuel Ethanol Specifications.

An additional project will be to update and possibly expand the Basic Engine Fuels, Petroleum Products, and Lubricants Laboratory Publication. The Subcommittee will undertake other projects as time and resources permit.

At the 2009 Interim Meeting, the FALS Chairperson informed the Committee that FALS is working toward getting changes made to the language within the document.

If you would like to participate in this Subcommittee, contact Ron Hayes, Chairperson Fuels and Lubricants Subcommittee, at (573) 751-2922, e-mail: ron.hayes@mda.mo.gov or Ken Butcher at (301) 975-4859, e-mail: kbutcher@nist.gov.

270-3 I Pelletized Ice Cream

Background: At the 2008 Annual Meeting open hearings, Cary Frye from the International Ice Cream Association (IICA), gave a briefing on behalf of industry on pelletized ice cream. Ms. Frye gave a briefing on the product, standard of identity, test method procedures and several other key points. Ms. Frye informed that conference that additional assistance would be required from the Food and Drug Administration (FDA) (refer to Table B Appendix D). Once FDA has addressed the issues and concerns, NIST will host a second meeting at NIST in Gaithersburg, Maryland, to follow up and seek resolution on the outstanding concerns. NIST will send out a meeting announcement to all state Directors and all other interested parties via the NIST W&M list server.

The NIST Weights and Measures Division submitted to the Committee detailed minutes pertaining to the June 27, 2008, meeting held at NIST in Gaithersburg, Maryland, concerning issues and concerns with the pelletized

ice cream product. The minutes (refer to Table B Appendix E) provide great detail of the current issue, background information, representatives and manufacturers, method of sale, and test method procedure.

This item has been presented at the WWMA and SWMA Annual Meeting and at the NEWMA and CWMA Interim Meetings. NEWMA discussed this issue, including the FDA's role and their impact on the NCWM process. One member stated that the FDA may be slow to reach a decision because of an impending change in leadership. Another member expressed the difficulty (practical experience) of testing this product.

All regions are in agreement that this item should remain Developmental until further information is received from FDA. At the 2009 Interim Meeting, it was reported by the NIST Technical Advisor that FDA is actively working on this item.

To participate in the work on pelletized ice cream, contact Lisa Warfield, at lisa.warfield@nist.gov or (301) 975-3308, or Cary P. Frye, International Dairy Foods Association at cfrye@idfa.org or (202) 220-3543.

270-4 I Method of Sale and Engine Fuel Quality Requirements for Hydrogen

Source: Western Weights and Measures Association (WWMA)

Proposal: The proposal is to add a Developing item to the 2008 - 2009 L&R agenda for method of sale and engine fuel quality requirements for hydrogen in NIST Handbook 130 (HB 130) to address gaseous hydrogen refueling applications. Note: There is a corresponding proposal to add a Draft Hydrogen Gas Measuring Devices Code in NIST HB 44 to address requirements for hydrogen gas refueling equipment.

Background: Eighteen states have hydrogen refueling dispensers in operation. Hydrogen stations using permanent and mobile refueling systems for automobiles, fleet vehicles (buses), forklifts, airport totes, are increasing and may go unnoticed. Many stakeholders who are not familiar with the weights and measures standards process will need to participate at this stage rather than after this is a commercial application. This effort by the U.S. National Work Group (USNWG) is to ensure there are appropriate standards and test procedures in place in time for dispenser manufacturers, service agencies, and officials, and to educate the general public, not if, but when hydrogen becomes commercially available.

Existing codes do not fully address hydrogen refueling applications because of hydrogen's properties and other technical differences in the setup and operations of dispensing systems. The development of legal metrology standards for newly emerging hydrogen technology is a necessary component of the hydrogen infrastructure. The weights and measures community must have time to consider requirements for hydrogen-refueling systems before this application is available for public access at corner service stations.

The USNWG is bringing the proposal before the weights and measures community to share this information about upcoming standards for an emerging technology. The simultaneous development of the code and corresponding test procedures will allow for input from the W&M and hydrogen communities, appropriate trials of the standards, and to address all areas of concerns early in the standards development process.

This item was reviewed at the WWMA and SWMA 2008 Annual Meeting and at the NEWMA 2008 Interim Meeting. NEWMA members generally discussed the "hydrogen issue" and its usage in the marketplace. It is anticipated that hydrogen at first will be relegated to "fleet vehicles" (such as CNG), and that retail sales will be slow in coming to the marketplace. NEWMA recommends that this item remain a Developing item.

At the 2009 Interim Meeting in Daytona Beach, Florida, the NIST Technical Advisor briefed the Committee on work that the USNWG Fuels Specifications Subcommittee (FSS) has done to date (refer to Appendix E).

Recommendation: The USNWG FSS presented the following December 2008 recommendation for consideration by the 2009 NCWM Laws and Regulations Committee.

Section 2. Non-food Products ^[Note 1, page 103]

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. National Fire Protection Association (NFPA) labeling requirements also apply.

2.XX.3.5. Hydrogen shall be labeled in accordance with 16 CFR 309 – FTC Labeling Alternative Fuels.

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_{MPa}).

FSS supports the proposed new definitions to address gaseous hydrogen refueling applications.

1. Specification for Hydrogen Fuel for Internal Combustion Engines and Fuel Cells

2. Definitions

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.

Proposed Specification for Hydrogen Fuel

The FSS identified several quality criteria where there was tentative agreement with their associated values (see properties 6, 7, 8, 9, 12, 14, and 16 which are highlighted in green) in the proposed Table 1. Hydrogen Fuel Quality Specification. When a quality property and numerical value (defining a maximum or minimum limit) is added to the specification, appropriate test methods must then be identified. As test methods are identified and adopted by the FSS they will be added to column 6 in Table 1. The 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 properties 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.

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	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 –

- Hydrogen fuel index is the value obtained with the value of total gases (%) subtracted from 100 %.
- Particulate Concentration is stated as µg/L@NTP = micrograms per liter of hydrogen fuel at 0 °C and at one atmosphere pressure (1 bar).
- Total Gases = Sum of all impurities listed on the table except particulates.
- 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 FTC's Fuel Rating Rule (16 CFR Part 309) see the requirements in "Labeling of Alternative Fuels" at <http://www.ftc.gov/bcp/edu/pubs/business/autos/bus29.shtm> requires dispensers to bear an declaration of minimum percent of hydrogen determined according to test methods described in "Standard Test Method for Analysis of Natural Gas by Gas Chromatography" (ASTM D1946).

Additional information on this hydrogen proposal and the corresponding hydrogen gas measuring devices code can be found at <http://ts.nist.gov/WeightsAndMeasures/Developing-Commercial-Hydrogen-Measurement-Standards.cfm>. For additional information on this item, contact Lisa Warfield at lisa.warfield@nist.gov or (301) 975-3308.

270-5 I National Fisheries Institute – Net Weight Issues

Discussion/Background: Lisa Weddig, Director of Regulatory and Technical Affairs at the National Fisheries Institute (NFI) gave a presentation (see Appendix F) to the Committee and at the open hearings at the 2009 Interim Meeting in Daytona, Florida. NFI is a trade association representing the seafood industry. Their membership consists of the industry from harvesters, U.S. processors, importers, to retail and food service operations. In 2006 their members voted to start an initiative called the Better Seafood Bureau. The mission of the Bureau is to address the growing problem in the industry of economic fraud. There are areas that have been identified as being particularly egregious and harmful to those in the industry trying to do the right thing. The three identified areas are species substitution, avoiding duties in the transshipment of product from one country to another, and inaccurate net weight and counts.

NFI would like to find a feasible and efficient manner to interact with the state weights and measures programs to address the net weight issue. It was suggested by the states that NFI notify the state Directors when an issue arises in their state. NFI was also encouraged to work with NCWM to further develop this item.

Joe Gomez, New Mexico, Chairman

Joe Benavides, Texas

Jonelle Brent, Illinois

John Gaccione, New York

Terence McBride, Tennessee

Ron Hayes, Missouri, Chairman FALS

Doug Hutchinson, Canada, Technical Advisor

Rob L. Underwood, Associate Member Representative

Ken Butcher, NIST Technical Advisor: e-mail: kenneth.butcher@nist.gov

Lisa Warfield, NIST Technical Advisor: e-mail: lisa.warfield@nist.gov

Laws and Regulations Committee

Appendix A

GAO-08-1114 Motor Fuels: Stakeholder Views on Compensating for the Effects of Gasoline Temperature on Volume at the Pump

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United States Government Accountability Office

GAO

Report to the Chairman, Committee on
Science and Technology, House of
Representatives

September 2008

MOTOR FUELS

Stakeholder Views on Compensating for the Effects of Gasoline Temperature on Volume at the Pump



GAO-08-1114

September 2008



Highlights of [GAO-08-1114](#), a report to the Chairman, Committee on Science and Technology, House of Representatives

Why GAO Did This Study

The volume, but not the energy content, of hydrocarbon fuels, such as gasoline and diesel, varies in response to changes in temperature. Thus, because of expansion, the energy content per gallon of 90 degree fuel is less than that of 60 degree fuel. States and localities adopt and enforce weights and measures regulations, often using the model regulatory standards published by the National Institute of Standards and Technology (NIST). Although technology now exists to compensate for the effects of temperature on gas volume, the costs of doing so at the retail level have become the subject of much debate among weights and measures officials, consumer groups, and representatives of the petroleum and fuel marketing industries.

GAO was asked to provide information on (1) the views of U.S. stakeholders on the costs to implement automatic temperature compensation, (2) the views of U.S. stakeholders on who would bear these costs, and (3) the reasons some state and national governments have adopted or rejected automatic temperature compensation. To do this work, GAO reviewed NIST and other documents and congressional testimony; interviewed stakeholders from 3 federal agencies, 17 states, and 15 groups representing a variety of interests, including consumers, truck drivers, and the oil and gas industry; and interviewed officials in 5 other nations.

Various stakeholders and officials provided technical and other comments, which were incorporated in the report as appropriate.

To view the full product, including the scope and methodology, click on [GAO-08-1114](#). For more information, contact David Maurer at (202) 512-3841 or maurerd@gao.gov.

MOTOR FUELS

Stakeholder Views on Compensating for the Effects of Gasoline Temperature on Volume at the Pump

What GAO Found

The costs to implement automatic temperature compensation are unclear. Most stakeholders said that implementing automatic temperature compensation for retail sales would involve the cost to purchase, install, and inspect new equipment on pumps, as well as costs to educate consumers about the change. Some stakeholders said the costs to adopt automatic temperature compensation ranged from \$1,300 to \$3,000 per pump, but none had estimated the total costs nationwide, in part because complete data are not available. Estimates of the cost to inspect the new equipment varied. Officials in a small number of states said inspection times would increase by 20 to 50 percent, while officials in three other states said the costs would not be significant. No stakeholders had developed estimates of the costs to educate consumers.

Stakeholders differ on whether retailers, consumers, or both would ultimately bear the costs of implementing automatic temperature compensation at the retail level. Some stakeholders, including state officials and industry representatives, said that the costs would be passed on to consumers through higher prices for fuel or other goods sold at retail stations. Others, such as consumer groups, said that retailers and consumers would share the costs and benefits. That is, some retailers could use funds they receive from major oil companies for remodeling to pay for the equipment. These stakeholders also said the benefits include consistent energy content for consumers and improved inventory management for retailers. Stakeholder views were largely based on professional judgment and general economic theory rather than on studies or other data, and most stakeholders said that a comprehensive cost-benefit analysis would provide policymakers with important information.

Governments that have adopted or permitted automatic temperature compensation for retail fuel sales cited improved measurement accuracy and greater equity between retailers and consumers as reasons for making the change; those that have prohibited it largely cited concerns that the costs would outweigh the benefits. Hawaii adopted temperature compensation more than 26 years ago because it provided purchasing equity for the industry and consumers. In 2008, Belgium mandated temperature compensation to help ensure more consistent energy content for consumers. Canadian officials cited improved measurement equity and accuracy as reasons for allowing retailers to sell temperature-compensated fuel in the early 1990s. In the United States, officials from eight states that have laws or regulations that prohibit automatic temperature compensation said the decision should be based on an analysis of the costs and benefits, with some expressing concern that the costs would outweigh the benefits. None of the governments that have adopted automatic temperature compensation have studied its impact.

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Abbreviations

EPA	Environmental Protection Agency
EU	European Union
FTC	Federal Trade Commission
NCWM	National Conference on Weights and Measures
NIST	National Institute of Standards and Technology

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United States Government Accountability Office
Washington, DC 20548

September 25, 2008

The Honorable Bart Gordon
Chairman
Committee on Science and Technology
House of Representatives

Dear Mr. Chairman:

Consumers and businesses alike are concerned about the steep rise in fuel prices in recent years. Because the volume of hydrocarbon fuels, such as gasoline and diesel,¹ varies in response to changes in temperature, some are concerned about the potential impact of temperature-related changes in volume on the amount they pay. More specifically, the volume of gasoline expands or contracts by 1 percent for each 15 degree increase or decrease in temperature, while the energy content of gasoline remains the same. For example, 10 gallons of gasoline at 60 degrees Fahrenheit (F) expands to 10.2 gallons of gasoline at 90 degrees F but maintains the same total energy content.² As a result, the average energy content per gallon of the 90 degree fuel will be less than that of the 60 degree fuel. In the United States, wholesale fuel transactions are routinely adjusted for temperature-related changes in volume. However, at the retail level, gasoline and diesel are sold by volume—specifically, 231 cubic inches per gallon—without regard to temperature, leading some to believe that the retail price of a gallon of fuel may not reflect its true value. Advances in measurement technology have allowed the development of devices that can automatically compensate for the effects of temperature on volume when dispensing fuel at retail gas pumps.³ While some argue that extending temperature compensation to the retail level could provide greater transparency in fuel prices, others contend that the cost to upgrade existing equipment could be substantial and impose economic hardship on retailers.

The National Conference on Weights and Measures (NCWM), a consensus-building organization composed of state and local regulatory officials and

¹This report focuses on gasoline and diesel rather than other petroleum products, such as heating oil or jet fuel.

²This example assumes the use of the same blend of gasoline. Energy content can also vary depending on the blend of gasoline.

³Throughout this report, we refer to the devices that dispense fuel as pumps. Individual pumps may dispense multiple types of fuel, such as regular and high-octane gasoline.

other interested parties, has discussed whether to adopt standards for temperature compensation of gasoline and diesel for over 30 years, most recently at its meeting in July 2008. NCWM plays a key role in the debate because states adopt and enforce weights and measures regulations.

NCWM receives technical guidance on this and other matters from the Office of Weights and Measures in the Department of Commerce's National Institute of Standards and Technology (NIST). In partnership with NIST, NCWM develops model regulatory standards that are available for adoption and enforcement by state or local weights and measures authorities. NIST publishes these standards in various handbooks, and any proposed changes to these handbooks are considered by NCWM.

Since 2000, NCWM has considered various proposals related to automatic temperature compensation, including proposals in 2007 and 2008 to adopt model regulatory standards that states could use to implement temperature compensation in retail sales of gasoline and diesel. Neither of the proposed model standards has been adopted. In addition to the deliberations of NCWM, the Congress has held hearings on the issue, and federal legislation has been proposed to require the use of temperature compensation in retail transactions. However, the economic implications of temperature-induced changes in the volume of motor fuels on the price of gasoline and diesel remains a topic of considerable debate, and the issue continues to elicit strong opinions, both for and against, from parties such as petroleum marketers, retailers, independent truckers, fleet owners, and consumer advocates.

In the context of this debate, you asked us to provide information on (1) the views of U.S. stakeholders⁴ on the costs to implement automatic temperature compensation, (2) the views of U.S. stakeholders on who would bear these costs, and (3) the reasons some state and national governments have adopted or rejected automatic temperature compensation. For each of these issues, we agreed to report on the support, such as studies or data, that stakeholders use for their views.

To obtain information from U.S. stakeholders on the costs to implement automatic temperature compensation and who would bear those costs, we reviewed NCWM documents and congressional testimony and performed a

⁴Throughout this report, we use the word "stakeholder" to refer to domestic individuals and groups with an interest in the current debate in the United States on this issue, including NCWM, NIST, current and former government officials, consumer groups, representatives of the petroleum and trucking industries, and fuel retailers.

literature search to identify relevant documents and stakeholders likely to have a view on the implementation of automatic temperature compensation in the United States. To identify additional stakeholders, we asked each stakeholder we interviewed for recommendations of knowledgeable other entities and selected for interviews those who would provide us with a broad and balanced range of perspectives on temperature compensation of gasoline and diesel. We used a standard set of questions to interview each of these individuals to ensure we consistently discussed each aspect of automatic temperature compensation. Specifically, we interviewed representatives of two consumer advocacy groups, five fleet owners and operators, a former NIST official, and officials at seven organizations that represent independent truck drivers, the oil and gas industry, independent petroleum marketers, convenience store and truck stop owners, and the trucking industry. To obtain views from governments that have adopted or rejected temperature compensation, we contacted officials in 16 states that have taken specific steps to adopt or prohibit automatic temperature compensation. We also contacted officials in California who are conducting a cost-benefit analysis of temperature compensation. In addition, we contacted officials from Australia, Belgium, Canada, the United Kingdom, and a European weights and measures organization because literature and interviews indicated these governments had adopted or had considered implementing automatic temperature compensation. We also interviewed officials from the Environmental Protection Agency (EPA), the Federal Trade Commission (FTC), and NIST because these agencies help oversee the marketplace generally or oversee aspects of the retail petroleum industry. See appendix I for a more detailed description of the methodology we employed.

We conducted our work from March 2008 to September 2008, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for the information we present for each of our audit objectives.

Results in Brief

The costs to implement automatic temperature compensation are unclear. Stakeholders said that implementing automatic temperature compensation for retail fuel sales would involve costs to purchase, install, and inspect new equipment on fuel pumps, as well as costs to educate consumers about the change. Although some stakeholders had limited estimates for costs associated with the adoption of automatic temperature

compensation, ranging from \$1,300 to \$3,000 per pump for the costs to purchase and install automatic temperature compensation equipment, none had estimated the total magnitude of these costs nationwide. These estimates from stakeholders were generally consistent with information we obtained from equipment manufacturers. Specifically, costs ranged from \$900 to \$1,800 to buy a kit to retrofit an existing pump and \$200 to install the kit. Stakeholders said the costs to adopt temperature compensation could be affected by such factors as whether the investment to adopt the devices occurred immediately or more gradually to accommodate routine replacement decisions by retailers. A small number of stakeholders said estimates of the magnitude of costs had not been developed, in part, because certain data are missing, such as the number of mechanical pumps still in use nationwide. Estimates of the cost to inspect the new equipment as part of state enforcement of weights and measures standards varied. Officials in a small number of states said inspection times would increase by 20 to 50 percent, while in three other states, officials said the costs would not be significant. However, none of these officials had estimated the costs. Finally, although adopting temperature compensation would require that consumers be educated about it, no stakeholders had developed estimates of the costs to, for example, provide disclosure on street signs, fuel pumps, and customer receipts.

Stakeholders differ on whether retailers, consumers, or both would ultimately end up paying the implementation costs. For example, some stakeholders, including state officials and industry representatives, said that the costs of implementing automatic temperature compensation would be passed on to consumers. In their view, the costs to purchase and install compensation equipment would be passed on to consumers through higher prices for fuel or other goods purchased at retail fueling stations. Other stakeholders, such as consumer groups, said that retailers and consumers would share both the costs and the benefits of implementing temperature compensation. That is, one stakeholder said some retailers could use funds provided to them by major oil companies for remodeling to pay for the equipment. Consumers, they say, currently pay retailers for energy content they do not receive when they buy fuel that is warmer than 60 degrees F. Moreover, these stakeholders said that consumers would gain by receiving more consistent energy content, and one said that retailers would benefit because the automatic temperature compensation technology would make it easier to detect gas leaks and to manage inventory. Stakeholder views were based on professional judgment, general economic theory, and assumptions about how the fuel market operates rather than on studies or other data, and most stakeholders said

that a comprehensive cost-benefit analysis would provide policymakers with important information.

Governments that have adopted or allowed automatic temperature compensation cited improved measurement accuracy and greater equity between retailers and consumers as reasons for making the change, whereas those that had not adopted automatic temperature compensation cited concerns that the costs would outweigh the benefits. For example, Hawaii adopted temperature compensation more than 26 years ago because, according to Hawaiian officials, it provided purchasing equity for both the industry and the consumer. According to Belgian officials, Belgium mandated temperature compensation beginning in January 2008 to help ensure greater consistency in the energy content of the fuel sold to consumers. To improve measurement accuracy and equity, among other things, Canada developed standards in the early 1990s that allowed, but did not require, retailers to sell temperature-compensated fuel, according to a Canadian official. In the United States, officials from eight states that prohibited automatic temperature compensation said the decision should be based on an analysis of the costs and benefits, with some expressing concern that the anticipated costs would outweigh any benefit to consumers and fuel retailers. Governments have not formally studied the impact of their decisions to implement or allow automatic temperature compensation. Specifically, neither Hawaii nor Canada has studied the impact of temperature compensation, although officials reported it had been well accepted by both consumers and the industry and was not controversial. In Belgium, temperature compensation has not been in effect long enough to study its impact.

Background

From the beginning of the modern petroleum industry in the early 1900s, both industry and the federal government have recognized the problem that temperature-induced changes in volume present for inventory control. Specifically, the fact that petroleum products, like most other substances, expand when heated and contract when cooled means that the amount of fuel in the inventories of retailers changes, literally, with the weather. Following a study of the issue conducted by the American Petroleum Institute from 1912 to 1917, the United States and Great Britain established the standard measure for petroleum products: at an ambient temperature of 60 degrees F, 231 cubic inches equals a gallon.

The effect of temperature on fuel volume varies depending on the density of the fuel. For example, gasoline's volume changes approximately 1 percent for every 15 degree temperature change, whereas diesel, which is a more dense fuel, changes approximately 1 percent in volume for every 22

degree temperature change. In practice, the density of gasoline and diesel sold to consumers varies depending on such things as the crude oil used to produce the fuel and the addition of other components to achieve certain ends. For example, federal efforts to reduce petroleum consumption and greenhouse gas emissions require the increased use of some components in fuel blends, such as ethanol, biodiesel, and other alternative fuels. In addition, ethanol is added to gasoline in certain geographic areas to help reduce the emissions that contribute to the formation of ground-level ozone, which has been linked to respiratory and other health problems. As a result, the composition and density of gasoline and diesel products vary considerably across the country. In 2004, at least 45 different kinds of gasoline were produced in the United States.

Certain properties of fuels other than volume, such as mass and energy content, do not change in response to changes in temperature. However, energy content can be affected by changes in the density of fuel that arise from the addition of alternative fuels or other blending components that have densities different from the gasoline itself.

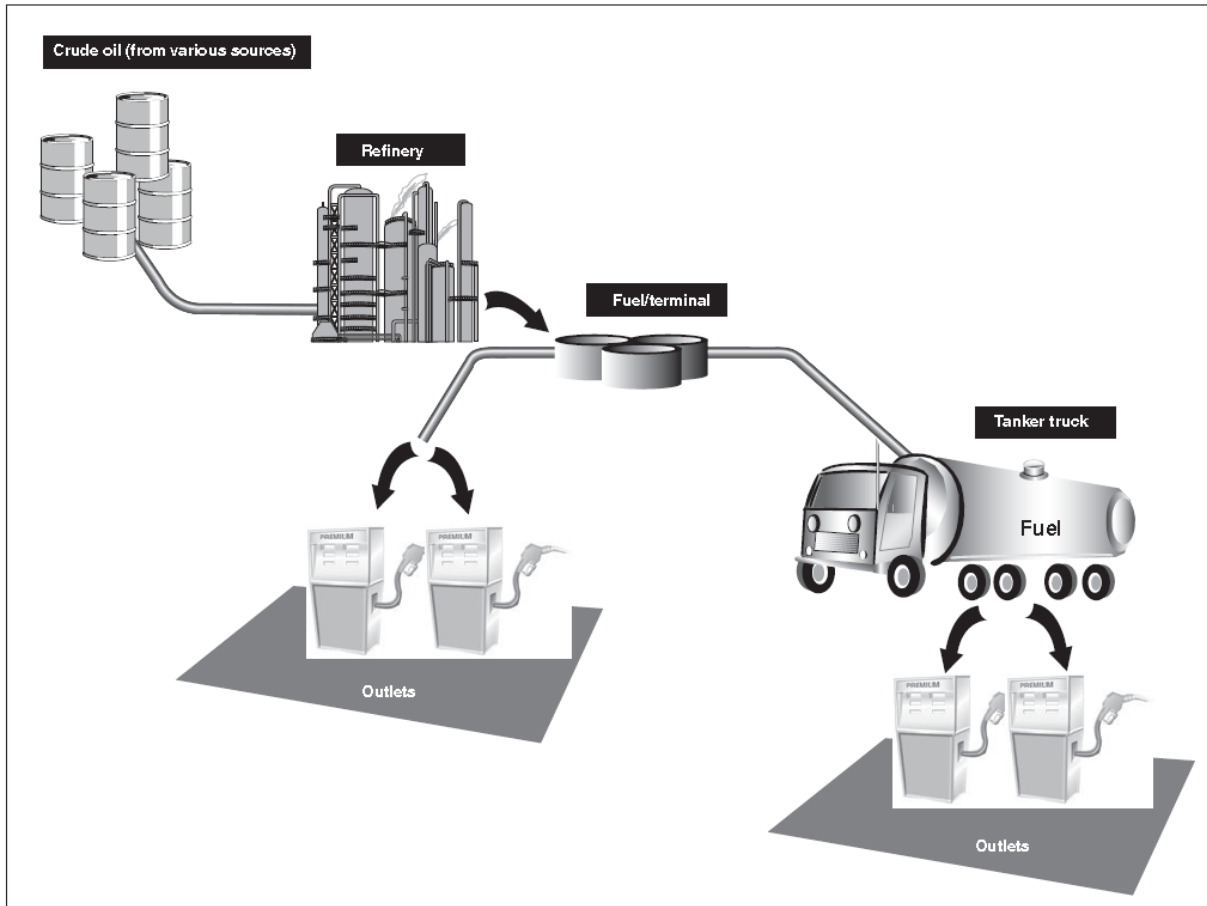
In the United States, the petroleum industry often adjusts for temperature-related changes in wholesale transactions for gasoline and diesel and in retail sales for other petroleum products, such as home heating oil, liquefied petroleum gas, and prepackaged liquids such as motor oil. In contrast, virtually all gasoline and diesel sold at the retail level is sold at 231 cubic inches per gallon regardless of the temperature of the fuel.

Temperature compensation can be achieved through several methods. First, volumetric changes can be calculated manually when the fuel density and temperature are known. Second, technological advances have led to the development of devices that automatically measure both the volume and temperature of the fuel at the time of purchase and correct the volume to the amount that would exist if the fuel were at 60 degrees F. Finally, in areas where the ambient temperature remains relatively constant throughout the year, pumps can be recalibrated to dispense the volume a gallon would occupy at 60 degrees F. For example, if the temperature in an area is relatively constant at 75 degrees F, pumps can be recalibrated to dispense 233 cubic inches per gallon.

Gasoline and diesel are distributed nationwide to fuel wholesalers through a supply infrastructure composed of pipelines, barges, tanker vessels, marine terminals, railroads, trucks, and storage tanks. At various points along the distribution chain, fuel is stored at terminal stations that generally have several large storage tanks. Fuel is then distributed, usually

by trucks, to retail gasoline stations, where it is typically stored in underground tanks (see fig. 1).

Figure 1: Distribution Network for Gasoline and Other Petroleum Products



Sources: GAO and Art Explosion (clip art).

Changes in the temperature of gasoline and other petroleum products can occur for several reasons from the time these products leave the refinery until they are deposited into a vehicle. For example, retail fueling stations located near a refinery or a pipeline may receive fuel that is still hot from the refining process, and the heated fuel will affect the temperature of the

fuel already in the storage tank.⁵ In addition, the use of underground storage tanks—particularly those with double walls—may lengthen the time required for the fuel to cool to ground temperature of about 55 degrees F. A common misconception is that the use of underground storage tanks helps ensure that fuel remains at or below 60 degrees F. According to a 2004 NIST study based on 2 years of data, the average temperature nationwide for fuel stored underground was about 64 degrees and varied among states from about 82 degrees in Florida to 53 degrees in Minnesota. Finally, the temperature of the fuel in the supply line to the pump will affect the temperature of the fuel initially deposited into the vehicle.

State and local governments adopt and enforce weights and measures regulations, including those to ensure that retail fuel pumps accurately measure motor fuels. Unlike many other countries, the United States does not have a federal weights and measures regulatory agency, although two federal agencies help oversee the marketplace generally, and a third oversees aspects of the retail petroleum industry. Among other things, NIST cooperates with other entities, including state and local governments, to establish standard practices, codes, and specifications. The FTC enforces consumer protection laws, including laws related to unfair and deceptive practices in the marketplace. EPA and authorized states regulate underground storage tanks that store petroleum.⁶ These regulations require a leak detection system on the underground storage tanks. None of these agencies has formally endorsed or opposed the implementation of automatic temperature compensation.

State and local governments develop regulations for weights and measures with input from NCWM and NIST. Established in 1905, NCWM is composed of state and local weights and measures officials, as well as related public and private sector members. A key goal of NCWM is to help ensure that consumers get the quantity of goods they pay for and that businesses sell the quantity that they advertise and intend to sell. NCWM helps ensure that uniform standards are applied to commercial transactions by developing regulatory standards for consideration by each jurisdiction, with technical, scientific, and administrative support provided

⁵The refining process “boils” crude oil to separate it into its various components. Gasoline is distilled from crude oil at temperatures ranging from 194 degrees F to 428 degrees F, while diesel is distilled at temperatures up to 698 degrees F.

⁶The underground storage tank regulations apply to underground tanks and pipes used to store or move petroleum and certain other hazardous chemicals.

by NIST. Membership in NCWM is open to all interested individuals, including regulatory officials, device manufacturers, and consumers; however, only regulatory officials may vote on the disposition of proposals under consideration by NCWM.

Most proposals for regulatory standards that come before NCWM originate in one of its regional weights and measures groups located throughout the nation or in one of its four standing committees, each of which focuses on a specialized area, such as laws and regulations. At each of NCWM's annual conferences, standing committees review the proposals submitted for consideration and hold open hearings to discuss them. Final reports containing the NCWM-approved model regulatory standards are presented in open forum to representatives and voted upon. Actions or subjects under consideration, but not proposed for voting, may be carried over for further consideration at a later time. NIST publishes NCWM's newly adopted model regulatory standards in handbooks. If a state chooses to adopt the model regulatory standards in state law or regulation, they will then have the effect of law in that state.

For over 30 years, NCWM has debated the pros and cons of compensating for temperature-induced changes in the volume of petroleum products, including gasoline and diesel. This debate is guided in part by NCWM's principles that any method of sale or measurement must provide accurate and adequate information about products so that purchasers can make price and quantity comparisons. In 2007, a standing committee recommended a proposal to allow, but not require, automatic temperature compensation at the retail level. NCWM did not reach consensus on the proposal, and the issue was deferred for further consideration. In 2008, a steering committee established by NCWM recommended a proposal to require automatic temperature compensation following a 10-year period during which retailers could decide when to purchase the equipment based on their business needs. According to the committee, this would allow the marketplace to determine when and whether to adjust retail sales for temperature. However, NCWM members did not reach consensus on the proposal, and the issue was deferred for further consideration. Also in 2007, the California legislature directed the state Energy Commission to study the costs and benefits of using automatic temperature compensation devices for retail sales, among other things. The commission is to complete its work by February 2009.

The Magnitude of Equipment and Education Costs of Adopting Automatic Temperature Compensation Is Unclear

Stakeholders said that implementing automatic temperature compensation for retail fuel sales would involve costs to purchase, install, and inspect new equipment on gasoline pumps, as well as costs to educate consumers about the change. Some stakeholders estimate the costs to purchase and install the temperature compensation devices would range from \$1,300 to \$3,000 per pump. To provide context for the estimates from stakeholders, we obtained information from two equipment manufacturers. These manufacturers said the costs can vary by the type of equipment. More specifically, the price of retrofit kits for electronic pumps ranges from \$900 to \$1,800, plus \$200 to install them. Costs to retrofit mechanical pumps are higher: \$2,000 to purchase and install a kit for one hose and \$3,800 for a dual hose pump. The costs to individual retailers would vary, in part, depending on the number of pumps, the number of hoses per pump, and the mix of electronic and mechanical pumps that would need to be replaced or retrofitted. In addition, an equipment manufacturer said that maintenance costs for electronic pumps would be negligible over the useful life of a pump, 10 to 12 years. Some stakeholders noted that the magnitude of costs has not been estimated, in part, because certain data, such as the number of mechanical pumps still in use across the country, are not available. As a result, the costs to adopt automatic temperature compensation are not known.

Several stakeholders said costs to purchase and install temperature compensation equipment could also be affected by other factors. For example, under a phased implementation schedule, retailers could upgrade their equipment in the normal course of replacing equipment, whereas immediate implementation would require retailers to invest in the equipment without regard to their business plans or ability to pay immediately. Also, a small number of companies in North America manufacture new pumps equipped to automatically compensate for temperature or kits to retrofit existing pumps. Two stakeholders said that the costs to purchase and install the equipment could rise in the face of shortages of both equipment and skilled installers that would occur if implementation of automatic temperature compensation were to occur suddenly rather than over a longer period of time.

Estimates of the magnitude of inspection costs varied. A small number of state officials said that automatic temperature compensation could increase inspection time by 20 to 50 percent and might require the purchase of testing equipment. In contrast, officials in three other states said that inspection costs to adopt temperature compensation would not be significant, although they had not estimated the cost. In Missouri, state officials said legislation was introduced, but not enacted, to divide the state into regions, each of which would adopt a new reference

temperature based on its average ambient temperature. State officials reported that adoption of temperature compensation by changing reference temperatures would require increasing staff by six inspectors and one clerical person for a cost of about \$1 million in the first 3 years.

No stakeholders have developed estimates of the costs to educate consumers when automatic temperature compensation is in use. However, costs would be incurred to provide disclosure on fuel pumps, customer receipts, and the street signs that show the retail price of fuel. A number of stakeholders noted that, if some retailers sold compensated fuels and others did not, consumers could be confused and might lack the ability to make informed value comparisons for their fuel purchases. According to some stakeholders, disclosure on pumps might be accomplished by adding the phrase “Volume corrected to 60 degrees F” to the face of the pump near the display of total gallons purchased. For customer receipts, printers could be programmed to add the same phrase. If automatic temperature compensation is in place throughout the nation, the need to disclose its use on pump signs might no longer be needed.

It Is Unclear Who Would Bear the Costs of Implementing Automatic Temperature Compensation

Stakeholders differ on whether consumers or a combination of retailers and consumers would bear the costs of implementing automatic temperature compensation. Specifically, many stakeholders, including state officials and industry representatives, said that the costs to purchase, install, and inspect compensation equipment would be passed on to consumers, generally through higher retail fuel prices, higher prices for nonfuel goods sold at retail fueling stations, or a combination of both. A few of these stakeholders said that retail prices must generally reflect the cost of goods sold or businesses will not remain in operation. However, since the information retailers use to make pricing decisions is proprietary in nature, it would be difficult to estimate how much prices would increase to cover the costs of implementing automatic temperature compensation. Some of these stakeholders also noted that differences in the cost of fuel and other goods sold could vary among retailers based on such factors as whether they owned or leased the land, the number of staff they employ, and whether the costs of inspections are paid directly by retailers or funded from tax receipts. However, one state official said that the ability of states to increase inspection fees may be limited by state statute.

Some stakeholders said the costs to implement automatic temperature compensation may result in disproportionate economic impacts on certain classes of retailers, such as small retailers and those in rural areas, that might be put out of business in the face of the investment to upgrade their

equipment. Retailers that are small or located in rural areas may dispense fewer gallons of fuel than larger retailers and, consequently, have fewer gallons from which to recover any costs associated with upgrading their equipment. A few stakeholders said an exemption for small retailers may be needed, such as an exemption based on the number of gallons dispensed. In contrast, another stakeholder said implementation that allowed retailers to make the decision of whether to add the devices to their equipment would eliminate the potential for disproportionate impacts.

However, other stakeholders, such as consumer groups, said that retailers and consumers would share in both the costs and the benefits of implementing temperature compensation. For example, one stakeholder noted that some retailers could use funds they receive from the major oil companies for remodeling to cover the cost of temperature compensation equipment. According to these stakeholders, consumers have already paid retailers for energy content they did not receive. That is, consumers generally buy fuel that is warmer than 60 degrees and has less energy content, according to these stakeholders. Such overpayments are greater in southern and western states than in other areas. Moreover, these stakeholders said consumers would benefit from greater transparency in fuel pricing, the ability to purchase fuel with more consistent energy content, and an enhanced ability to compare purchases from competing retailers because price differences would be based largely on differences in customer service or amenities such as clean rest rooms. One noted that retailers would also benefit because the automatic temperature compensation technology would allow retailers to manage inventory for both their deliveries and their sales of fuel on a temperature-compensated basis. Moreover, retailers could more easily identify fuel leaks by reconciling their inventory records to measurements of the fuel in their storage tanks. Specifically, if a measurement of stored fuel showed a retailer had less fuel on hand than it had sold, the difference could be the result of a leak.

Stakeholders also differed on the benefits of automatic temperature compensation. Many noted that temperature compensation provides a more accurate and replicable measurement method, but some expressed concern that the potential cost outweighed the benefit. Within the weights and measures community, support has been growing for the adoption of automatic temperature compensation standards, in part because of the improved accuracy and the availability of equipment that makes implementation more feasible than in the past. Several stakeholders noted that automatic temperature compensation brings equity to the marketplace and provides both consumers and retailers with comparable

information about their fuel purchases. Specifically, when retailers and consumers purchase temperature-compensated fuel, they each receive comparable products. According to two stakeholders, consumers currently cannot determine before or after a purchase the actual best price for a gallon of gas because they do not know the temperature of the fuel. Some stakeholders who thought the cost would outweigh the benefit said that the increased accuracy in measurement would not benefit consumers because fuel costs would increase as retailers recouped their investment in the compensation devices.

Stakeholders also held different opinions on whether automatic temperature compensation would ensure consistent energy content in each gallon of fuel. While temperature compensation adjusts for the impact of fuel temperature on the energy content of each gallon, it would not affect other factors that impact energy content, such as the use of fuel blends and additives. That is, multiple stakeholders said that the use of ethanol and other additives, as well as seasonal fuel blends, results in fuels that may vary in energy content by season or by retail outlet. More specifically, they noted other factors may affect the energy content of fuel, including the refining process itself and the crude oil used as the source for the gasoline. Others said automatic temperature compensation will ensure greater consistency in energy content and mileage per gallon. One stakeholder said that, as fuel prices increase, the issue of energy loss from the lack of temperature compensation will become more important, while another said that the use of blends could increase the significance of the effect of temperature on fuel in the future.

Stakeholders' views that various factors may affect fuel prices are consistent with our prior work on gasoline pricing.⁷ Specifically, in a series of reports issued from 2000 through 2007, we concluded that higher gasoline prices resulted from a range of local and global factors, including higher crude oil prices, recent mergers and increased market concentration in the petroleum industry, the increased use of blended

⁷GAO, *Energy Markets: Increasing Globalization of Petroleum Products Markets, Tightening Refining Demand and Supply Balance, and Other Trends Have Implications for U.S. Energy Supply, Prices, and Price Volatility*, [GAO-08-14](#) (Washington, D.C.: Dec. 20, 2007); GAO, *Gasoline Markets: Special Gasoline Blends Reduce Emissions and Improve Air Quality, but Complicate Supply and Contribute to Higher Prices*, [GAO-05-421](#) (Washington, D.C.: June 17, 2005); GAO, *Energy Markets: Mergers and Many Other Factors Affect U.S. Gasoline Markets*, [GAO-04-951T](#) (Washington, D.C.: July 7, 2004); GAO, *Motor Fuels: Gasoline Prices in Oregon*, [GAO-01-433R](#) (Washington, D.C.: Feb. 23, 2001); and GAO, *Motor Fuels: California Gasoline Price Behavior*, [GAO/RCED-00-121](#) (Washington, D.C.: Apr. 28, 2000).

fuels, the level of state gasoline taxes, and costs to transport gasoline from refineries to retailers. We also found in our work on the use of special gasoline blends that it can be difficult to establish a definitive causal link between factors and prices because only some of the many factors that may affect gasoline prices at various times are readily and consistently observable.

Regardless of their views, stakeholders based their opinions largely on professional judgment and general economic theory or assumptions about how the fuel market operates rather than on studies or other data. For example, one stakeholder commented that it was unreasonable to assume that retailers would absorb the costs to upgrade 14 or 16 pumps without trying to recoup those costs through the prices of retail goods they sell. However, none of the stakeholders based their views on studies of the impact of the costs on fuel or retail goods. Some stakeholders said that because the petroleum market is fiercely competitive, particularly in areas that sell high volumes of fuel, consumers already receive the lowest fuel price that retailers can offer, and one said that temperature is not likely to be a relevant factor in their pricing decisions. Because the fuel market is so competitive, one stakeholder said, retailers do not generate enough profit to cover the costs of temperature compensation equipment and so would pass the costs on to consumers. In contrast, other stakeholders said that retailers may already adjust their prices to account for the expansion and contraction of fuel, while still others questioned the benefit to consumers from investing in temperature-compensating devices in areas where the average ambient temperature is close to 60 degrees F.

The majority of stakeholders—including state officials, consumer and industry representatives, and fleet owners—said that a cost-benefit study such as the one under way in California would provide policymakers with important information. The California study will examine the costs for retailers to purchase and install appropriate equipment and calibrate it. In addition, the study will develop data on the costs to agencies to develop appropriate test procedures, acquire calibration equipment, and inspect the pumps at retail stations. Information on the costs and benefits was needed to make an informed decision on automatic temperature compensation, according to many stakeholders. A small number said they would wait to see the results of California's study before deciding whether to support or oppose the implementation of automatic temperature compensation. Moreover, some who oppose automatic temperature compensation said they would support it if a cost-benefit analysis showed a benefit for the consumer.

Governments That Have Adopted Automatic Temperature Compensation Did So Largely to Improve Purchasing Equity, and Those That Have Not Cited Concerns That the Costs Would Outweigh the Benefits

Governments that have adopted or permitted automatic temperature compensation, or are considering doing so, cited improved measurement accuracy and greater equity between retailers and consumers as reasons for making the change, whereas those governments that do not allow temperature compensation cited concerns that the costs would outweigh the benefits. Hawaii, Belgium, Canada, and the European Union (EU) have each adopted a policy on temperature compensation—mandatory in Hawaii and Belgium and permissive in the remaining jurisdictions. In addition, the United Kingdom is considering a national approach to temperature compensation, and Australia may do so again. Both countries debated the issue in the 1990s but did not adopt nationwide policies for retail fuel sales at that time.

Because retail motor fuel dispensers equipped with automatic temperature compensation devices were not readily available 26 years ago, Hawaii developed its own method to achieve temperature compensation for retail sales of fuel to provide purchasing equity for both the industry and the consumer, according to a state official. The method is based on test procedures that rely on both the temperature and density of the fuel. A 5-year study of the average temperature of fuel delivered to consumers in Hawaii found that the fuel temperature was approximately 80 degrees F. More specifically, Hawaiian weights and measures officials test retail pumps to ensure that they meet the state standard—to deliver the amount of fuel a 231 cubic inch gallon would occupy at 60 degrees F, or its expanded or contracted equivalent at any other temperature. In Hawaii, the expanded equivalent is about 234 cubic inches per gallon—to reflect the increased volume at the higher fuel temperature. Implementation was phased in over 1 year. A state official said retailers may apply for a variance from the state standard provided they can demonstrate that the temperature of the fuel they deliver to consumers in their location differs from 80 degrees F. According to a state official, temperature compensation is a matter of fairness and equity.

Belgium mandated temperature compensation for retail sales of fuel beginning in January 2008. Belgium adopted temperature compensation for retail sales, in part, because some retailers were artificially heating fuel, and the government sought greater consistency in the energy content of the fuel sold to consumers, according to a weights and measures official. After January 2008, any newly installed pumps must be equipped for temperature compensation and, by January 2015, all pumps must be equipped to dispense temperature-compensated fuel. A Belgian official told us that the 7-year transition period will allow retailers to make adjustments over time, in the normal course of their operations, thereby reducing the overall cost to implement temperature compensation. While

retailers will decide when to install temperature compensation equipment, they are prohibited from turning it off. That is, once the equipment is in place and dispensing temperature-compensated fuel, all hoses attached to the equipment must continue to dispense temperature-compensated fuel. To date, the Belgian government has not developed guidance for consumers or retailers, in part because the transition to temperature compensation has just begun, according to the official.

Canada has adopted a permissive policy on automatic temperature compensation for the retail sale of liquid petroleum products, such as gasoline, diesel, and home heating oil. Specifically, Canada established technical and other standards in the early 1990s that allowed retailers to sell temperature-compensated fuel, but it did not require them to do so. According to a Canadian official, Canada developed the standards largely for three reasons: advances in measurement technology had made temperature compensation equipment more readily available, automatic temperature compensation is thought to be a more equitable and accurate method of measuring fuel, and temperature compensation addresses retailers' concerns about inventory losses potentially due to temperature-related changes in volume. Today, over 90 percent of Canadian fuel retailers sell temperature-compensated fuel. Canada imposed policy controls on the use of temperature-compensated equipment to prevent practices that might harm consumers or businesses, and any change to pumps requires an inspection by government officials. For example, pumps with automatic temperature compensation devices must be operable and dispense temperature-compensated fuel at all times throughout the year. In addition, pumps equipped with the devices must have a sticker that says "Volume Corrected to 15 degrees C"⁸ adjacent to the pump's visual and printed net quantity display. Retailers may elect to convert only selected pumps or product lines, provided that all pumps for the same grade or blend of fuel are converted and the compensation equipment is activated at the same time.⁹ Because Canada's regulations are permissive rather than mandatory, retailers may choose to stop using compensation devices provided they obtain permission from Canadian weights and measures officials. Permission would not be granted if retailers wanted to only use automatic temperature compensation

⁸The reference standard of 15 degrees Celsius (C) is roughly equivalent to 60 degrees F.

⁹Canada also allows partial conversion to automatic temperature compensation based on "trade levels" that use different types of pumps, such as those mounted on vehicles or those that dispense fuel at high speed. In such cases, all pumps for a given trade level must be converted and activated at the same time.

seasonally when it was to their benefit, according to a Canadian official, who also said no retailers have sought to stop using the devices.

In addition, the EU currently permits member states to adopt temperature compensation, although fewer than 2 percent of retailers have installed the necessary equipment, according to an official with a European weights and measurement organization. This official said that making adoption possible, but not required, allows the market to make the decision when business owners decide it is in their interests to do so. As a result, implementation will occur gradually, thereby avoiding a “shock wave” from immediate mandatory implementation, according to the official. A shock wave would occur if retailers were required to purchase the equipment without regard to whether they had the funds to do so. The EU does not have a harmonized policy on temperature compensation, but, according to the official we interviewed, information on fuel temperature received by the retailer and dispensed to consumers would be important to the debate. However, the official also noted that retailers may, at their discretion, adjust prices to compensate for temperature-related changes in volume.

Currently, in Australia the states and territories require retailers to sell fuel on a compensated basis. However, by July 2010, responsibility for weights and measures regulation will shift from the states and territories to the federal government. According to an Australian official, the new national trade measurement legislation will replicate the current state and territory requirements for the sale of fuel. As part of the consultation process for developing new trade measurement regulations, comments on any aspect of trade measurement controls, such as temperature compensation, will be invited from all stakeholders, and the matter of temperature conversion of fuel sales at the retail level may well be raised.

Officials in the United Kingdom said they anticipate issuing a statement in the fall of 2008 that temperature compensation for retail fuel sales will be permitted nationwide but not mandated.

In the United States, officials in eight states that have laws or regulations prohibiting automatic temperature compensation largely said the decision should be based on an analysis of the costs and benefits, with some expressing concern that the anticipated costs would outweigh any benefit to consumers and fuel retailers. In some cases, these decisions were made more than 20 years ago, and the officials we interviewed had limited information about the reasons. More recently, Missouri and Texas considered state legislation to implement temperature compensation. In Missouri, where the average temperature of stored fuel is 62 degrees F,

officials said that consumers would be negatively affected if temperature compensation were adopted by changing the reference temperature because they would have to buy more temperature-adjusted gallons than uncompensated gallons to obtain the same amount of fuel. In addition, the state would need to add six inspectors and one clerical person at a cost of about \$1 million in the first 3 years. Moreover, they said retailers would face significant expense to purchase the compensation equipment if temperature compensation were achieved by the use of compensation devices. Specifically, Missouri officials in 2006 estimated that 65 percent of the state's pumps could be retrofitted, and 35 percent would need to be replaced, at a cost of about \$341 million. In Texas, officials have postponed further consideration of temperature compensation until a comprehensive nationwide cost-benefit analysis has been completed. In addition, officials in some states said that evidence of benefits to consumers from automatic temperature compensation could lead states to reconsider their current position.

Finally, governments have not formally studied the impact of their decisions to implement or not to implement automatic temperature compensation. Specifically, neither Hawaii nor Canada has studied the impact of temperature compensation, although officials reported it was not controversial and was generally well accepted by both consumers and the industry. In Belgium, temperature compensation has been implemented too recently to study its effects.

Concluding Observations

The weights and measures community has debated the costs and benefits of automatic temperature compensation for more than three decades with no resolution. The issues have not changed substantially, and both sides continue to passionately put forth their views. In general, supporters say that extending temperature compensation to the retail level could provide more transparency in fuel prices, while those who are opposed argue that upgrading existing equipment would be costly and pose potential economic hardship on retailers.

It remains unclear, however, what it would actually cost to implement automatic temperature compensation and whether consumers or businesses would end up paying those costs. Moreover, the two governments with the longest experience in temperature compensation of retail fuel sales (Hawaii and Canada) have not studied the effect of their policies. As a result, a policy debate is being played out without good information about the potential costs and benefits, and with both proponents and opponents basing their views on their professional judgment and their general understanding of economic theory.

Looking forward, there appears to be a real need for an objective analysis of the key issues stakeholders raise about costs and benefits, including the potential for higher costs to consumers and improved inventory management for retailers. Such a study would need to bring together petroleum-related scientific, engineering, and economic expertise. Absent such analyses, NCWM and state governments face potentially significant challenges to informing their decisions regarding automatic temperature compensation.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the Chief, Weights and Measures Division, National Institute of Standards and Technology; stakeholders we interviewed; appropriate congressional committees; and other interested parties. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or maurerd@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made contributions to this report are listed in appendix II.

Sincerely yours,



David C. Maurer
Acting Director
Natural Resources and Environment

Appendix I: Scope and Methodology

In conducting our work on each of our objectives, we reviewed National Conference on Weights and Measures (NCWM) documents and congressional testimony and performed a literature search to identify relevant documents and stakeholders likely to have a view on the implementation of automatic temperature compensation. We used the individuals identified through our document review and literature search as a starting point for the sampling technique that we used to identify additional stakeholders. That is, we used an iterative process (often referred to as the “snowball sampling” technique) to identify other stakeholders and selected for interviews those who would provide us with a broad and balanced range of perspectives on temperature compensation of gasoline and diesel. We used a standard set of questions to interview each of these individuals to ensure we consistently discussed each aspect of automatic temperature compensation. We also asked open-ended questions to allow people to share their views on this issue. To develop the questions, we reviewed NCWM and National Institute of Standards and Technology (NIST) documents, as well as congressional testimony. We used content analysis to identify the main themes among responses.

We continued interviewing and soliciting names until we determined we had appropriate coverage from all the relevant stakeholder groups. During the course of our review, we interviewed officials from the following 15 organizations, listed alphabetically: American Automobile Association; American Petroleum Institute; American Trucking Association; Consumer Watchdog; Defense Energy Support Center; National Association of Convenience Store Owners; NATSO, an organization representing travel plaza and truck stop owners; Owner Operator Independent Drivers Association; Petroleum Marketing Association of America; Society of Independent Gasoline Marketers of America; Schneider National, Incorporated; Swift Transportation Incorporated; United Parcel Service; United States Postal Service; and Weights and Measures Consulting. In addition, we interviewed federal officials at NIST, the Environmental Protection Agency, and the Federal Trade Commission because these agencies help oversee the marketplace generally or oversee aspects of the retail petroleum industry. We also obtained information from two of the three manufacturers who produce equipment that allow for automatic temperature compensation at retail pumps.

We also contacted officials in 17 states that the literature suggested may have taken or considered specific steps to adopt or prohibit automatic temperature compensation. Some of these states had proposed legislation, were identified in a survey conducted by NIST on state practices, or were recommended by other officials. One state—California—is conducting a state-mandated cost-benefit analysis of automatic temperature

Appendix I: Scope and Methodology

compensation. These 17 states included a mix of states that could be considered hot (5), cold (4), or neutral (7) based on NIST's analysis of temperature data for stored fuel. The 17th state was not included in NIST's analysis because of a lack of data. We interviewed officials in the following 17 states, listed alphabetically: Arizona, California, Florida, Hawaii, Iowa, Maine, Massachusetts, Minnesota, Missouri, Montana, Nebraska, New York, Oregon, Pennsylvania, South Dakota, Texas, and Wyoming.

Finally, we interviewed officials in Australia, Belgium, Canada, the Netherlands, and the United Kingdom because literature indicated they either had adopted or had considered implementing automatic temperature compensation, as well as officials at a European weights and measures organization.

We conducted our work from March 2008 to September 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for the information we present for each of our audit objectives.

Appendix II: GAO Contact and Staff Acknowledgments

GAO Contact

David C. Maurer, (202) 512-3841 or maurerd@gao.gov

Staff Acknowledgments

In addition to the individual named above, Cheryl Williams (Assistant Director), Cynthia Norris, and Henry Clay made key contributions to this report. Also contributing to this report were Pedro Almoguera, Nancy Crothers, and Cindy Gilbert.

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Appendix B

An Economic Analysis of the California Energy Commission Staff’s Fuel Delivery Temperature Study and the “Hot Fuel” Allegations

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**An Economic Analysis of the
California Energy Commission Staff's
Fuel Delivery Temperature Study
and
the "Hot Fuel" Allegations**

LECG

An Economic Analysis of the CEC Staff's *Fuel Delivery Temperature Study* and the "Hot Fuel" Allegations¹

Michael A. Flynn²

Since competition and cost of doing business determine the price of [motor fuel] products in the marketplace, the pricing structure for retail sales reflects loss or gain of product [due to temperature variation].³

If you tell [retailers] that they now have to sell on a net basis, you cannot assume that the price per gallon is going to remain the same.⁴

Introduction and summary

- The "hot fuel rip-off" is a myth, and to its credit, the *Fuel Delivery Temperature Study: Staff Report* (the "CEC Staff Report") does not conclude otherwise. The "hot fuel" myth is based on the incorrect assumption that – in the absence of overt temperature compensation at the retail pump – retail prices are not adjusted for the effect of

¹ This study presents the results of the author's independent economic analysis of proposals to require temperature compensation of retail sales of motor fuel in California, and more generally, of the national "hot fuel" controversy that gave rise to the California proposals. Preliminary versions of this study were presented informally to staff of the California Energy Commission on November 12, 2008, and to the Committee Workshop Regarding Staff Draft Report on Assembly Bill 868 Fuel Delivery Temperature Study on December 9, 2008. This study has been funded by a consortium of retail industry associations, including the National Association of Convenience Stores (NACS); NATSO, Inc.; the Petroleum Marketers Association of America (PMAA); and the Society of Independent Gasoline Marketers of America (SIGMA). However, the views expressed herein – as well as any errors – remain the responsibility of the author.

² Principal, LECG, 2000 Powell Street, Suite 600, Emeryville, California 94608.

³ Presentation of Harold E. Harris, Engineering Coordinator, Exxon Company, "Temperature Correction of Petroleum Products at Retail", *Report of the 59th National Conference on Weights and Measures*, July 11, 1974 at p. 195.

⁴ Remarks of Ross J. Andersen, Director of Weights and Measures, New York State Department of Agriculture and Markets, in the transcript of the CEC Staff Workshop re: AB 868 (Fuel Delivery Temperature Study), March 4, 2008, at p. 76.

temperature on the volume of fuel sold to consumers. Retail competition and repeat purchasing already adequately protect consumers from any “hot fuel” overcharges. Mandating an overt system of temperature compensation in California – whether the *ATC Retrofit*⁵ or the imposition of a “new reference temperature”⁶ – would add to costs that would have to show up in the retail price of gasoline and diesel fuel, without any offsetting benefit whatever.

- The “hot fuel” adherents erroneously assume that retail sales of gasoline and diesel fuel are not adjusted for temperature-induced expansion if temperature-compensation technology has not been explicitly incorporated into retail dispensers. They are wrong because they fail to realize that retail competition *already* leads dealers to take reductions in their target pump prices as fuel temperatures increase with warmer weather.
 - The “hot fuel” allegations amount to nothing more than unsupported conjectures based on the physical properties of motor fuel. In any event, as a matter of economics, these alleged profits are fundamentally irreconcilable with both the “highly competitive business environment” within which retailers operate and the structure, conduct and profit performance of the U.S. retail motor fuel industry.
 - These activists make no attempt to offer independent evidence that the “hot fuel rip-off” profits supposedly enjoyed by retailers in “warm” areas actually exist. To the contrary, the actual data on the profitability of U.S. retail stations completely refute the existence of the alleged “hot fuel profits” and effectively dispose of the “hot fuel” claims.
- Despite its many misapprehensions and economics errors, the *CEC Staff Report* should be commended for not endorsing the “hot fuel rip-off” allegations, for recognizing that California retailers operate in a “highly competitive business environment”, and generally for showing how difficult it is to make an economically credible cost-benefit case for the imposition of retail temperature compensation in California. But there are serious flaws in the *CEC Staff Report*, including:

⁵ In this paper, *ATC Retrofit* refers to the option analyzed by the CEC staff to fit all existing California retail fuel dispensers with automatic temperature compensation technology. See *CEC Staff Report* at Chapter 4, pp. 59-81.

⁶ Similarly, the “new reference temperature option” refers to the alternative to the *ATC Retrofit* under which all retail pumps would be adjusted to dispense “gallons” that measured approximately 232.7 cubic inches (the volume occupied by a net gallon at 71.1°F.), rather than standard U.S. gallons measuring 231.0 cubic inches. See *CEC Staff Report* at Chapter 5, pp. 86-88.

- The claim that – at least in the short- and medium term – California consumers would enjoy “more fuel” worth \$438 million annually following the proposed *ATC Retrofit*. This claim is wrong because the *CEC Staff Report* makes the same economics error that pervades the “hot fuel” allegations, namely that it would be possible to adjust the size of the quantity unit used to measure retail fuel transactions without causing any change in the retail price. In truth, California motorists would receive exactly the same amount of fuel at precisely the same total outlays after the *ATC Retrofit* as before.
- The claim that \$438 million a year in consumer “savings” could be extracted from retailers’ revenue, even though these “savings” likely are greater than dealers’ *total pre-tax* profits. In truth, retailers would need to increase their retail prices immediately in proportion to the increased size of each “gallon” dispensed following the *ATC Retrofit*.
- The claim that only in “the long term” would California retailers succeed in “recapturing” the revenue lost as a result of the *ATC Retrofit*, and that in the interim, California motorists would benefit from “more fuel” at no increase in retail prices. In truth, this is economic nonsense; dealers would need to increase retail prices immediately or go out of business.
- The claim that the cost to dealers of the *ATC Retrofit* – including both the increased direct wholesale cost per unit of fuel as well as the indirect equipment and labor costs associated with the *ATC Retrofit* itself – could be absorbed out of retailers’ profits or shifted to purchasers of the non-fuel items sold by convenience stores. In truth, this also is economic nonsense; the only way retailers could “absorb” such costs would be to increase their pump prices proportionately.
- The claim that California motorists would enjoy “increased price transparency benefits” worth \$3.2 million a year as the result of the *ATC Retrofit*. The CEC staff’s attempt to calculate these supposed benefits is based on an error-filled misapplication of the economic concept of *deadweight loss*. In truth, these “benefits” would be zero for California motorists as a group.
- The suggestion that Hawaii illustrates a successful early response by a state to the “hot fuel” issue. In truth, the switch to the larger “Hawaiian gallon” accomplished nothing; retail prices in Hawaii would have increased by the same percentage.
- The claim that the establishment of a “new reference temperature” in California also would save motorists \$438 million a year, at least until retailers “recaptured” that revenue in “the long term”. In truth, the choice of a particular “reference temperature” is completely arbitrary. More importantly, there is no need to adopt

any “reference temperature” in connection with retail fuel sales. Consumers would pay identically the same dollar amount for identically the same quantity of motor fuel, no matter what “reference temperature” – or no reference temperature at all – was mandated in California.

- But the most glaring problem with both the “hot fuel rip-off” allegations and the *CEC Staff Report* is their common failure to recognize that retail competition already fully protects consumers from any “hot fuel” overcharges and that, as a result, the “overcharges” and “hidden dealer profits” that supposedly result from the “hot fuel rip-off” never existed in the first place.
 - Competition in retail fuel markets already adjusts pump prices to compensate for the seasonal effect of temperature on the volume of gasoline and diesel fuel.
 - Repeated purchases by consumers are sufficient to insulate them from any cross-sectional differences among dealers’ fuel temperatures in local competitive areas.
 - Independent data on the profitability of retail stations – and in particular, on their profitability by U.S. region – show conclusively that there simply are no “hot fuel” profits.

- In summary, the supposed benefits claimed by temperature-compensation proponents are illusory, and spring from the same faulty logic that has given rise to the “hot fuel” allegations themselves. The only thing that the proposed *ATC Retrofit* would accomplish would be higher retail prices for gasoline and diesel fuel, owing to the costs of that retrofit itself. Emphatically, consumers would *not* enjoy “more fuel” as a result. Because competition already adjusts retail prices to compensate for seasonal temperature variation, there simply is no need to require an expensive, elaborate and likely confusing and disruptive system of automatic temperature compensation at the retail level in California.

Alternative systems for measuring retail motor fuel transactions

Quantity and price units

Every retail motor fuel transaction has two components: the *quantity* of fuel being purchased (measured in some standardized unit of physical volume) and the *price per unit* of that fuel (expressed in monetary units – such as U.S. dollars – for each quantity unit).

In retail transactions, there generally are alternative systems of weights and measures available for measuring the quantities and expressing the prices involved. For goods sold by weight, for example, transactions can be denominated in tons (both long and short), hundredweights, pounds or ounces, as well as in metric measures such as metric tons, kilograms,

and grams. For goods sold by liquid volume, there are gallons, quarts, pints, fluid ounces, cubic inches, British imperial gallons and quarts, and so forth, along with metric alternatives such as cubic centimeters, liters, kiloliters and cubic meters.

Conversion between alternative quantity units

Any volume expressed in terms of one unit of measure can be easily and exactly converted into the equivalent volume measured in terms of any other unit of volume measure. For example, it is simple to convert quantities measured in U.S. pounds into the equivalent number of kilograms and – relevant to the present matter – quantities measured in U.S. gallons can be easily and accurately restated in terms of the equivalent number of liters.

At the same time, if one knows the competitively-determined price in dollars per unit for one volume unit of measure, simple arithmetic yields the competitive price if the good or commodity is instead measured in some other unit of volume. As one example (shown in **Figure 1**), if one knows the current retail price for a gallon of gasoline, it is straightforward to determine the equivalent price for a liter purchased at retail.

Figure 1.
Changing from gallons to liters affects only the price per unit, not total outlays.

Change from U.S. Gallons to Liters						
	Unit of measurement for quantity sold	Size of quantity unit (cubic inches)	Total quantity units available for sale	Dealer's target total sales revenue	Resulting dealer target street price per unit	Total cost of 100 US gallons (23,100 cubic inches)
Before	U.S. Gallon	231.00	8,000.0	\$24,000	\$3.000	\$300.00
After	Liter	61.02	30,285.2		\$0.792	\$300.00
Change		-73.58%			-73.58%	0.00%

Since examples of this sort will be used repeatedly in this paper, it is useful to spend some time on how **Figure 1** was constructed. It starts with the assumption that the retailer has 8,000 U.S. gallons available for sale, for which he hopes to realize \$24,000 in sales revenue.⁷ This requires that he achieve a target street price of \$3.000 per gallon. Now assume that his

⁷ At this point, it does not matter whether the 8,000 gallons have been measured in *gross* units (i.e., not compensated for temperature variation) or *net* (i.e., temperature-compensated) units. Similarly, it does not matter at this point how the dealer arrived at his target revenue of \$24,000. In later variations on this basic illustration, it will be specifically assumed that the retailer's wholesale cost per gallon is \$2.875 (or \$23,000 for 8,000 gallons) and that if his target margin per gallon is 12.5 cents, his target retail price per gallon should be \$3.000. Selling 8,000 at \$3.000 per gallon would generate \$24,000 in sales revenue.

sales must henceforward be measured in liters (at 61.02 cubic inches per liter) instead of U.S. gallons (defined as 231.00 cubic inches). Simple arithmetic shows that the retailer would derive 30,285.2 liters from the 8,000 U.S. gallons. But at what retail price would he seek to sell each liter? The answer – \$0.792 – is gotten by dividing the \$24,000 in target sales revenue by the 30,285.2 liters available for sale.

There are several features of this example that should be noted. First, it is the retailer's motivation to keep constant his total sales revenue – combined with the fact that he operates in a competitive business environment – that drives the result. He cannot hope to repeatedly achieve more than \$24,000 in sales revenue because competition from his rivals would make that impossible. At the same time, he cannot repeatedly settle for less than \$24,000 in sales revenue because this would mean that his return over time would be insufficient to sustain him in business.

Second, as this example shows clearly, it is easy to translate between any two units of measure when each can separately be expressed in terms of a specific number of cubic inches per unit.

Third, and most importantly, a change in the unit of measure by a particular percentage would result in a change in the retail price per unit by the same percentage. In this example – going from U.S. gallons to liters – the volume of the unit of measurement declines by 73.58 percent (from 231 to 61.02 cubic inches). Therefore, it should not be surprising that the dealer's target street price per unit also falls by 73.58 percent (from \$3.000 to \$0.792).

Fourth, and last, this example makes clear that the change from U.S. gallons to liters did not give the consumer any “more” or “less” fuel than before. A retail customer who – prior to the change from gallons to liters – purchased 100 gallons (23,100 cubic inches) in a month for \$300.00 now receives over 378 “units” for his \$300.00. But it should be obvious that this does *not* mean that he got “more” fuel following the change from U.S. gallons to liters. If the retailer switched from liters back to U.S. gallons so that the consumer then received his 23,100 cubic inches in larger units of measure (namely, gallons), this also would not mean that he was getting “more” fuel after the switch.⁸

These four principles are again illustrated in **Figure 2**, in which the assumed change is from U.S. gallons (231 cubic inches) to imperial gallons (277.40 cubic inches).

⁸ However, this seems to be the “logic” implicit in the *CEC Staff Report*.

Figure 2.
Changing to imperial gallons affects only the price per unit, not total outlays.

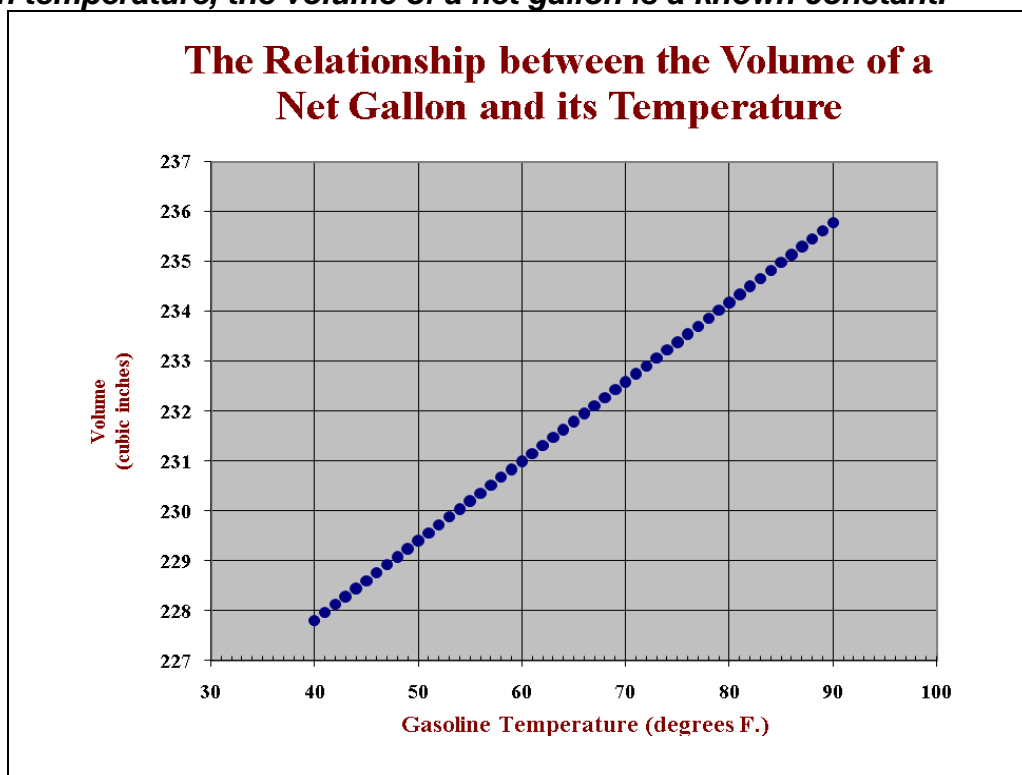
Change from U.S. Gallons to Imperial Gallons						
	Unit of measurement for quantity sold	Size of quantity unit (cubic inches)	Total quantity units available for sale	Dealer's target total sales revenue	Resulting dealer target street price per unit	Total cost of 100 US gallons (23,100 cubic inches)
Before	U.S. Gallon	231.00	8,000.0	\$24,000	\$3.000	\$300.00
After	<i>Imperial Gallon</i>	<i>277.40</i>	<i>6,661.8</i>		<i>\$3.603</i>	<i>\$300.00</i>
Change		<i>20.09%</i>			<i>20.09%</i>	<i>0.00%</i>

Quantity units defined by temperature

Next, I extend these examples to deal with changes in fuel volume induced by changes in temperature. As is well-known to anyone familiar with the “hot fuel” allegations, the variation in the volumes occupied by gasoline and diesel fuel due to temperature variation has motivated the so-called *net* gallon, which (in the case of gasoline) occupies 231 cubic inches only at 60° F. At temperatures in excess of 60° F., a net gallon occupies more than 231 cubic inches, while at temperatures below 60° F., a net gallon is smaller than 231 cubic inches. So, in contrast to a *gross* gallon – which always is 231 cubic inches, regardless of the fuel’s temperature – the volume (in cubic inches) of a *net* gallon of fuel varies directly with temperature.

But the key insight is that any “gallon” defined in terms of a reference temperature – such as the *net* gallon defined at 60° F. – corresponds to a *known* number of cubic inches at any other temperature, owing to the linear relationship between the temperature of a net gallon of motor fuel and its volume in cubic inches. This is illustrated in **Figure 3**, which shows the number of cubic inches occupied by a net gallon at temperatures from 30° to 100° F. Because of this simple linear relationship, at any particular temperature there is one – and only one – “size” of a net gallon of gasoline or diesel fuel, and knowing the temperature of the fuel is the same as knowing the size in cubic inches of a net gallon of that fuel.

Figure 3.
At each temperature, the volume of a net gallon is a known constant.



This means that fuel units defined in terms of temperature are no different than any other fuel units that are defined in terms of cubic inches, notwithstanding the *CEC Staff Report's* mistaken assertion to the contrary.⁹ The fact that the number of cubic inches varies as the temperature varies is a red herring. The important point is that *at any particular temperature* the number of cubic inches is a *known constant*, and retail competition can and will lead to the appropriate adjustment in the price per unit.

Next, consider a change in the quantity unit of measure from U.S. gallons to a hypothetical “75° F. reference temperature gallon”¹⁰ as shown in **Figure 4**, which is similar to **Figures 1 and 2** already discussed. It should not be surprising that the retailer’s resulting target street price of \$3.031 per “gallon” is 1.035 percent greater than the original \$3.000 per gallon, because – at 233.39 cubic inches – the volume of this 75° F. reference temperature gallon is 1.035 percent greater than a 231-cubic inch U.S. gallon.

⁹ The *CEC Staff Report* incorrectly claims at p. 6 that “A change from gross to net gallons at retail stations in California would not be similar to a conversion to the metric system...because the cubic inches dispensed to retail motorists would *vary* according to temperature. The number of cubic inches dispensed to retail motorists if stations converted to liters would be *fixed* under varying temperature (emphasis in original).”

¹⁰ Defined as the volume – 233.39 cubic inches – occupied by a net gallon at 75° F.

Figure 4.
Changing to "75° gallons" affects only the price per unit, not total outlays.

Change from U.S. Gallons to "75° F. Reference Standard Gallons"						
	Unit of measurement for quantity sold	Size of quantity unit (cubic inches)	Total quantity units available for sale	Dealer's target total sales revenue	Resulting dealer target street price per unit	Total cost of 100 US gallons (23,100 cubic inches)
<i>Before</i>	U.S. Gallon	231.00	8,000.0	\$24,000	\$3.000	\$300.00
<i>After</i>	75° Gallon	233.39	7,918.0		\$3.031	\$300.00
<i>Change</i>		1.04%			1.04%	0.00%

Taken together, **Figures 1, 2 and 4** illustrate an important principle: If retail sales of gasoline and diesel take place in a competitive market, that retail competition insures that any change in the size of the unit used to measure quantity would necessarily be accompanied by an equal change in the competitive price per “unit”. A consumer would never receive “more” or “less” fuel, and she would not pay “more” or “less” for that fuel. Her total dollar outlays for a specific quantum of fuel – such as 23,100 cubic inches or 100 U.S. gallons – would remain the same, regardless of which system of quantity units is used and regardless of the differences in the size of the particular units of measure.

“Net” and “gross” systems of measurement

Because volumes of motor fuel can be measured using any of several quantity units – such as U.S. gallons, liters, net gallons, “reference temperature gallons”, and the like – it is necessary to insure that the physical unit used to measure quantity and the retail price per unit are based on the *same* unit of measurement.

The “hot fuel” controversy arises from the fact that quantities of fuel sold in the U.S. can be measured using either of two alternative systems, *gross* gallons or *net* gallons.¹¹ As a result, the price of fuel can be denominated in dollars per *gross* gallon or in dollars per *net* gallon.

This is summarized in **Figure 5**, a simple diagram that illustrates four possible scenarios for measuring retail sales of motor fuel generated by forming the possible combinations of the two systems for measuring quantities with the two systems for measuring price per unit:

¹¹ A *net* gallon of fuel is defined as the quantity of fuel (measured by weight) that would occupy 231.0 cubic inches at 60°F. A *gross* gallon – alternatively, a U.S. gallon – of fuel occupies 231.0 cubic inches regardless of temperature.

Figure 5.
Four possible scenarios for measuring retail fuel transactions.

		<i>How the QUANTITY of fuel is measured at retail</i>	
		<i>In GROSS gallons (no adjustment for temperature)</i>	<i>In NET gallons (temperature-compensated)</i>
<i>How the PRICE of fuel is expressed at retail</i>	<i>In \$ per GROSS gallon (no adjustment for temperature)</i>	I	II
	<i>In \$ per NET gallon (temperature-compensated)</i>	III	IV

Scenario I Retail sales are measured in *gross* gallons and priced in dollars per *gross* gallon.

Scenario II Retail sales are measured in *net* gallons but sold at the price per “unit” that would prevail if sales were measured in *gross* gallons.

Scenario III Retail gasoline sales are measured in *gross* gallons but priced at the same dollars per unit that would prevail if retail quantities were measured in *net* gallons.

Scenario IV Retail gasoline sales are measured in *net* gallons and priced in dollars per *net* gallon.

Consumers’ interests are protected as long as retail fuel sales take place in a highly competitive market and the *same* system – it does not matter whether *gross* or *net* – is used when measuring both quantities and prices. In terms of **Figure 5**, if the assumptions of **Scenario I** are met (in other words, in the absence of temperature compensation at the retail pump, the price is determined in a competitive retail market and denominated in terms of dollars per *gross* gallon), then consumers’ interests are as fully protected as they would be under **Scenario IV**, but without the costs generated by the implementation of automatic temperature compensation. It is the core assumption of this paper that no dispute or problem arises as long as retail fuel sales are conducted according to *either Scenario I or Scenario IV*. This is because,

under either of these two scenarios, there is no conflict between the system for measuring quantities and the system for measuring prices.

But *Scenarios II and III* would be problematic, because each is predicated on a fundamental inconsistency between the system for measuring quantity and the system for measuring prices.¹² In any transaction, quantity and price must be measured in terms of units that are logically consistent with each other, or the result would be nonsensical. For example, no one would seriously maintain that the total amount of a retail gasoline sale should be calculated by measuring the quantity in liters and then multiplying that quantity by the price per unit that would emerge if quantities were measured in gallons. Therefore, it is reasonable to expect that the retail prices of gasoline and diesel fuel should be expressed in terms of the same physical unit that is used to measure the quantity of motor fuel being sold at retail.

Net vs. gross systems in the “hot fuel” allegations

The only way to make logical sense of the claims of “hot fuel” activists is that they must think that fuel sales in California – and in the U.S. generally – currently take place according to *Scenario III*, in which it is assumed that retail prices are stated in dollars per *net* gallon without there being any adjustment for temperature-induced expansion when measuring *quantities*.¹³ This is illustrated by **Figure 6**. Only by making such an assumption could these activists expect (as they do) that current retail prices per “unit” would remain the same even if the quantity unit was changed from gross gallons to net gallons. While temperature-compensation activists might believe they are pushing for *Scenario IV*, they would be wrong if retail prices actually are denominated in dollars per gross gallon. Put differently, this means that – as depicted in **Figure 7** – these “hot fuel” activists really are demanding that retail sales be governed by *Scenario II*, which improperly mixes net quantity units with prices stated in terms of gross units.

¹² Whether retail transactions are based on the same system of measure as is used in connection with so-called “upstream” transactions is irrelevant. But there would be a problem if a *mixed* system (i.e., a combination of gross and net measures) were used at retail. Specifically, if *net* quantity units were required solely on the ground that net units also were employed in “upstream” transactions, while retail prices somehow continued to be expressed in dollars per *gross* gallon, the result would be economic chaos.

¹³ For what else could these activists mean when they insist that consumers “aren’t getting what they paid for”? If this is not their assumption, then retail sales would be taking place under *Scenario I* currently, effectively mooting the entire “hot fuel” controversy.

Figure 6.
The status quo as seen by the “hot fuel” activists.

		How the QUANTITY of fuel is measured at retail	
		In GROSS gallons (no adjustment for temperature)	In NET gallons (temperature-compensated)
How the PRICE of fuel is expressed at retail	In \$ per GROSS gallon (no adjustment for temperature)	I	II
	In \$ per NET gallon (temperature-compensated)	III	IV

Figure 7.
The scenario actually demanded by the “hot fuel” activists.

		How the QUANTITY of fuel is measured at retail	
		In GROSS gallons (no adjustment for temperature)	In NET gallons (temperature-compensated)
How the PRICE of fuel is expressed at retail	In \$ per GROSS gallon (no adjustment for temperature)	I	II
	In \$ per NET gallon (temperature-compensated)	III	IV

Net vs. gross systems in the CEC Staff Report

The *CEC Staff Report* appears to be predicated on different assumptions than those made by the “hot fuel” activists (**Figures 6 and 7**). Instead of assuming that retail fuel sales currently are measured in gross gallons but priced in terms of net gallons (**Figure 6**), the *CEC Staff Report* offers no explicit assumption at all. But the CEC staff appears to accept that retailers’ sales and prices are both measured in gross gallons (i.e., **Scenario I** as shown in **Figure 5**).¹⁴

But by claiming that – at least in the short- and medium term following the *ATC Retrofit* – retailers could be expected to dispense temperature-compensated net gallons at their unchanged former prices for U.S. (or gross) gallons, the *CEC Staff Report* assumes that retail sales would follow **Scenario II** in **Figure 8** during that interval.

Figure 8.
The CEC Staff Report’s “short- and medium-term” scenario.

		How the QUANTITY of fuel is measured at retail	
		In GROSS gallons (no adjustment for temperature)	In NET gallons (temperature-compensated)
How the PRICE of fuel is expressed at retail	In \$ per GROSS gallon (no adjustment for temperature)	I	II
	In \$ per NET gallon (temperature-compensated)	III	IV

¹⁴ It should be pointed out, however, that the *CEC Staff Report* makes a contradictory assumption in connection with its attempt to analyze the “information asymmetry” supposedly inherent in current retail fuel sales in California. There the CEC staff explicitly assumes that “Retailers price fuel on a net gallon basis and then sell the fuel on a gross gallon basis.” See *CEC Staff Report* at Appendix R, p. 149. In its body, the *CEC Staff Report* cannot be making this assumption (that retail prices currently are priced on a net gallon basis). If it did, the anticipated revenue “recapture” by retailers would lift pump prices to supracompetitive levels, something that is economically incompatible with the “highly competitive business environment” within which retailers are deemed to operate.

Only in the long term does the *CEC Staff Report* concede that retailers would manage to recapture their previous revenue levels by achieving pump prices that are consistent with the temperature-compensated, net gallons they would be dispensing. This is illustrated by *Scenario IV* in **Figure 9**.

Figure 9.
The CEC Staff Report's "long-term" scenario.

		How the QUANTITY of fuel is measured at retail	
		In GROSS gallons (no adjustment for temperature)	In NET gallons (temperature-compensated)
How the PRICE of fuel is expressed at retail	In \$ per GROSS gallon (no adjustment for temperature)	I	II
	In \$ per NET gallon (temperature-compensated)	III	IV

"Net" and "gross" systems are equally valid alternatives

The *net* and *gross* systems of measurement provide alternative depictions of the same objective facts, as is illustrated by **Figure 10**. So long as each is used independently and consistently, either system of measurement can be used in retail operations and transactions, because they are two different ways of measuring the *same* objective reality. As should be clear from the examples shown in **Figures 1, 2 and 4**, no objective aspect of that reality changes depending on which measurement system is employed. In particular, the total dollar cost to a motorist for a given quantum of fuel would be identical under either *Scenario I* or *Scenario IV*. A problem would arise only if one fails to use a particular system *consistently* by, for example, mixing quantity units from one system with price units from the other.

Figure 10.
Net and gross systems are equally valid alternatives for the same objective reality.

In "Cold" Climate (gasoline at 45° F.)							
	Total "gallons" delivered	Size of "gallon" (in cubic inches)	Dealer's cost of delivered fuel	Dealer's Implicit cost per "gallon"	Dealer's target gross margin	Dealer's target sales revenue	Dealer's target street price per "gallon"
Measured in NET Gallons*	8,082.8	228.61	\$23,000	\$2.846	\$1,000	\$24,000	\$2.969
Measured in GROSS Gallons	8,000.0	231.00		\$2.875			\$3.000
In "Hot" Climate (gasoline at 75° F.)							
	Total "gallons" delivered	Size of "gallon" (in cubic inches)	Dealer's cost of delivered fuel	Dealer's Implicit cost per "gallon"	Dealer's target gross margin	Dealer's target sales revenue	Dealer's target street price per "gallon"
Measured in NET Gallons*	7,917.2	233.39	\$23,000	\$2.905	\$1,000	\$24,000	\$3.031
Measured in GROSS Gallons	8,000.0	231.00		\$2.875			\$3.000

* "Net Gallons" are used in this and subsequent exhibits for illustrative purposes. In actuality, retailers receive only "Gross Gallons" but may be billed for "Net Gallon" equivalents.

Figure 10 illustrates how a dealer's receipt and sale of the same physical quantity of gasoline can be accounted for using either of two systems: *Scenario I* (with prices and physical units expressed in gross gallons) or *Scenario IV* (with prices and physical units denominated in net gallons). The essential equivalence of these two alternative systems is the result of the competitive discipline that leads a retailer to seek to generate the same \$24,000 in total revenue from an assumed wholesale delivery of gasoline, no matter whether he conducts his trade in gross units or in net units.

Figure 10 also illustrates the impact of temperature variation on these two alternative systems for measuring retail transactions in motor fuel. Obviously, temperature differences have no impact when both prices and quantities are measured using net units. But gross measurement systems are equally capable of adjusting for temperature variation, even though this can result in different numbers of gross gallons available for sale from the same physical quantum of gasoline as its temperature changes. Retail competition compensates for the varying number of available gallons by inducing the dealer to set target street prices that vary by the exact amount needed to

insure that selling that fuel will generate the target \$24,000, regardless of the temperature of the fuel at the time.

That a consumer would fare equally well under consistently-applied gross and net systems of measurement is demonstrated in **Figure 11**. In a “cold” climate, the dealer’s target sales revenue of \$24,000 would lead him to seek a retail price of \$2.969 per net gallon or \$3.000 per gross gallon. But the key point of **Figure 11** is that it would cost a consumer \$297 for 100 net gallons of gasoline, no matter whether the retailer’s pump prices were stated in terms of net gallons or gross gallons.¹⁵ Similarly, in a “warm” climate, the motorist’s cost for 100 net gallons of gasoline would be identically the same at \$303, no matter whether the retailer dispensed fuel in net gallons or gross gallons.

Figure 11.
A consumer’s total outlay is identical using either the net or gross system.

<i>In "Cold" Climate (gasoline at 45° F.)</i>					
	Total "gallons" available for resale	Size of "gallon" (in cubic inches)	Dealer's Implicit cost per "gallon"	Dealer's target street price per "gallon"	Total retail cost of 100 net gallons
Measured in NET Gallons*	8,082.8	228.61	\$2.846	\$2.969	\$297
Measured in GROSS Gallons	8,000.0	231.00	\$2.875	\$3.000	\$297
<i>In "Hot" Climate (gasoline at 75° F.)</i>					
	Total "gallons" available for resale	Size of "gallon" (in cubic inches)	Dealer's Implicit cost per "gallon"	Dealer's target street price per "gallon"	Total retail cost of 100 net gallons
Measured in NET Gallons*	7,917.2	233.39	\$2.905	\$3.031	\$303
Measured in GROSS Gallons	8,000.0	231.00	\$2.875	\$3.000	\$303

The careful reader will notice that – for the purposes of **Figures 10 and 11** – it was assumed that the dealer’s wholesale price was \$2.875 per *gross* gallon and that he sought to

¹⁵ This paper makes occasional reference to a particular “quantum of fuel”, meaning a fixed number of net gallons. The fact that the number of net gallons is invariant with respect to temperature is used only for convenience of exposition, and such usage should *not* be taken to mean that measuring retail transactions using net units is inherently superior to using gross gallons.

achieve a retail margin of \$0.125 per *gross* gallon. However, nothing of substance would change if it were assumed instead that the dealer paid a wholesale price of \$2.875 per *net* gallon and sought a margin of \$0.125 per *net* gallon, a fact demonstrated in **Figures 12 and 13**. In this alternative, a consumer would pay the identical amount – \$300 – for the fixed quantum of gasoline (i.e., 100 net gallons), regardless whether the retail transaction itself were denominated in terms of gross gallons or net gallons.

Figure 12.
Nothing changes if the dealer's targets are denominated in net gallons.

In "Cold" Climate (gasoline at 45° F.)							
	Total "gallons" delivered	Size of "gallon" (in cubic inches)	Dealer's cost of delivered fuel	Dealer's Implicit cost per "gallon"	Dealer's target gross margin	Dealer's target sales revenue	Dealer's target street price per "gallon"
Measured in NET Gallons*	8,082.8	228.61	\$23,238	\$2.875	\$1,010	\$24,248	\$3.000
Measured in GROSS Gallons	8,000.0	231.00		\$2.905			\$3.031
In "Hot" Climate (gasoline at 75° F.)							
	Total "gallons" delivered	Size of "gallon" (in cubic inches)	Dealer's cost of delivered fuel	Dealer's Implicit cost per "gallon"	Dealer's target gross margin	Dealer's target sales revenue	Dealer's target street price per "gallon"
Measured in NET Gallons*	7,917.2	233.39	\$22,762	\$2.875	\$990	\$23,752	\$3.000
Measured in GROSS Gallons	8,000.0	231.00		\$2.845			\$2.969

Figure 13.

A consumer's total outlays are the same under net and gross systems.

<i>In "Cold" Climate (gasoline at 45° F.)</i>					
	Total "gallons" available for resale	Size of "gallon" (in cubic inches)	Dealer's Implicit cost per "gallon"	Dealer's target street price per "gallon"	Total retail cost of 100 net gallons
Measured in NET Gallons*	8,082.8	228.61	\$2.875	\$3.000	\$300
Measured in GROSS Gallons	8,000.0	231.00	\$2.905	\$3.031	\$300
<i>In "Hot" Climate (gasoline at 75° F.)</i>					
	Total "gallons" available for resale	Size of "gallon" (in cubic inches)	Dealer's Implicit cost per "gallon"	Dealer's target street price per "gallon"	Total retail cost of 100 net gallons
Measured in NET Gallons*	7,917.2	233.39	\$2.875	\$3.000	\$300
Measured in GROSS Gallons	8,000.0	231.00	\$2.845	\$2.969	\$300

The inconsistency of the "hot fuel" activists

The "hot fuel" activists have what can only be described as a schizophrenic approach to the measurement issues presented by variations in fuel temperature, a fact illustrated in **Figure 14**. These activists prefer to overlook entirely the retail fuel transactions that occur in "cold" climates. This no doubt is due to the fact that – were they to apply the same "logic" they employ when analyzing transactions in "hot" climates – they would have to conclude that it is the *consumers* who are "ripping off" the retailers in these colder states.

Figure 14.

“Hot fuel” activists prefer to ignore retail transactions in “cold” climates.

In "Cold" Climate (gasoline at 45° F.)								
Ignore Transactions in "Cold" Climates				Dealer's cost of delivered fuel	Dealer's Implicit cost per "gallon"	Dealer's target gross margin	Dealer's target sales revenue	Dealer's target street price per "gallon"
Measured in NET Gallons*	8,082.8	228.61		\$23,238	\$2.875	\$1,010	\$24,248	\$3.000
Measured in GROSS Gallons	8,000.0	231.00			\$2.905			\$3.031
In "Hot" Climate (gasoline at 75° F.)								
	Total "gallons" delivered	Size of "gallon" (in cubic inches)	Dealer's cost of delivered fuel	Dealer's Implicit cost per "gallon"	Dealer's target gross margin	Dealer's target sales revenue	Dealer's target street price per "gallon"	
Measured in NET Gallons*	7,917.2	233.39	\$22,762	\$2.875	\$990	\$23,752	\$3.000	
Measured in GROSS Gallons	8,000.0	231.00		\$2.845			\$2.969	

But there is another telling inconsistency even within their analysis of retail fuel transactions in “hot” climates. As was illustrated in **Figure 7**, temperature-compensation activists effectively are demanding that retail sales of “hot” fuel be measured using a *mixed* system of measurement units – namely **Scenario II** – with quantities measured in *net* gallons but sold at *unadjusted gross* prices per unit.

Figure 15 shows the consequences that would result if a retailer actually attempted to conduct his business in the way demanded by the “hot fuel” activists (assuming a fuel temperature of 75° F.). Because these activists would expect the dealer to dispense larger (i.e., 233.39-cubic-inch) *net* gallons at this temperature – but at the same \$3.000 target retail price the dealer previously sought on each *gross* gallon sold – this would result in an immediate and significant reduction in the dealer’s sales revenue and profitability. In the illustration in **Figure 15**, the dealer’s gross margin would decline by nearly 25 percent. Since the dealer’s other costs of doing business also must be covered by that gross margin and since his net profit is only a small fraction of the total gross margin, such a 25-percent reduction likely would erase his entire profit, and over time, would jeopardize the very existence of the retailer’s business.

Figure 15.
The effect of the “hot fuel” activists’ demands on a retailer’s gross margin.

In "Hot" Climate (gasoline at 75° F.)							
	Size of "gallon" (in cubic inches)	Total "gallons" available for resale	Dealer's target sales revenue	Dealer's target street price per "gallon"	Actual sales revenue	Resulting dealer gross margin	Change in dealer's gross margin
<i>What the CEC Staff Report advocates...</i>	233.39	7,917.2	\$24,000.00	\$3.000	\$23,751.60	\$751.60	-\$248.40
...compared to current transactions using GROSS quantities and prices	231.00	8,000.0	\$24,000.00	↑ \$3.000	\$24,000.00	\$1,000.00	

The “hot fuel rip-off” controversy

The allegations themselves

Starting – and ending – with a few propositions, its adherents claim that the “hot fuel rip-off” is a proven scientific fact:

- Since the 1920s, most U.S. motor fuel transactions have been conducted on a “net” basis¹⁶ at all levels of distribution *except* retail sales to consumers.
- The volumetric expansion and contraction of gasoline and diesel fuel due to variations in temperature are well-established scientific facts.
- Consequently, a 231-cubic-inch gallon of fuel at 60° F. contains more energy than does a 231-cubic-inch gallon measured at a warmer temperature.
- Most U.S. retail sales of motor fuel take place at temperatures that – on average – exceed 60 ° F.¹⁷

¹⁶ That is, denominated in gallons that are temperature-compensated to 60 ° F.

¹⁷ Taken over the entire U.S. and all seasons of the year, the temperature of gasoline sold at retail supposedly averages about 64.7° F. But this estimate is based on figures collected by an unnamed manufacturer of storage tank monitoring equipment, the sampling properties of which are unknown. (Testimony of Richard Suiter, National Institute of Standards and Technology, before the Domestic Policy Subcommittee of the Oversight and Government Reform Committee, June 8, 2007 at p. 4.) The

On the basis of these propositions – and nothing more – the “hot fuel” activists assert that motorists are not getting the fuel that they paid for because U.S. retailers sell fuel in volumetrically-measured, 231-cubic-inch gallons with no adjustment or compensation in price or volume to correct for differences in temperature or in energy content. By selling this “hot fuel”, gasoline retailers supposedly have been shorting consumers by about 800 million gallons of fuel annually and overcharging them by billions of dollars each year.¹⁸ The “hot fuel” activists also charge that retailers collect approximately \$350 million each year in state and federal fuel taxes on the so-called “phantom gallons” created by temperatures in excess of 60° F. that they keep for themselves rather than remitting to the government.

The most recent “hot fuel” controversy was sparked by a series of articles that appeared in late 2006 and in 2007 in the *Kansas City Star* under the byline of Steve Everly that purported to document the supposedly decades-long practice by which U.S. retailers of gasoline and diesel fuel had been systematically shortchanging their customers.¹⁹ Using fuel storage tank temperature data, the impact of state-by-state average temperatures on fuel volume, and state-by-state motor fuel consumption data, the *Star* and Everly calculated that retail sales of “hot fuel” cost consumers approximately \$2.3 billion annually.²⁰

estimate supplied by this manufacturer for California (74.7° F.) has been shown by the *California Fuel Temperature Survey* – which yielded an average statewide temperature of 71.1° F. – to be not just “slightly” but significantly overstated. (*CEC Staff Report* at p. 25)

¹⁸ Statement of Joan Claybrook, President, *Public Citizen*, “Hot Fuel Means Big Rip-Off at Gasoline Pumps,” December 14, 2006 (“[in] a practice common in the gasoline retail industry...retailers have been ripping off consumers to the tune of an estimated 2 billion dollars a year.”)

¹⁹ The “hot fuel” charges were initially laid out in two 2006 front-page articles by Steve Everly: “It’s Hot Fuel for You, Cold Cash for Big Oil,” *Kansas City Star*, August 27, 2006 at p. A1; and “Technology, New Rules Can Fix Hot-Fuel Issues,” *Kansas City Star*, August 28, 2006 at p. A1. These were followed by more than a half dozen additional articles written by Mr. Everly and published by the *Star* in 2006, 2007 and 2008.

²⁰ Everly’s and the *Star*’s methodology was sketched as follows:

The fuel temperature data was gathered by the National Institute of Standards and Technology from storage tanks at 1,000 gas stations and truck stops in 48 states and the District of Columbia during a period from 2002 to 2004.

The NIST data revealed that the average temperature of fuel across the country and year-round was 64.7 degrees Fahrenheit – almost 5 degrees higher than the government standard of 60 degrees.

...

The *Star* estimated how much fuel sales were affected in each state based on the state’s average fuel temperature and how much fuel volume would expand or contract under those conditions. In most states, consumers got less energy per gallon than they were paying for because fuel temperatures were hotter than the standard. That translates into lower gas mileage – and more fill-ups down the road. In some cold-weather states,

The charges in the *Kansas City Star* series were taken up, repeated and amplified by a number of advocates²¹ and journalists at other newspapers.²² In 2007, the “hot fuel” allegations resulted in congressional hearings²³ and formed the basis for a number of lawsuits brought on behalf of classes of retail customers that have named various motor fuel retailers as defendants.²⁴

There are three important subtexts to the “hot fuel rip-off” allegations.

The first is that it is “Big Oil” – seeking to preserve its “hot fuel” profits by systematically shortchanging its retail customers – that has prevented the implementation of automatic temperature compensation at retail, while protecting its own interests by insisting on temperature compensation at all higher stages in the distribution chain from refinery to the corner gas station. In truth, not all “upstream” transactions are conducted on a temperature-compensated basis – a fact acknowledged by the *CEC Staff Report* – and there are economically reasonable explanations for its actual occurrences that having nothing to do with avoiding “hot fuel rip-offs”. Further, “Big Oil” owns and operates fewer than 10 percent of gasoline retail facilities, therefore its influence over retail fuel pricing decisions throughout the nation is significantly limited.

The second is that “Big Oil’s” hypocrisy is demonstrated by its “rush” in the 1990s to adopt temperature compensation on retail sales in Canada, supposedly because the industry was losing money when it sold fuel to motorists at temperatures below 15° C.²⁵ Again, there is an

drivers actually got a bit more energy per gallon because their gas was cooler than the standard.

The resulting state-by-state consumption change figures were then multiplied by the prevailing gas price in each state as reported during the last week of July by AAA. Those state-by-state gas figures were then combined with national figures for diesel consumption and price to arrive at the \$2.3 billion nationwide estimate.

²¹ These include Joan Claybrook of *Public Citizen*, John Siebert of the *Owner-Operator Independent Drivers Association (OOIDA)*, and Jamie Court and Judy Dugan of *OilWatchdog* (a project of *Consumer Watchdog.org*, formerly known as *The Foundation for Taxpayer and Consumer Rights (FTCR)*).

²² Including Elizabeth Douglass and Ronald D. White, *Los Angeles Times*, and David R. Baker, *San Francisco Chronicle*.

²³ Hearings on Hot Fuels, Subcommittee on Domestic Policy of the Committee on Oversight and Government Reform, Rep. Dennis Kucinich, Chairman, June 8 and July 25, 2007.

²⁴ These individual actions have been consolidated into the multi-district action captioned *In re: Motor Fuel Temperature Sales Practices Litigation (MDL 1840)* that has been assigned to the U.S. District Court for the District of Kansas.

²⁵ The Canadian reference temperature for motor fuel transactions that is roughly equivalent to 60° F.

economically rational explanation for the process by which temperature compensation was initially introduced in Canada and then spread to include the majority of retailers.

The third is that the state of Hawaii and George Mattimoe, its then Deputy Director of Weights and Measures, have shown that individual states can effectively end the “hot fuel rip-off” by requiring retailers to dispense larger “gallons” that – on average – compensate motorists for temperature-induced expansion. As is discussed at greater length below, the entire “Hawaii-Mattimoe” legend also is a myth. In particular, the introduction of the slightly larger “Hawaii gallon” did not “save” motorists anything. Because retail prices increased by the percentage given by the ratio of the volume of the “Hawaii gallon” to the U.S. statutory gallon, Hawaiian consumers’ outlays for a given quantum of motor fuel were unchanged.

Not surprisingly, “hot fuel” advocates prefer to focus attention on just those states – like California – in which the average temperature of dispensed fuel exceeds 60° F. and, therefore, the “hot fuel” overcharges supposedly are greatest. These activists appear to have little to say about the significant number of “colder” states in which – by their logic – it is the retailers who have been “ripped off” by consumers.

The “hot fuel” allegations are unproven conjectures

But the ATC proponents’ conclusions are pure conjectures that have never been verified by independent data. The “hot fuel” adherents appear to take as given their assumption that actual retail prices reflect the true market price for *temperature-compensated net* gallons. That is, they assume that actual retail prices have not been adjusted in any way to account for the volumetric expansion that occurs when fuel is greater than 60° F. The “hot fuel” adherents maintain that – in the absence of direct evidence that each retailer consciously calculates the adjustment to his retail price required by the actual temperature of the fuel in his tanks – no such “adjustment” ever occurs.

Put it in terms of scientific analysis and hypothesis-testing, all that these activists offer is a *hypothesis* about retail profits that they derive from the fact of temperature expansion, measurement of retail sales in 231-cubic-inch gallons regardless of temperature, and the average retail price per gallon at which those sales were made. But this in no way *proves* that retailers have actually extracted and pocketed any “hot fuel” profits. A hypothesis may have been formulated, but it has not been subjected to confirmation using independent data.

In other words, these claims by temperature-compensation activists – like any conjectures – must be shown to be consistent with *all* the relevant facts before they should be accepted as true. To the extent there is any validity to these claims, it means that it is the *retailers* who are reaping these “hot fuel” profits, not upstream refiners and wholesale marketers (because, say the “hot fuel” activists, ATC governs transactions at these higher levels in the distribution chain).

So it needs to be demonstrated that independent, direct measurements of actual retail store profitability confirm the existence of the supposed “hot fuel” profits. Similarly, it must be shown that the trends in the number and profitability of retail gasoline stores are consistent with the alleged decades-long existence of the supposedly massive “hot fuel” profits. If the actual data are inconsistent with these implications of the “hot fuel” allegations, then there ought to be considerable skepticism about the “hot fuel” claims.

Similarly, if it can be demonstrated that the retail prices posted for gasoline actually are the result of the competitive interactions of retailers and consumers, and that these prices *do* reflect the effect of temperature on volume, then the entire edifice erected by the temperature-compensation proponents simply collapses.

The economic flaw in the “hot fuel” activists’ argument is their assumption that prices currently charged at retail stations have not been adjusted for the effect of temperature because these activists see no evidence that each retailer makes the overt adjustments to his or her pump prices that would be required. In the absence of such explicit, overt adjustments by retailers, they argue that the street prices posted by retailers must be for the same temperature-compensated “net” gallons that they purchased at wholesale. Since retailers currently pump gross (or uncompensated) gallons, the “hot fuel” activists insist that motorists fail to receive “what they paid for.”

The “hot fuel” activists also insist that the “rip-off” exposed by the *Kansas City Star* has since been “proven” by the Kucinich hearings²⁶ as well as by the *CEC Staff Report* itself.²⁷

But nothing of the sort has occurred. The activists’ conclusions regarding the size and dollar value of the supposed “rip-off” really are nothing more than conjectures, based only on the physics of motor fuels subjected to temperature variation. The “hot fuel rip-off” allegations “predict” the accumulation of billions of dollars in ill-gotten “hot fuel” profits by retailers, but its adherents have done nothing to actually go out and directly measure these profits to see if they even exist and that their magnitude and geographic distribution are even consistent with the “hot fuel” rip-off hypothesis.

²⁶ David Tanner, “BREAKING NEWS: U.S. House report validates “hot fuel” rip-off,” *Land Line: The Business Magazine for Professional Truckers*, June 7, 2007 (emphasis added) http://www.landlinemag.com/Special_Reports/2007/Jun07/060707_hotfuel.htm

²⁷ Judy Dugan, “CEC Deep Freeze On Hot Fuel,” *OilWatchdog*, December 4, 2008 (emphases added) <http://www.oilwatchdog.org/articles/?storyId=24060&topicId=8072>

“A California Energy Commission (CEC) draft report on the “hot fuel” ripoff *proves beyond doubt* that consumers are unfairly treated at the pump...

“The CEC draft... *fully acknowledges* that consumers suffer annual loss in the hundreds of millions of dollars statewide (emphases added).”

The CEC Staff Report and the “hot fuel” allegations

Pursuant to AB 868²⁸ directing the California Energy Commission “to conduct a cost-benefit analysis and make recommendations relative to the implementation of automatic temperature compensation devices at retail service stations,” the staff of the California Energy Commission conducted a nearly year-long series of workshops that culminated in late November with publication of the *Fuel Delivery Temperature Study: Staff Report*.²⁹

Yet even though the “hot fuel” allegations led directly to the *CEC Staff Report*, there is an unmistakable tension between the two. At no point does the *CEC Staff Report* discuss the “hot fuel” allegations, much less endorse them.

While the *CEC Staff Report* does not even refer to the “hot fuel” controversy, its derivation of the potential consumer benefits from the *ATC Retrofit* are similar in methodology and amount to the “hot fuel profits” calculated for California by the *Kansas City Star*.³⁰ Unlike the implicit charge of the “hot fuel activists”, the *CEC Staff Report* does not claim that retailers’ pump prices are denominated in dollars per net gallon while they sell temperature-expanded gross gallons to motorists. But the *CEC Staff Report* does insist that

[F]uel sold at retail in California has not been volume-adjusted to compensate for variations in temperature, leading to concerns over potential inequities for retail motorists.³¹

At the same time, the *CEC Staff Report* concedes that retailers operate in a “highly competitive business environment.”³² The CEC Staff does not realize that, as a matter of economics, this concession is sufficient to establish that retail competition *must adjust retail prices* to compensate for temperature variations. Otherwise, retailers would be earning *supracompetitive* (i.e., “hot fuel”) profits, which are economically incompatible with a “highly

²⁸ Davis, Chapter 398, Statutes of 2007.

²⁹ CEC-600-2008-012-SF, Gordon Schremp, Principal Author, November 2008 (hereinafter referred to as the *CEC Staff Report*).

³⁰ Everly and the *Kansas City Star* calculated that retail purchasers of gasoline in California were being “ripped off” by approximately \$509 million per year, while the *CEC Staff Report* estimates that the annual benefit of the *ATC Retrofit* to California purchasers of retail gasoline would have amounted to \$376 million during the April 2007 - March 2008 study period. The approximately \$133 million annual difference is explained by the fact that the *Kansas City Star* assumed the average annual temperature of gasoline sold at retail in California was 74.7° F., while the *CEC Staff Report* concludes that the correct figure was at 71.1° F., or 3.6° F cooler.

³¹ *CEC Staff Report* at p. 5.

³² *CEC Staff Report* at p. 72.

competitive” market. It seems not to have occurred to the authors of the *CEC Staff Report* that competition might cause the *price* of the gross gallons dispensed by retailers to vary inversely with the temperature of that fuel. Nor does the *CEC Staff Report* explain how the thousands of California retailers – who operate in a highly competitive business environment – would be able to restore and sustain the supracompetitive prices that would be needed to “recapture” their previous revenue levels.

As a result, the *CEC Staff Report* appears to view the proposed *ATC Retrofit* in a vacuum – as something that California *could* mandate – with the only important question being whether it would succeed in transferring the \$438 million annually from retailers to motorists in the long term. The *CEC Staff Report* is interested only in whether that “consumer benefit” would be economically achievable and sustainable, and not in whether it is needed to correct the *status quo*. In short, the *CEC Staff Report* treats the *ATC Retrofit* as something akin to a “no fault” remedy for a nonexistent problem.

Consumers would not enjoy “more fuel” after the ATC Retrofit

The CEC staff appears to seriously believe that mandating the *ATC Retrofit* would result in “more fuel” for California motorists. How else can one interpret such statements as:

If Automatic Temperature Compensation (ATC) was required in California, [the] benefits would include *more fuel* for consumers (emphasis added).³³

or the following:

Potential Consumer Benefits Resulting From ATC Retrofit

This section of the report details the staff efforts to properly characterize and quantify [the] potential benefits. It should first be noted that “consumer benefits” have been denoted as the monetary value of *the additional transportation fuel* that California motorists would have received if ATC devices had been in place during the study period of April 2007 through March 2008. *The additional fuel* would be in terms of slightly larger size gallons as measured in cubic inches that would occur under circumstances in which retail fuel temperatures are warmer than 60 degrees Fahrenheit.³⁴

Not content to leave it at that, the *CEC Staff Report* continues:

³³ CEC Staff PowerPoint presentation at its June 5, 2008 workshop, Slide 6.

³⁴ *CEC Staff Report* at p. 75 (emphases added).

It is understood that retail transactions transitioning from gross to net gallons *will not alter the total demand for fuel* consumed over the study period, but rather result in variable size gallons depending on temperature. The main question to address is whether consumers would retain *the additional cubic inches* dispensed from ATC fuel dispensers during warmer period [sic] of the year without any attempt by retail station owners to recapture this revenue by raising prices of fuel and non-fuel goods.³⁵

One hardly knows where to begin. What “additional fuel” or “additional cubic inches” is the *CEC Staff Report* talking about, especially when any changes “will not alter the total demand for fuel”?³⁶

All that would be accomplished by either the *ATC Retrofit* or the adoption of a “new reference temperature” would be to change the size (in cubic inches) of the “gallon” used to measure retail fuel transactions. Under the *ATC Retrofit*, the size of that “gallon” would vary throughout the calendar year as a function of the seasonal variation in fuel temperature. Under the “new reference temperature” option, the size of that “new” gallon would be fixed at 232.77 cubic inches.

Because the size of a “gallon” at each possible alternative temperature is fixed and known – owing to the linear relationship shown in **Figure 3** – the changes following the *ATC Retrofit* or the “new reference temperature” would be no different in principle than the hypothetical change from U.S. gallons to British imperial gallons that has already been shown in **Figure 2**. In that example, competition resulted in dealers’ target retail prices increasing from \$3.000 to \$3.603, or by the same percentage that a 231-cubic-inch volume must be increased in order to occupy 277.4 cubic inches. Also in that example, if a consumer had been purchasing 23,100 cubic inches (or 100 U.S. gallons) at \$300 before the change, she would receive the same 23,100 cubic inches for the same \$300 following the change. She definitely would not receive “more fuel” after the switch.

³⁵ *Id.*

³⁶ Assume that a consumer buys 20 gallons of gasoline at \$3.00 per gallon, for a total outlay of \$60.00. The “logic” implicit in the *CEC Staff Report* is best illustrated by a scam in which a confidence man promises to quadruple the amount of gasoline received by that consumer while at the same time reducing by half his cost per unit. Whereupon the scam artist switches from gallons to quarts to measure the quantity of fuel purchased while reducing the retail price “per unit” from \$3.00 to \$1.50. By the “logic” implicit in the *CEC Staff Report*, the consumer would be getting “more” fuel at a “lower” price per unit, but he would now have to pay \$6.00 – or twice as much – for each gallon as was previously necessary.

As already shown in **Figure 4**, the adoption of any particular “reference temperature” – such as 75°F – has no effect on the total quantum of fuel received by a consumer or the total amount he pays at retail for it.

But as will be demonstrated in a later section of this paper, the same logic applies to “gallons” of fuel that vary in size (measured in cubic inches) due to seasonal changes in fuel temperature. At each possible temperature over the annual seasonal cycle, the volume occupied by a specific quantum of fuel (e.g., a specific number of net gallons) is fixed and known. More to the point, the number of gross gallons available to a retailer for sale to consumers also is fixed and known by him. In a competitive retail market, the retailer will aim for a target pump price that compensates him for the wholesale cost of that fuel while also allowing him to cover his other expenses and to earn a competitive return.

In other words, resorting to automatic temperature compensation to adjust for seasonal variations in temperature is, in principle, no different than mandating a sequence of changes in the applicable “reference temperature” throughout the calendar year. While each “gallon” may contain more (or fewer) cubic inches, this would not mean that motorists received “more” (or “less”) fuel. After all, the whole point of automatic temperature compensation is that it is supposed to ensure that consumers receive the *same* number of net gallons for a given outlay in dollars.

Because motorists do *not* receive “more fuel” following a change from U.S. gallons to gallons defined by a “reference temperature” greater than 60°F., they similarly would not get “more fuel” following the proposed *ATC Retrofit*. Rather, they would continue to receive the *same* total number of net gallons at the *same* total cost.

Put succinctly, the *CEC Staff Report* tries to quantify the “potential consumer benefits resulting from the *ATC Retrofit*” by adding up the “additional cubic inches of fuel” that consumers would “receive” with each “gallon” purchased and then valuing these additional cubic inches at unchanged retail prices. But consumers would be equally well off if the price they must pay per U.S. gallon is reduced to account for temperature-induced expansion. This is exactly what is achieved currently by retail competition without the expense and disruption that would be occasioned by the *ATC Retrofit*.

The choice for retailers: increase price immediately or go out of business

The *CEC Staff Report* appears to be based on the assumption that only the costs of the *ATC Retrofit* itself might eventually lead retailers to successfully increase their street prices, but even here it expects that any such increases would be only partially successful and, in any event, would succeed only “in the long term”. The *CEC Staff Report* appears to liken retailers’ raising their pump prices in order to “recapture” their erstwhile revenue streams as an attempt to “get even” for the *ATC Retrofit*, rather than as critically necessary for them to remain economically viable.

Gasoline retailing is competitive, as economists – and, one hopes, the CEC staff – use that term. This means that industry participants enjoy on average only normal competitive profits and that, at the margin, participants earn a return that is just sufficient to induce them to remain in business. Were retailers somehow required to pay for the costs of implementing temperature compensation at their stations out of their competitively-determined and -limited profits, this could reduce their profitability to a level below the minimum necessary to induce them to continue in operation.

The *CEC Staff Report* fails to recognize that – as a matter of elementary economics – the *ATC Retrofit* would necessarily result in an immediate increase in retail prices that exactly offsets the “benefits” it imagines consumers would enjoy as they received “more fuel” at unchanged retail prices.

Since retail competition already adjusts pump prices in response to temperature variation – thus insuring that the retail price of fuel remains constant when expressed in terms of net gallons – and dealers currently operate in a highly competitive environment, these dealers do not have any “hot fuel” profits out of which to absorb the increase in their wholesale cost per “gallon” that would be induced by either the *ATC Retrofit* or a new “reference temperature” for California. Instead, the gross margins out of which they must pay their other expenses and earn a competitive profit would be immediately and substantially reduced.

The amount of this reduction would entirely eliminate retailers’ profits and leave them unable to fully cover their other costs of doing business. According to the *CEC Staff Report*, the *ATC Retrofit* would extract \$438 million per year in revenue from fuel retailers, at least in the short- and medium term.³⁷ According to the most recent “station count” published by *NPN News*, there are approximately 9,700 such retailers in California. Simple arithmetic indicates that the average California motor fuel retailer would lose \$45,155 in sales revenue each year following the *ATC Retrofit*. This greatly exceeds the \$33,000 in annual *pre-tax* profits that the *CEC Staff Report* gives as the total profit earned by the average fuel-dispensing convenience store over the period from 1998 through 2007.³⁸ The *CEC Staff Report* does not indicate how California dealers could absorb such a revenue loss and remain in business.

Instead, the *CEC Staff Report* opines that retail competition would make it difficult for dealers to increase their pump prices to compensate for the larger “gallons” they would dispense under either the *ATC Retrofit* or the switch to the “California reference temperature option”. This is exactly backwards, because it is that very competition that would *force* retailers to increase their pump prices *immediately* upon implementation of either option, or quickly go out of business.

³⁷ *CEC Staff Report* at p. 76.

³⁸ *CEC Staff Report* at p. 83.

In terms of economics, requiring retailers to dispense larger temperature-compensated gallons would be effectively the same as increasing their wholesale cost *per* “gallon”. Again in terms of elementary economics, this would amount to an increase in each retailer’s *direct* (or *marginal*) cost per unit sold. In a competitive market, if all firms are confronted with an identical increase in their direct cost per unit sold, the market-equilibrium price per “gallon” must go up by the amount of that increase in the cost per “gallon”. Competitors who fail to achieve this higher price would eventually go out of business.

In acknowledging that retailers operate in a highly competitive business environment, the *CEC Staff Report* takes this to mean that this “can, at times, create temporary difficulties and challenges with regard to recovering increased expenses” that depends on the “spheres of competition” within which each retailer operates.

But these “increased expenses” that the CEC staff has in mind appear to involve only the cost of the proposed *ATC Retrofit* itself. It is true that – for the most part – these would be one-time fixed expenses that would not vary directly with the number of gallons sold. Economists term these “indirect” or “fixed” expenses, and distinguish them from direct (or marginal) costs that do vary directly with the quantity of the product produced or sold. In general, it is true that competition does not guarantee that an individual seller or producer will be able to recover increases that he alone experiences in his indirect or fixed expenses by increasing his prices.

However, when *all* sellers incur the *same* expense – and consumers have no alternative sources for the product they sell – then there is little to restrain an attempt by individual sellers to increase retail prices in order to compensate for that increased expense.³⁹

The *CEC Staff Report* is wrong as a matter of economics when it suggests that retailers would respond to an immediate increase in their direct (marginal) cost per unit of gasoline only in the long term. The speed and extent by which increases in dealers’ marginal costs are transmitted to pump prices has been extensively studied by economists who generally have

³⁹ In principle, pump prices – on a cost per gallon basis – could increase by *more* than is needed to compensate for the *average* retailer’s cost to implement the *ATC Retrofit*. In a competitive market comprised of sellers with differing cost structures, the impact on the *market* equilibrium price of a cost increase incurred by all sellers is a function of its impact on the cost structure of the *marginal* (or least efficient) seller. In the present context, this is the “low monthly volume” retailer. Assuming that this retailer must expend the same total dollar amount to retrofit his pumps as a “high volume” retailer, he would sell fewer gallons per month over which he could hope to distribute these retrofit costs. This would require that – in order to successfully shift the cost of his *ATC Retrofit* to his customers – he would have to achieve a greater increase in his per-gallon pump prices than would be necessary for his “high volume” rivals. Because of this, these rivals might be content to see retail prices per gallon increase by enough to allow their “low volume” competitor to recover his *ATC Retrofit* costs, even though such an increase would be more than enough to cover their own such costs. The result could be that retail prices increase by *more* than the aggregate cost of the *ATC Retrofit*, allowing the higher-volume dealers to “over-recover” their own costs.

found that increases in retailers' wholesale cost for fuel are substantially passed through to retail pump prices within about a week or two and in their entirety within at most a few weeks.⁴⁰

The illusion of "increased prices on non-fuel items"

As a matter of economics, it is even more difficult to understand how the *CEC Staff Report* concludes that retailers would or could defray the cost of the *ATC Retrofit* or their increased wholesale cost per "gallon" by raising prices on the non-fuel items they sell.^{41, 42}

First of all, such a shift – even assuming it were feasible – would in no way reduce the total cost ultimately born by consumers for the *ATC Retrofit*. It would merely shift some of that total cost to other items also purchased by motorists who patronize motor fuel retailers with convenience stores. Even if such a shift were feasible, it would be nonsensical as a matter of economics to pretend that the cost to Californians of the ATC retrofit is limited to just that portion that results in higher pump prices.

But to the extent that motor fuel retailers – especially convenience stores – sell such items, they do so in competition with supermarkets, fast food outlets, non-fuel convenience stores, auto stores, drug and sundries stores, and the like. Therefore, to suggest that motor fuel retailers could profitably raise their prices on non-fuel items can mean only that – at present – such retailers must be failing to maximize their profits. If station owners *could* simply increase prices on their non-fuel items to pay for the costs of the *ATC Retrofit* without harming their ability to compete with non-fuel retailers, then it would have been economically rational for them to have done so already. In other words, because of the competitive environment in which they operate, it must be assumed that the prices at convenience stores for non-fuel items have been established at levels that maximize retailer profits, and that a further increase in these prices

⁴⁰ See (among other examples): Severin Borenstein, Colin Cameron and Richard Gilbert, "Do Gasoline Prices Respond Asymmetrically to Crude Oil Price Changes?", *Quarterly Journal of Economics*, 112 (February 1997); Energy Information Administration, "Price changes in the Gasoline Market," February 1999; and Michael Burdette and John Zyren, *Gasoline Price Pass-through*, Energy Information Administration Petroleum Marketing Annual, 2003 at http://www.eia.doe.gov/pub/oil_gas/petroleum/feature_articles/2003/gasolinepass/gasolinepass.htm.

⁴¹ *CEC Staff Report* at p. 68. ("[CEC] Staff assumes that retail station owners will attempt to recover these [*ATC Retrofit*] costs by raising prices on products that are sold at retail stations, both fuel and non-fuel commodities.")

⁴² *CEC Staff Report* at p. 73. ("For example, retail stations that sell fuel and non-fuel commodities (such as convenience stores) have increased flexibility to attempt incremental expense recovery by increasing prices for multiple goods (gasoline and foodstuffs) and/or services (car washes). But a retail station that only sells transportation fuels has less flexibility and can only attempt to pass along increased expenses by raising the price of fuel they sell. These types of retail stations are estimated to account for less than 20 percent of the gasoline and diesel fuel sales.")

would only decrease those profits. It is not clear how the CEC staff has obtained the expertise to render such a judgment and to perceive an unexploited opportunity for increased profitability that apparently has eluded the owners and operators of the more than 100,000 fuel-selling convenience stores in the U.S.

It should be obvious that the other sellers of the non-fuel items that are also available at retail stations would incur no increased costs in connection with the *ATC Retrofit* because they have no fuel dispensers. But the *CEC Staff Report* does not explain how motor fuel retailers could successfully shift the increased capital costs of the *ATC Retrofit* itself and their higher per-“gallon” wholesale fuel costs to the non-fuel items available in their convenience stores when none of the non-fuel retailers with whom they compete would have experienced similar cost increases.

Since motor fuel retailers have no latitude to shift the costs of the ATC retrofit and higher per-“gallon” wholesale costs to their sales of non-fuel items, this means that these costs must be shifted in their entirety to retail fuel prices. In particular, an increase in the per-“gallon” wholesale price – an increase in the retailer’s marginal cost – will necessarily be passed through in its entirety to pump prices.

But so too would be the cost of the *ATC Retrofit* itself, which cannot be shifted to non-fuel items because the competing non-fuel sellers of such items would not have to undertake any *ATC Retrofit* and incur similar fixed or indirect cost increases. And because *all* motor fuel retailers would face the *same* increased costs – and because consumers seeking to purchase gasoline or diesel fuel would have no alternative sources – it also is likely that retailers would be able to pass such costs through to their pump prices in their entirety.⁴³

The CEC Staff Report’s “increased price transparency benefit”

Because the *CEC Staff Report* ultimately concludes that neither the *ATC Retrofit* nor the “new reference temperature option” would yield measurable benefits in the form of “more fuel” for California consumers in the long term, the *only* positive contribution to the “benefits” side of the cost-benefit analysis that the CEC staff has managed to identify comes from the so-called

⁴³ A credible argument can be made that, in the new equilibrium, *more* than 100 percent of the *ATC Retrofit* costs could be passed through to retail customers. Here is how that might happen: In a competitive equilibrium, the market clearing price is determined by the costs of the least efficient producer. The indirect cost of the *ATC Retrofit* would loom larger for those retailers who sell relatively smaller fuel volumes per month. This is because they have fewer gallons of retail sales over which to distribute (or amortize) the fixed costs of the *ATC Retrofit*. If these low-volume retailers seek street prices that allow them to fully recapture their *ATC Retrofit* costs, and if it is their street prices that determine the market price, then all of the higher-volume, more efficient retailers would be content to match the pump prices of their less-efficient rivals, thus enabling them to “over-recover” their own *ATC Retrofit* costs.

“increased price transparency benefit” of \$3.2 million per year that supposedly would result from the *ATC Retrofit*.⁴⁴

The “logic” of *CEC Staff Report’s* Information Asymmetry Model is this: In the absence of the *ATC Retrofit*, consumers buy “more” gasoline at “higher” prices than they would if they had full information regarding the temperature of the fuel in a retailer’s tanks.⁴⁵ But in order to “find” and “monetize” this putative benefit, the CEC staff has resorted to a misguided attempt to force the “hot fuel” controversy and the proposed *ATC Retrofit* into the economic frameworks of *deadweight loss* and *consumer surplus*. As is shown below, this attempt fails as a matter of economics.

The main justification offered by the *CEC Staff Report* for the proposed *ATC Retrofit* is that it would enable consumers to enjoy “more fuel”. But in the context of the Information Asymmetry Model, motorists are better off if they buy “less fuel”; “more fuel” supposedly is the *harm* that arises in the *absence* of automatic temperature compensation.

Moreover – as demonstrated later in this paper – competition already leads to adjustments in retail prices in response to seasonal changes in the prevailing average fuel temperature in each local area, and each consumer’s repeated purchases are sufficient to protect against the possibility that the average temperature of a motorist’s fuel purchases might significantly exceed the prevailing average fuel temperature in the local area.

So what additional “increased price transparency benefit” potentially remains that can be realized only by implementing the *ATC Retrofit*? According to the *CEC Staff Report*, this supposed benefit comes from ending the danger that a consumer might “overpay” for fuel purchased from a particular retailer because the consumer does not realize how “warm” that retailer’s fuel is. In other words, this consumer would buy “too many” gross gallons because he does not realize that each such “gross” gallon contains marginally less energy. But following the *ATC Retrofit*, the consumer would be assured that he is getting “identical” net gallons, no matter which station he patronizes.

This argument has a surface plausibility, except that it overlooks all those consumers who currently “underpay” for fuel because they do not realize how “cool” that fuel is relative to the prevailing average temperature. These consumers would be roughly equal in number to the

⁴⁴ *CEC Staff Report* at pp. 76-78. Even if the *CEC Staff Report’s* analysis were otherwise unassailable – which it emphatically is not – it still would be the case that consumers would enjoy only *half* of that \$3.2 million per year. As a matter of elementary economics, half of the benefit attributed by CEC staff to ending the supposed “deadweight loss” would be retained by retailers; consumers’ gain would be limited to the remaining half. See, for example, Robert S. Pindyck and Daniel L. Rubinfeld, *Microeconomics* (5th ed.), (Prentice Hall, 2001) at pp. 288-293.

⁴⁵ *CEC Staff Report* at p. 149 (“The inefficiency occurs from consumers consuming more gallons than they would have if they had full information on the fuel temperature.”).

consumers who “overpay” because of the same “information asymmetry”. So for all motorists in the aggregate, the “increased price transparency benefits” would be zero, because the positive benefits conferred on motorists who would otherwise “overpay” for “warmer-than-average” fuel are cancelled out by the negative benefits of those motorists who would otherwise “underpay” for “cooler-than-average” fuel.

According to the *CEC Staff Report*, the value of the supposed “increased price transparency benefit” is measured by the difference between the “larger” number of “higher-priced gallons” that consumers unwittingly buy (because they are unaware of actual fuel temperatures and cannot work out the “true” price per net gallon) and the “smaller” number of “lower-priced gallons” they would purchase after the *ATC Retrofit*. In the diagram that accompanies *Appendix R*, the “increased price transparency benefit” is gained by ending the total “deadweight loss” that arises because there are non-zero differences between the pre- and post-*ATC Retrofit* prices and quantities.

But the *CEC Staff Report’s* attempt to use the diagram in *Appendix R* to analyze the problem supposedly raised by the sale of “warmer than average” fuel to an unsuspecting consumer is problematic. In that scenario, *either* the dispensed quantum of fuel is too small *or* the price per unit of fuel is too high, *but not both simultaneously*.⁴⁶ The reason this is important is that the “deadweight loss” triangle in that diagram has nonzero area *only* if P_{none} (the price per unit paid by consumers in the absence of ATC) is greater than P_{full} (the price per unit that would prevail under ATC) *and at the same time* Q_{none} (the quantity of fuel purchased by consumers in the absence of ATC) exceeds Q_{full} (the quantity of fuel they would buy if they enjoyed the “price transparency” promised by ATC). Otherwise that triangle has zero area and there would be no deadweight loss.⁴⁷

The only way that $Q_{none} > Q_{full}$ can be satisfied is if the analysis is limited to transactions measured in gross gallons involving just those consumers purchasing at retailers whose fuel temperature exceeds the local cross-sectional average. Similarly, the only way that $P_{none} > P_{full}$ can be satisfied is if the analysis focuses on just those motorists who buy at stations whose fuel temperature exceeds the prevailing cross-sectional average.

⁴⁶ In other words, it cannot be the case that *both* the quantum of fuel is too small *and at the same time* the price charged for that quantum of fuel is too high.

⁴⁷ There is another way to see that the diagram in *Appendix R* is wrong. In that diagram, $P_{none} > P_{full}$ and $Q_{none} > Q_{full}$ only because *CEC Staff Report* assumes an *inward* shift (i.e., toward origin) in the demand curve from $D_{no\ info}$ to $D_{full\ info}$, meaning that the consumer purchases less fuel at every possible price per unit. But how can this be, if consumers are supposed to be getting *more* fuel following the *ATC Retrofit*?

In other words, the only way that the *CEC Staff Report* can achieve its desired result is if it ignores those consumers who purchase at retailers with fuel temperatures that fall below the prevailing local average.

But measured over *all* California purchasers of motor fuel at retail, the putative “increased price transparency benefit” has got to be zero. Following the *ATC Retrofit*, all that would change is that market transactions – originally measured in gross gallons and proceeding at prices denominated in dollars per gross gallon – henceforward would be conducted using net gallons to measure quantity and priced in dollars per net gallon. But nothing real would change, only the units used to measure the transactions (and these have changed in compensatory ways, leaving total market quantities and dollar outlays absolutely unchanged).

But since California motorists in the aggregate would receive the same total quantity of fuel (measured in net gallons) for the same total dollar outlay following the *ATC Retrofit* as they did before, there would be no difference between P_{none} and P_{full} and no difference between Q_{none} and Q_{full} , the area shown in *Appendix R* as the total “deadweight loss” would disappear, and the “increased price transparency benefit” would be zero.

This means that the fact that the *ATC Retrofit* would enable *some* motorists to avoid “overpaying” for warmer-than-average fuel in particular transactions would be exactly offset by the negative “benefits” of those motorists who would lose the opportunity to “underpay” for cooler-than-average fuel.

Hawaii and the “New Reference Temperature Option” for California

The CEC Staff Report’s “new reference temperature option”

The possible adoption of a “new reference temperature option” is the fallback option favored by “hot fuel” activists in the event that full automatic temperature compensation is not mandated.⁴⁸ The *CEC Staff Report* also considered this option – with 71.1° F. selected as the reference temperature – as an alternative to the *ATC Retrofit*.

The *CEC Staff Report* refers to the “new reference temperature option” as the “Hawaii example”⁴⁹ because it would result in the use of a larger “California gallon” to measure retail

⁴⁸ See, for example, Letter of Judy Dugan of *Consumer Watchdog* to the California Energy Commission, December 3, 2008 (“If the CEC recommends a legislative prohibition [of any voluntary fuel temperature compensation]...it must recommend adoption of a cost-free but less accurate solution – a statewide reference temperature of 71 degrees [even though this] would offer less benefit to consumers in warmer parts of the state, and be a greater cost burden on retailers in colder parts of the state.”).

⁴⁹ *CEC Staff Report* at p. 14.

fuel quantities similar to the “Hawaii gallon” adopted by the State of Hawaii at the urging of George Mattimoe.⁵⁰ Advocates of the “reference temperature” option believe that the judicious choice of a particular reference temperature would save consumers money because retail sales would henceforward be measured using “larger gallons” that more nearly approximate the volume of a net gallon at prevailing local fuel temperatures. However, these same advocates are also fearful that some “inequities” would remain, because actual fuel temperatures could still vary from the adopted “reference temperature”. For example, these consumers become concerned if they think that the chosen reference temperature is not identically equal to the local average fuel temperature, or if the seasonal variation in fuel temperatures around that particular reference temperature is “too large”.

These beliefs – and concerns – are misplaced. No matter what specific reference temperature is selected, its imposition in a competitive market for retail motor fuel sales would have absolutely no effect whatever on the prices paid by consumers for a specified quantity of fuel. But worse, the adoption of a reference temperature conveys the erroneous impression to consumers that there is some significance to the particular reference temperature chosen, and that a different reference temperature would yield different results at the pump.

The *CEC Staff Report* succumbed to this mistaken view:

Energy Commission staff believes that a reference temperature is a more viable option in Hawaii because there is very little seasonal volatility in climate temperatures throughout the year, as well as very small geographic difference in temperature in areas dispensing gasoline on any given day. California, on the other hand, has many climate zones that have large variations in seasonal temperatures throughout the year. The existence of the diversity and range of temperatures at any given time in California would also make the reference temperature option not as preferable as it is in Hawaii.⁵¹

The particular reference temperature selected makes no difference

This finding shows that the CEC staff does not understand that – in a competitive market – redefining the “size” of the quantity unit used to measure retail sales of motor fuel would have no effect whatever on consumer outlays for fuel. Moreover, it simply would not matter whether that chosen reference temperature was exactly equal to the average temperature of fuel in the relevant geographic area, or indeed, whether it was even within the annual range of such temperatures. By extending **Figure 4**, these conclusions are demonstrated in **Figures 16, 17 and 18**.

⁵⁰ The CEC staff interviewed Mr. Mattimoe in connection with its report. (*CEC Staff Report* at p. 13)

⁵¹ *CEC Staff Report* at p. 107.

Figure 16 is the same as **Figure 4** except that it assumes that 50° F. (rather than 75°) is the “reference temperature”.⁵² Since – at 229.41 cubic inches – this “50° F. reference temperature gallon” is 0.69 percent smaller than a U.S. gallon, it should not be surprising that the resulting target street price of \$2.979 (obtained by dividing the target sales revenue of \$24,000 by the 8,055.6 available “50° gallons”) is 0.69 percent less than the target retail price of \$3.000 for a U.S. gallon.

Figure 16.

Changing to "50° gallons" affects only the price per unit, not total outlays.

<i>Change from U.S. Gallons to "50° F. Reference Standard Gallons"</i>						
	Unit of measurement for quantity sold	Size of quantity unit (cubic inches)	Total quantity units available for sale	Dealer's target total sales revenue	Resulting dealer target street price per unit	Total cost of 100 US gallons (23,100 cubic inches)
<i>Before</i>	U.S. Gallon	231.00	8,000.0	\$24,000	\$3.000	\$300.00
<i>After</i>	<i>50° Gallon</i>	<i>229.41</i>	<i>8,055.6</i>		<i>\$2.979</i>	<i>\$300.00</i>
<i>Change</i>		<i>-0.69%</i>			<i>-0.69%</i>	<i>0.00%</i>

Next, consider **Figure 17**, which assumes that the “reference temperature” is 90° F. Because – at 235.78 cubic inches – this “90° gallon” is 2.07 percent larger than a 231-cubic inch U.S. gallon, the resulting target retail price per “gallon” is 2.07 percent greater than the target retail price of \$3.000 per gross gallon, or \$3.062.

⁵² By design, this is more than 20° cooler than California’s actual average fuel temperature.

Figure 17.

Changing to "90° gallons" affects only the price per unit, not total outlays.

Change from U.S. Gallons to "90° F. Reference Standard Gallons"						
	Unit of measurement for quantity sold	Size of quantity unit (cubic inches)	Total quantity units available for sale	Dealer's target total sales revenue	Resulting dealer target street price per unit	Total cost of 100 US gallons (23,100 cubic inches)
<i>Before</i>	U.S. Gallon	231.00	8,000.0	\$24,000	\$3.000	\$300.00
<i>After</i>	90° Gallon	235.78	7,837.8		\$3.062	\$300.00
<i>Change</i>		2.07%			2.07%	0.00%

Finally, **Figure 18** analyzes the change in the target retailer price per unit under the assumption that 71.1°F. is adopted as the “California reference temperature”. The resulting target street price of \$3.023 is 0.77 percent greater than \$3.000, which is to be expected since at 232.77 cubic inches, the “California gallon” is 0.77 percent bigger than the 231 cubic inches occupied by a gross gallon.

Figure 18.

Changing to "71.1° gallons" affects only the price per unit, not total outlays.

Change from U.S. Gallons to "71.1° F. California Reference Temperature Gallons"						
	Unit of measurement for quantity sold	Size of quantity unit (cubic inches)	Total quantity units available for sale	Dealer's target total sales revenue	Resulting dealer target street price per unit	Total cost of 100 US gallons (23,100 cubic inches)
<i>Before</i>	U.S. Gallon	231.00	8,000.0	\$24,000	\$3.000	\$300.00
<i>After</i>	71.1° Gallon	232.77	7,939.2		\$3.023	\$300.00
<i>Change</i>		0.77%			0.77%	0.00%

Each of **Figures 4 and 16 through 18** analyzes the effect on a retailer’s target price per unit assuming a switch from gross gallons as the unit of measure to each of four alternative “reference temperature gallons” where each “reference temperature gallon” is defined as the number of cubic inches occupied by a net gallon at the indicated temperature (respectively, 75°, 50°, 90° or 71.1°F.). The key is that each of these “reference temperature gallons” actually is defined in terms of a specific number of cubic inches. In other words, in the case of each

reference temperature, the number of cubic inches is constant and independent of the actual fuel temperature at the time of the transaction for which a particular “reference temperature gallon” is used as the quantity unit. For example, a “71.1°F. California gallon” will occupy identically 232.77 cubic inches *at every possible temperature* from, say, 30°F. all the way up to 100°F. In other words, its volume in cubic inches does *not* vary as the fuel temperature varies.

But *at any particular actual fuel temperature*, a consumer would pay the same amount for a given quantum of fuel – measured in a fixed number of cubic inches – no matter which of these four “reference temperature gallons” actually is used. Suppose the actual fuel temperature is 82°F. and that competition has established \$3.000 per U.S. gallon as the target retail price, meaning that it would cost a consumer \$300 to purchase 100 U.S. gallons (or 23,100 cubic inches). As already demonstrated in **Figures 4 and 16 through 18**, it would cost the same \$300 to purchase 23,100 cubic inches of gasoline no matter which of the four “reference temperature gallons” had been adopted at the time and no matter the actual temperature – whether 30°F. or 100°F. or anywhere in between – of the fuel itself.

The “Hawaii example” and the “hot fuel” activists

It should not be surprising that Hawaii’s well-known switch to a “80°F. Hawaiian reference standard gallon” likely had absolutely no effect on retail consumers’ outlays for a given quantum of gasoline. As summarized in **Figure 19**, the 234.19 cubic inch “Hawaiian gallon” would have been about 1.38 percent larger than a U.S. gallon. Maintaining the current hypothetical (rather than the retail prices that prevailed at the time of the actual imposition of the “Hawaiian gallon”), and continuing to assume that retailers sought to generate the same target sales revenue of \$24,000, Hawaiian dealers would have had to raise their target pump prices by the same 1.38 percent to \$3.041 per “gallon”.

Figure 19.
A change to 80° "Hawaii gallons" affects the price per unit, not total outlays.

<i>Change today from U.S. Gallons to 80° F. "Hawaii Gallons"</i>						
	Unit of measurement for quantity sold	Size of quantity unit (cubic inches)	Total quantity units available for sale	Dealer's target total sales revenue	Resulting dealer target street price per unit	Total cost of 100 US gallons (23,100 cubic inches)
<i>Before</i>	U.S. Gallon	231.00	8,000.0	\$24,000	\$3.000	\$300.00
<i>After</i>	80° Gallon	234.19	7,891.1		\$3.041	\$300.00
<i>Change</i>		1.38%			1.38%	0.00%

Nevertheless, the so-called “Hawaii example” remains a favorite of the “hot fuel” activists, having been prominently mentioned in the *Kansas City Star* series in late 2006⁵³ and taken up subsequently by other “hot fuel” activists.^{54, 55} The *CEC Staff Report* cites the State of

⁵³ Steve Everly, “Technology, New Rules Can Fix Hot-Fuel Issues,” *Kansas City Star*, August 28, 2006, p. A1:

OAHU, Hawaii | Idyllic weather, pounding surf and a warm, welcoming culture help make Hawaii unique in this nation.

So does its gallon of gas.

The Hawaiian gallon contains nearly 234 cubic inches of fuel – about three cubic inches more than is dispensed in the rest of the United States. The extra volume, required by state law, helps offset the hotter temperature in this tropical climate, which causes the gasoline to expand. If the gallon wasn’t temperature-adjusted, Hawaiians would receive less energy per gallon than called for under the government standard. That’s because for nearly a century, gasoline and diesel have been dispensed across America at a more-condensed 231 cubic inches – based on the assumption of a fuel temperature of 60 degrees.

The larger Hawaiian gallon saves consumers in the state millions of dollars a year. But across the rest of America, consumers will lose an estimated \$2.3 billion this year because of “hot” fuel. No other state adjusts for temperature fluctuations when dispensing fuel, including warm-weather states such as California, Texas and Florida, where drivers lose hundreds of millions of dollars a year.

In fact, few consumers even realize that they’re not getting what they pay for when they fill up at the pump. That’s because no national law requires retail station owners to sell fuel at the government standard of 60 degrees, or use pumps that adjust to reflect the hotter fuel.

That omission might seem odd, especially considering soaring gas prices and record oil industry profits. As Hawaii proved, states can take action to address the hot-fuel problem.

⁵⁴ Judy Dugan, “Californians Say Aloha (in the Bye-Bye Sense) to Their Savings – State Gasoline Price Tops Hawaii,” *OilWatchdog*, March 17, 2008: <http://www.oilwatchdog.org/articles/?storyId=19150>

Hawaii’s retail gallon of gasoline is larger than in the rest of the U.S. because of the state’s “hot fuel” law. Hawaii is warm year-round, and so is gasoline sold in the state, averaging over 80 degrees. Gasoline expands and loses energy as it heats up. Hawaii requires a gallon slightly more than 1% larger than the U.S. standard, a hypothetical “60-degree” gallon.

“In reality, Hawaii’s gasoline is more than a nickel cheaper than California’s, because drivers are already getting four cents extra worth of gasoline in each gallon,” said Dugan. “No wonder oil companies and marketers are so opposed to giving motorists in California and other warm states a fair measure of fuel by compensating for fuel temperature on retail sales.”

Hawaii and George Mattimoe – its then Deputy Director of the Division of Weights and Measures – as early pioneers in the campaign to end the “hot fuel rip-off.” This acclaim results from the belief that Hawaii and Mattimoe purportedly saved that state’s motorists “millions of dollars”⁵⁶ by resetting retail pumps to dispense larger, “Hawaii gallons” of approximately 234 cubic inches of gasoline rather than statutory U.S. gallons of 231 cubic inches.⁵⁷

The *CEC Staff Report* appears to accept these claims regarding Hawaii:

Hawaii is the only state in the nation that has adopted a form of temperature compensation at retail outlets. This occurred when the state increase the size of their gallon from the U.S. standard of 231 cubic inches to a larger Hawaiian gallon of about 233 cubic inches.⁵⁸

In implicit acknowledgment of the “Hawaii example”, AB 868 directed the CEC to conduct a cost-benefit analysis of the possible establishment of a “different statewide reference temperature” for use in California. Pursuant to that direction, CEC staff apparently interviewed Mr. Mattimoe in connection with its consideration of the option of establishing a “California reference temperature” to be used as the basis retail sales in the state.⁵⁹

The *CEC Staff Report* acknowledges the “input and support in the production of this report” provided by Mr. Mattimoe and the Hawaii Department of Weights and Measures,⁶⁰ and credits him for having spear-headed the campaign to have a standardized unit of measure adopted in Hawaii,⁶¹ and for reducing the cost of fuel to Hawaiian consumers.⁶²

⁵⁵ Statement of Joan Claybrook, President, *Public Citizen*, “Hot Fuel Means Big Rip-Off at Gasoline Pumps”, December 14, 2006. http://www.citizen.org/pressroom/print_release.cfm?ID=2337 (“Since the 1970s, Hawaii has adjusted the standard volume of a gallon of gasoline to account for its warmer temperatures.... Ultimately, Congress needs to step in to protect consumers nationwide against hot fuel overcharges.”)

⁵⁶ Janos Gereben, “Technical Wizard Here Helps Us Save on Gas,” *Honolulu Star-Bulletin*, November 18, 1975, p. A1.

⁵⁷ The size of this “Hawaii gallon” was determined to be the volume of a net gallon at the average year-round temperature in Hawaii, 80°F.

⁵⁸ *CEC Staff Report* at p. 1.

⁵⁹ *CEC Staff Report* at pp. 11, 13-14.

⁶⁰ *CEC Staff Report* at pp. i-ii.

⁶¹ *CEC Staff Report* at p. 13.

But the discussion in the *CEC Staff Report* also shows that the CEC staff failed to conduct an independent analysis of the historical record and data to verify the claims made by Mattimoe⁶³ and the “hot fuel” activists regarding the practical effect of imposing the “Hawaii gallon”. Had it done so, the CEC staff would have discovered that the adoption of that unit of measure had no effect whatever on the retail cost of fuel to Hawaiian consumers.

What actually happened in Hawaii

The first thing that the CEC staff would have learned is that – rather than instituting the practice in 1974 as claimed by Mattimoe and others, “Hawaii has been making allowance for the expansion of gasoline in gasoline pumps since 1969,”⁶⁴ a time when retail gasoline prices likely were less than about 43.9 cents per gallon.^{65, 66}

Figure 20 suggests that the adoption of the “Hawaii gallon” would have meant an increase of substantially less than one cent per gallon in 1969, given the prevailing retail price levels at the time. **Figure 20** incorporates the approximate retail price level that prevailed in Hawaii in 1969, and shows that the resulting impact on retail prices of the 1969 imposition of the “Hawaii gallon” would have amounted to about six-tenths of one cent per gallon when retailers’ incorporated their higher wholesale cost per “gallon” into their pump prices.⁶⁷

⁶² *CEC Staff Report* at p. 14 (“Despite improving the situation and reportedly saving consumers money by having a higher reference temperature...”)

⁶³ Presentation of George E. Mattimoe, “Temperature Correction of Petroleum Products at Retail,” *Report of the 59th National Conference on Weights and Measures 1974* (July 7-12, 1974) at pp. 166-181.

⁶⁴ Janos Gereben, “Technical Wizard Here Helps Us Save on Gas,” *Honolulu Star-Bulletin*, November 18, 1975, p. A1. Apparently, the 1969 change was implemented at the county (island) level by action of county commissioners. The effect of the 1974 action by the State of Hawaii was to codify the counties’ practice into state law.

⁶⁵ *Honolulu Star-Bulletin*, “Local Gasoline Prices Vary,” May 19, 1968, p. D7.

⁶⁶ *Honolulu Star-Bulletin*, “Third Firm Raises Price of Gasoline, April 23, 1970, p. A14.

⁶⁷ While no specific reference to the impact of the 1969 adoption of the “Hawaii gallon” on retail prices can be located, it is reasonable to conclude that retailers did adjust their street prices to account for it. This inference is supported by the fact that retailers did raise their prices in response to other cost increases during the relevant period. See *Honolulu Star-Bulletin*, May 19, 1968 at p. D7 (“Local Gasoline Prices Vary”); April 1, 1970 at p. A5 (“Standard Hikes Price of Gasoline in Isles”); April 23, 1970 at p. A14 (“Third Firm Raises Price of Gasoline”); and November 23, 1970 at p. B3 (“Standard Oil Stations Boost Gasoline 1 Cent”).

Figure 20.

Adoption of the "Hawaii gallon" in 1969 increased target retail prices by 0.6¢.

Change in 1969 from U.S. Gallons to 80° F. "Hawaii Gallons"						
	Unit of measurement for quantity sold	Size of quantity unit (cubic inches)	Total quantity units available for sale	Dealer's target total sales revenue	Resulting dealer target street price per unit	Total cost of 100 US gallons (23,100 cubic inches)
<i>Before</i>	U.S. Gallon	231.00	8,000.0	\$3,500	\$0.438	\$43.75
<i>After</i>	80° Gallon	234.19	7,891.1		\$0.444	\$43.75
Change		1.38%			1.38%	0.00%

A reasonable inference is that the adoption of the “Hawaii gallon” *did* lead to an increase in contemporaneous retail prices, but because the amount of the implied increase was so small and because it came at a time when Hawaiian retailers were increasing their pump prices in response to other cost increases, consumers did not take particular notice.⁶⁸

Ironically, the best summary of the impact of adopting a new “reference temperature” is from Measurement Canada:

Why was 15°C chosen as the reference temperature for ATC?

The reference temperature of 15°C is a long-standing international standard used in most countries for the purchase and sale of petroleum products...

Would using a different reference temperature save me money?

No. The actual reference temperature used does not matter. In the sale of temperature compensated petroleum products, the volume is based on 15°C. This means that the consumer is paying for a 15°C litre at a 15°C price, no matter what the temperature of the product. If a different

⁶⁸ In an interesting side note, while Mattimoe went to some lengths to redefine the unit of measure for use in retail fuel sales, no similar change was imposed on wholesale transactions in Hawaii. This is significant because at the time, such transactions were *not* compensated for temperature in any way. Consequently, Hawaiian retailers publicly complained that they were being unfairly treated following Mattimoe’s initiative, because the gasoline they purchased at wholesale was not measured in “Hawaii gallons” or corrected in any way for expansion due to temperature, while at the same time they were required to dispense such gallons to their customers. See *Honolulu Star-Bulletin*, “Is Temperature Meter Necessary? Buying Gasoline a Heated Issue,” August 5, 1981 at p. A3.

reference temperature were chosen, the purchaser would still receive consistent amounts of product. *However, a different price per litre would possibly be charged if a different reference temperature were used.*⁶⁹

The adoption of automatic temperature compensation by Canadian retailers

As the *CEC Staff Report* appears to acknowledge,⁷⁰ the adoption in the mid-1990s of automatic temperature compensation by most Canadian retailers resulted from the particular circumstances in Canada at the time, and does not amount to “proof” of the “hypocrisy” of U.S. retailers.⁷¹ Canadian consumers did not save – or lose – any money on their purchases of gasoline and diesel fuel following that change. But the Canadian adoption of automatic temperature compensation did generate considerable confusion and complaints that should serve as a cautionary warning to proponents of the *ATC Retrofit* in California.

The permissive legal framework and the specter of underground leaks

In the early and mid-1990s, Canadian retailers became particularly concerned about their liability for underground leaks from their storage tanks because their stations were not equipped with automatic tank monitoring systems that would enable them to track their inventories and to detect any leakage. A spate of negative coverage had appeared in the Canadian press at the time.⁷² This created an opportunity for automatic temperature compensation because that technology would – as a byproduct – enable retailers to better track their underground inventory and to detect leaks.

⁶⁹ Measurement Canada, *Information Bulletin - Automatic Temperature Compensation and the Retail Sale of Gasoline and Diesel Fuel*, updated 2008-02-21 (emphases added).
<http://www.ic.gc.ca/epic/site/mc-mc.nsf/en/lm01094e.html>.

⁷⁰ *CEC Staff Report* at pp. 14-15.

⁷¹ See John Siebert, *OOIDA*, “Temperature Compensation at the Retail Pump,” presentation before the Interim Meeting of the National Conference on Weights and Measures, January 22, 2007 (“I have two words for those who oppose temperature compensation at the retail pump: Canada... and CANADA!!!”)

⁷² *Winnipeg Free Press*, “Buried fuel tanks raise alarm,” July 12, 1993, A1; “Gas leaks [at Winnipeg service stations] spark merchants’ anger,” March 29, 1993, A1; “Gas stations clean contaminated soil,” March 29, 1993, B1. See also *Halifax Chronicle Herald*, “Leaking gas tanks retailers’ nightmare,” April 6, 1993, pp. B1-2; *Calgary Herald*, “Gasoline leaks contaminating well water,” April 22, 1994, A14; *Daily Commercial News*, “Buried gas tanks create quandary,” September 7, 1994, pp. 1, 3; *Calgary Herald*, “Court orders Shell to pay \$430,000 penalty; fines, damages assessed after water contaminated at service station,” November 4, 1995, A3.

At the same time, Canadian law had been changed – at the urging of a would-be supplier of the necessary equipment – to allow individual retailers to voluntarily implement automatic temperature compensation in their dispensers.⁷³

The temporary “first mover advantage” enjoyed by early adopters

More importantly, Canada's colder temperatures gave a "first mover advantage" to early adopters of ATC technology. This is illustrated by **Figure 21**, which demonstrates that a retailer with ATC would have a significant tactical advantage over rivals who had not adopted ATC. The “early adopter” either could gain additional sales revenue by posting the same apparent price per liter as his rivals, or he could appear to post a lower price per liter while keeping his total sales revenue unchanged.

Figure 21.
“First mover” advantage for early adopter of ATC in “cold” climate.

<i>Fuel temperature at 45° F.</i>	<i>“First Mover” (Installs ATC equipment)</i>				<i>Local Rival (Does not install ATC)</i>			
	<i>Size of “gallon” (in cubic inches)</i>	<i>Total “gallons” available for sale</i>	<i>Target retail price per “gallon”</i>	<i>Resulting total sales revenue</i>	<i>Size of “gallon” (in cubic inches)</i>	<i>Total “gallons” available for sale</i>	<i>Target retail price per “gallon”</i>	<i>Resulting total sales revenue</i>
Without ATC equipment	231.00	8,000.0	\$3.000	\$24,000	231.00	8,000.0	\$3.000	\$24,000
With ATC equipment <i>Option 1</i> (pump price “same” as Local Rival) or <i>Option 2</i> (pump price “below” Local Rival)	<i>228.61</i>	<i>8,083.7</i>	<i>\$3.000</i>	<i>\$24,251</i>				
	<i>228.61</i>	<i>8,083.7</i>	<i>\$2.969</i>	<i>\$24,000</i>				

That Canadian manufacturer of ATC equipment – Kraus Technology⁷⁴ – seized the opportunity created by the “first mover” advantage and the prospect of improved leak detection to actively pitch its ATC products to Canadian retailers as a way to boost profits.⁷⁵ Because of

⁷³ CEC Staff Report at p. 14.

⁷⁴ Ironically, this is the same Kraus Technology on which the CEC staff relies for its estimates of the cost of the equipment needed to accomplish the *ATC Retrofit*.

⁷⁵ Steve Everly, “Hot fuel for you means cold cash for big oil, retailers,” *Kansas City Star*, August 27, 2006 at p. A1.

Hans Kraus, who owned a company in Canada that supplied equipment to the petroleum industry, helped push the change [in Canadian law to permit voluntary adoption of automatic temperature compensation].. Kraus had produced a retrofit kit allowing temperature compensation at existing pumps, and he needed to market his

the competitive advantage gained by the first retailer to adopt ATC in a particular local area, rivals would be forced to follow suit or suffer competitively. When Kraus induced Texaco to implement it at all their stores, other retailers had no alternative but to follow suit.⁷⁶

The resulting confusion and complaints among the Canadian public

As was explained and demonstrated earlier in this report, the adoption of automatic temperature compensation did not "save" Canadian consumers anything. But significantly, it actually generated a torrent of complaints and negative press accounts because the 15° C reference standard was warmer than the actual average Canadian temperature of 6° C, and in particular because motorists felt they were being "shorted" in cold weather.⁷⁷

gizmo. So he prepared a study showing that temperature compensation would make the industry money in Canada. The industry bought his pitch and pushed for a change in Canadian law.

Today, sales material used by Kraus Global Products in Canada asserts that using fuel dispensers that don't adjust for temperature is an "inherently inaccurate" way to sell fuel. In one example, the sales material claims an Edmonton, Alberta, gas station could save \$23,000 for every \$1 million in fuel it sold.

⁷⁶ Written statement of Hugh Cooley, Shell Oil Company, before the Subcommittee on Domestic Policy of the House Committee on Oversight and Government Reform, July 25, 2007 at p. 3:

My understanding is that the government of Canada approved temperature adjustment for retail gasoline fifteen years ago at the urging of the manufacturer of a temperature adjustment device. A few years later, some retailers began to temperature adjust, presumably to obtain a competitive advantage over other retailers as a result of their lowered unit cost. Once the trend became apparent, other retailers followed to avoid a competitive disadvantage.

⁷⁷ *Montreal Globe*, "Drivers will pay for unpumped gasoline," September 15, 1994, D3; *Toronto Star*, "Drivers face new squeeze at pump; new meters means less in your tank in winter but more in summer," September 15, 1994 at p. B1:

Drivers will be paying millions at the pump for gasoline they're not getting. Service stations are installing sophisticated meters that apply a basic law of physics to your bill. Like all liquids and gases, gasoline expands when it's hot and contracts when it's cold. The new meters charge you as if the gasoline was at 15C, an international standard used for crude oil tanker loads. "That might be okay for South Carolina, but the average temperature here should be 5 degrees or less," said Ron Chalmers, who has spent \$200,000 installing meters on the tanker trucks he uses to deliver fuel to Imperial Oil Ltd. outlets.

See also *The (Kitchener, Ontario) Record*, "The federal government aids and abets oil cartel," June 16, 1998, at p. A11:

The oil industry's most eye-catching piece of robbery is the adjustment of gasoline pumps to take into account the fact that the volume of gasoline contracts as the temperature goes down. Unfortunately for consumers, the pumps are set to a temperature

Once the other retailers in an area were forced to follow suit by acquiring automatic temperature compensation equipment themselves, the first mover's competitive advantage would disappear. In the long run, the principal beneficiaries of the widespread adoption of ATC equipment were its manufacturers.

No savings by Canadian motorists after the adoption of ATC

Canadian motorists paid the same amount for a given quantity of fuel following the widespread adoption of automatic temperature compensation as they did prior to it, owing to the competitive market for retail fuel sales in Canada.

of 15 C, although the average temperature in Canada is only 6 C. The effect is that most of the year, drivers are actually getting less gas than the pump indicates.

See also: *CBC Marketplace*, "Are we getting hosed at the pumps?" February 16, 1999.

<http://www.cbc.ca/consumers/market/files/cars/gasprice/index.html>:

At pumps across Canada, the price isn't always right.

Most of us don't pay much attention when we're filling up. We may check the pump to verify the price and the number of litre we're paying for, but that's about it. But the next time you fill up, look for a little black sticker that says "this register has been volume corrected to 15 degrees Celsius."

What does that mean?

Well, the bottom line is, if it's colder than 15 degrees, you're getting less gas than you paid for.

...

Critics say there's a problem with that method in Canada, because the temperature of gas is closer to the mean air temperature of our country, which is 6 degrees. And because of that, they say for most of the year, you're paying for gas you're not getting."

"I think it's been a bit of a sneaky price increase by the major oil companies that's been inflicted on consumers," says Dave Collins of Wilsons Fuels, an independent retailer in Halifax, which operates 54 service stations Nova Scotia and New Brunswick. All but two of them sell gas which is *not* temperature compensated.

"As a consumer you don't know that it's temperature compensating," Collins says. "The vast majority of Canadians can't make an informed choice. They believe that a litre is a litre."

Mike Budded, with the Independent Retail Gasoline Marketers Association of Canada, in Toronto, agrees, and adds that "the problem as we see it is that an inappropriate temperature has been picked for compensation."

The CEC Staff Report's underestimate of the true cost of the proposed ATC Retrofit

It is highly likely that the estimates of the total costs associated with retrofitting each California retailer's dispensers to incorporate automatic temperature compensation are too low by a significant margin.

First, the *CEC Staff Report* has uncritically adopted cost estimates from Kraus Global, an obviously biased source with an apparent history of inducing governments to institute policy changes for which it turns out to be the principal beneficiary. Moreover, it does not appear that the Kraus estimates have been adjusted to reflect the price increases that likely would result if all California retailers tried to purchase and install retrofit kits simultaneously.

Nor is it obvious that individual retailers would be able to borrow the necessary capital at all, much less at the rates assumed by the *CEC Staff Report*.

As a matter of economics, it is unlikely that any retailers would want to "beat the rush" by implementing ATC ahead of any mandatory deadline. This is because – unlike the case in Canada with its colder temperatures – a California retailer who elected to be an "early adopter" of automatic temperature compensation would suffer a "first mover *disadvantage*", as shown in **Figure 22**. This competitive disadvantage arises not just from the dealer's need to pay for the *ATC Retrofit* equipment. The more important cost – and competitive disadvantage – would be caused by the fact that he would be dispensing "larger" gallons than those pumped by his competitors following the retrofit. Thus he would face a choice between posting higher apparent retail prices per "gallon" than his local rivals (in order to maintain his target retail sales revenue) or sacrificing revenue by posting per-"gallon" prices that matched his competitors'.

Figure 22.

"First mover" disadvantage for early adopter of ATC in "warm" climate.

<i>Fuel temperature at 75° F.</i>	<i>"First Mover"</i> <i>(Installs ATC equipment)</i>				Local Rival (Does not install ATC)			
	Size of "gallon" (in cubic inches)	Total "gallons" available for sale	Target retail price per "gallon"	Resulting total sales revenue	Size of "gallon" (in cubic inches)	Total "gallons" available for sale	Target retail price per "gallon"	Resulting total sales revenue
Without ATC equipment	231.00	8,000.0	\$3.000	\$24,000	231.00	8,000.0	\$3.000	\$24,000
With ATC equipment <i>Option 1</i> (pump price "same" as Local Rival)	<i>233.39</i>	<i>7,918.0</i>	<i>\$3.000</i>	<i>\$23,754</i>				
or <i>Option 2</i> (pump price "above" Local Rival)	<i>233.39</i>	<i>7,918.0</i>	<i>\$3.031</i>	<i>???</i>				

Though it was available to the CEC staff, the *CEC Staff Report* takes no notice of the much higher estimate of the cost to implement automatic temperature compensation that was prepared by the State of Missouri.⁷⁸ If one scales the Missouri estimate of \$341 million upward to reflect the ratio between the number of retail stores in California compared to Missouri, the result suggests that it would cost over \$700 million – rather than the \$102 to \$123 million figure arrived at by the CEC staff⁷⁹ – to accomplish the *ATC Retrofit*.

Nor does the *CEC Staff Report* recognize two additional respects in which it likely has overlooked the true financial cost of its proposed *ATC Retrofit*:

First, as discussed earlier in this paper, it is reasonable as a matter of economics to expect that retail prices could increase by *more* than average retailer’s costs associated with the *ATC Retrofit*, owing to the greater proportionate burden that such costs would represent for the smaller-volume retailers who would be the marginal retail suppliers following that retrofit.

Second, the *CEC Staff Report* underestimates the effect that the *ATC Retrofit* would have on retail prices if some retailers were forced to withdraw from the market rather than incur the expense needed to remain in business. The CEC staff appears to believe that such withdrawals would be of concern only if they occurred in “isolated communities”. As a matter of economics, this is incorrect; economists have documented the fact that reductions in the density of retail stores lead to increased retail prices, all else constant, no matter where they occur.

How competition adjusts retail prices to account for seasonal temperature variation.

Like the “hot fuel” allegations themselves, the consumer benefits anticipated by the *CEC Staff Report* upon implementation of the *ATC Retrofit* evaporate if it should be the case that retail competition *already* adjusts retail prices for seasonal variations in fuel temperature. As demonstrated in this section, the discipline imposed on retailers by the need to be able to pay for their wholesale deliveries of fuel, to cover their other costs of doing business and to earn a competitive return – combined with unrelenting competition from rival retailers – forces price adjustments that compensate for the average temperature-induced expansion of motor fuel volumes in local competitive areas.

⁷⁸ That 2006 estimate – \$341 million – was reported by the U.S. Government Accountability Office in its September 2008 report *Stakeholder Views on Compensating for the Effects of Gasoline Temperature in Volume at the Pump* (GAO-08-1114) at p. 18. The State of Missouri has not offered any details about how that estimate was constructed.

⁷⁹ *CEC Staff Report* at p. 4.

In short, the absence of overt temperature-compensation technology at the retail level does *not* mean that retail prices are not adjusted for the temperature-induced expansion (and contraction) in fuel volume. The fact that it is *market competition* from other retailers that forces the appropriate adjustment – and that dealers themselves do not consciously and explicitly change their pump prices to achieve this result – does not change the essential fact that retail pump prices already *are* adjusted for seasonal temperature variation.

Where the *ATC Retrofit* would compensate for the temperature-induced expansion in fuel volumes by, in effect, varying the *size* of each dispensed “gallon” as fuel temperatures vary, retail competition achieves equivalent compensation by adjusting the *price* of each 231-cubic-inch gross gallon dispensed by retail pumps.⁸⁰ The practical result is that a consumer’s total outlay for a specific quantum of fuel (measured, say, in net gallons) would be identical using either method. The important difference is that adjustment for temperature variation through retail competition is already in place and effective at zero incremental cost, compared to the hundreds of millions of dollars that would be required to accomplish the *ATC Retrofit*. Because of this, the imposition of the *ATC Retrofit* on California retailers would not generate any additional benefits for California motorists, even though it inevitably would saddle them with higher prices for gasoline and diesel fuel.

Because it is market competition, rather than explicit deliberation and calculation by each dealer that forces the necessary adjustments, anyone looking for the specific notes and calculations by which individual retailers determined the appropriate changes in their pump prices will do so in vain. This is because the mechanism at work is a practical illustration of Adam Smith’s “invisible hand”.⁸¹

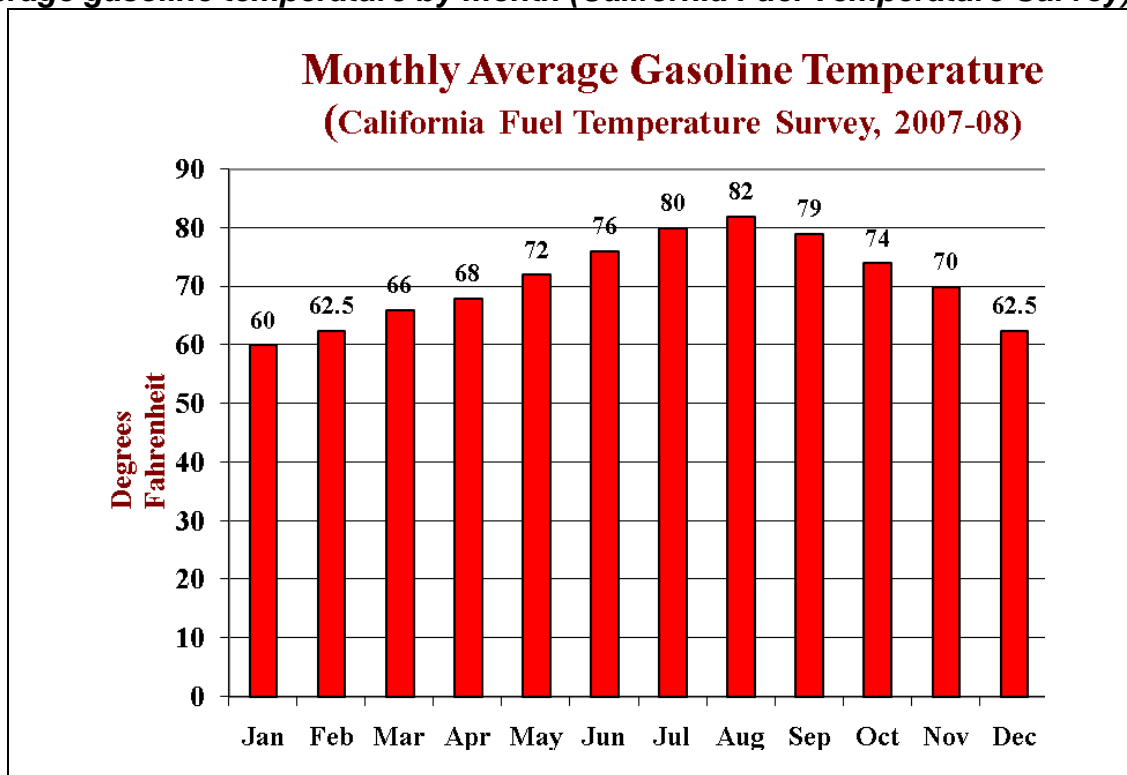
⁸⁰ Automatic temperature compensation explicitly varies the *volume* of each dispensed “gallon” in proportion to the expansion induced by temperature changes, while keeping constant the posted price per *net* gallon. Retail competition, on the other hand, keeps constant the volume of each *gross* gallon dispensed (at 231 cubic inches) but induces dealers to adjust their pump prices as average fuel temperatures vary with the seasons.

⁸¹ Adam Smith, *The Wealth of Nations*, Volume IV Chapter II, Modern Library edition, pp. 484-485 (emphases added):

As every individual...endeavors as much he can both to employ his capital in the support of domestic industry, and so to direct that industry that its produce may be of greatest value; every individual necessarily labors to render the annual revenue of the society as great as he can. He generally...neither intends to promote the public interest, nor knows how much he is promoting it...[B]y directing that industry in such a manner as its produce may be of the greatest value, he intends only own gain, and *he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention.* Nor is it always the worse for the society that it was not part of it. By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it. I have never known much good done by those who affected to trade for the public good. It is an

So how does retail competition induce – indeed, *force* – retailers to adjust their pump prices to compensate for temperature-induced changes in fuel volume? The explanation – which requires only that the retailer operate in a competitive market⁸² with knowledge of how much sales revenue he needs to generate and how many (gross) gallons he has available to sell⁸³ in order to try to achieve that target revenue – is illustrated in the following series of figures that are based on the monthly California-wide average retail gasoline temperatures shown in **Figure 23** derived from the *California Fuel Temperature Survey*⁸⁴ and on the assumption that the hypothetical retailer receives and sells a single load of 8,000 gallons of gasoline each month.

Figure 23.
Average gasoline temperature by month (California Fuel Temperature Survey).



affectation...not very common among merchants, and very few words need to be employed in dissuading them from it.

⁸² *CEC Staff Report* at p. 72.

⁸³ Dealers have access to this information through their tank monitoring systems. See *California Fuel Temperature Survey*, Presentation by Ken Lake, California Division of Measurement Standards, CEC Staff Workshop, March 4, 2008 at slides 3-4.

⁸⁴ *CEC Staff Report*, Figure 10 at p. 37.

Month-by-month illustration of how competition makes the adjustment

Start with **Figure 24** that assumes that the retailer takes wholesale delivery of 8,000 gallons of gasoline in January and that the temperature of that gasoline is 60°F. As a result, the delivery measures an identical 8,000 gallons, regardless of whether it is measured in net or gross terms. Assume that the dealer paid \$2.875 per net gallon, so that the total wholesale cost of the delivered fuel is \$23,000. Assume further that the dealer’s target retail margin – from which he must pay the other expenses associated with his business and generate a profit sufficient to justify remaining in business – is \$1,000 (or 12.5 cents per gross gallon). So in order to pay for the wholesale delivery of gasoline and achieve his target margin, he must try to generate total retail revenue of \$24,000. Using simple arithmetic, it follows that he must try to achieve a (target) pump price of \$3.000 per gallon (both net and gross).

Figure 24.
How retail competition adjusts for the effect of temperature on fuel volume—
JANUARY.

Month	Total GROSS gallons received	Fuel temp (F.)	Total NET gallons available for resale	Wholesale price per NET gallon	Cost to retailer of delivered fuel	Wholesale price per GROSS gallon	Target dealer margin	Target sales revenue	Target retail price per NET gallon	Target retail price per GROSS gallon	Difference in target GROSS price relative to January
January	8,000.0	60.0	8,000.0	\$2.875	\$23,000	\$2.875	\$1,000	\$24,000	\$3.000	\$3.000	
February											
March											
April											
May											
June											
July											
August											
September											
October											
November											
December											

Next, consider the retailer’s situation in February upon receipt of another delivery of 8,000 gross gallons of gasoline, shown in **Figure 25**. Since the temperature of this fuel is a somewhat warmer 62.5°F., that delivery yields only 7986.2 net gallons. At an unchanged wholesale price of \$2.875 per net gallon, the wholesale cost of this delivery is \$22,960.33. Add to that the dealer’s target margin of \$1,000 (8,000 gross gallons x \$0.125), and one determines that the dealer’s sales revenue target is \$23,960. When the dealer divides this target sales revenue figure by the number of gross gallons he has in inventory and available for sale, he realizes that he can achieve his target revenue with a pump price of \$2.995 per gallon, *a decrease of half a cent per gallon from his target price in January*. In other words, market competition has led the dealer to decrease his target retail price by 0.17 percent (or \$.005) because temperature-induced fuel expansion caused the volume occupied by net gallon to increase by the same 0.17 percent (or 0.398 cubic inches).

Figure 25.
How retail competition adjusts for the effect of temperature on fuel volume—
FEBRUARY.

Month	Total GROSS gallons received	Fuel temp (F.)	Total NET gallons available for resale	Wholesale price per NET gallon	Cost to retailer of delivered fuel	Wholesale price per GROSS gallon	Target dealer margin	Target sales revenue	Target retail price per NET gallon	Target retail price per GROSS gallon	Difference in target GROSS price relative to January
January	8,000.0	60.0	8,000.0	\$2.875	\$23,000	\$2.875	\$1,000	\$24,000	\$3.000	\$3.000	
February	8,000.0	62.5	7,986.2	\$2.875	\$22,960	\$2.870	\$1,000	\$23,960	\$3.000	\$2.995	- 0.5¢
March											
April											
May											
June											
July											
August											
September											
October											
November											
December											

But notice that the dealer’s target retail price per *net* gallon did *not* change. In January, the target retail revenue of \$24,000 was distributed over 8,000 net gallons, yielding a target retail price of \$3.000 per net gallon. In February, the dealer’s target revenue of \$23,958.60 was distributed over 7,986.2 net gallons, again resulting in a target pump price of \$3.000 per net gallon.

Next (shown in **Figure 26**) comes March, with a still warmer fuel temperature of 66.0°F. Now the delivery of 8,000 gross gallons corresponds to just 7,966.9 net gallons, which – at an unchanged wholesale price of \$2.875 per net gallon – costs the dealer \$22,905 in total. When his target margin of \$1,000 is added to the wholesale cost of the fuel itself, the dealer’s sales revenue target becomes \$23,905. Dividing that figure by the 8,000 gross gallons available for sale from his inventory, the dealer determines that his target retail price per gross gallon needs to be \$2.988, or *1.2 cents less per gallon* than was his target in January.⁸⁵

⁸⁵ As a net gallon has expanded by 0.41 percent since January, the dealer’s target street price per *gross* gallon has fallen by 0.41 percent. However, his target retail price per *net* gallon remains constant at \$3.000.

Figure 26.

**How retail competition adjusts for the effect of temperature on fuel volume—
MARCH.**

Month	Total GROSS gallons received	Fuel temp (F.)	Total NET gallons available for resale	Wholesale price per NET gallon	Cost to retailer of delivered fuel	Wholesale price per GROSS gallon	Target dealer margin	Target sales revenue	Target retail price per NET gallon	Target retail price per GROSS gallon	Difference in target GROSS price relative to January
January	8,000.0	60.0	8,000.0	\$2.875	\$23,000	\$2.875	\$1,000	\$24,000	\$3.000	\$3.000	
February	8,000.0	62.5	7,986.2	\$2.875	\$22,960	\$2.870	\$1,000	\$23,960	\$3.000	\$2.995	- 0.5¢
March	8,000.0	66.0	7,966.9	\$2.875	\$22,905	\$2.863	\$1,000	\$23,905	\$3.000	\$2.988	- 1.2¢
April											
May											
June											
July											
August											
September											
October											
November											
December											

Repeating this process for each of the remaining nine calendar months, as depicted in **Figure 27**, shows that as the fuel temperature continues to rise in the months from April through August, the dealer’s target retail price per gross gallon declines, reaching \$2.956 in August when the fuel temperature reaches its maximum value of 82° F. This is a 4.4 cent per gallon reduction from the January target retail price of \$3.000 per gross gallon. Thereafter, as fuel temperatures ebb with the cooling weather, the dealer’s target retail price per gallon increases, reaching \$2.995 per gross gallon in December. The month-by-month target retail prices that result from this process are shown in **Figure 28**.

Figure 27.

**How retail competition adjusts for the effect of temperature on fuel volume—
ENTIRE YEAR.**

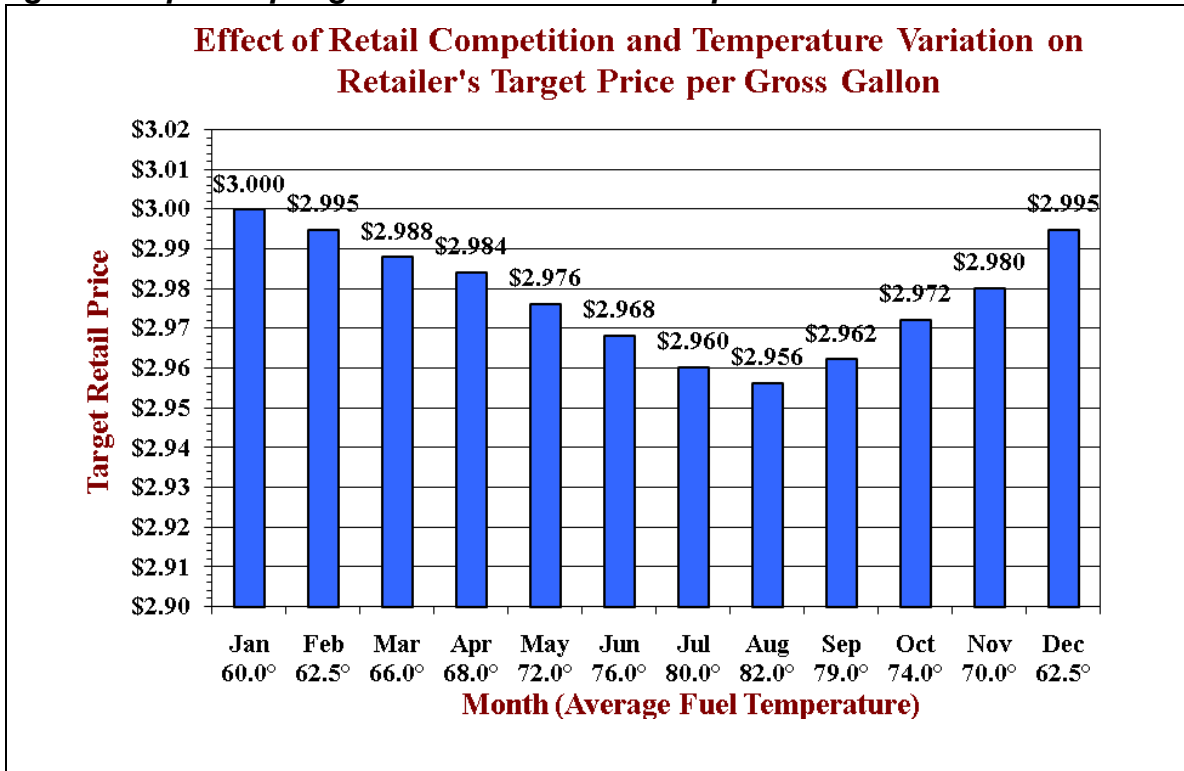
Month	Total GROSS gallons received	Fuel temp (F.)	Total NET gallons available for resale	Wholesale price per NET gallon	Cost to retailer of delivered fuel	Wholesale price per GROSS gallon	Target dealer margin	Target sales revenue	Target retail price per NET gallon	Target retail price per GROSS gallon	Difference in target GROSS price relative to January
January	8,000.0	60.0	8,000.0	\$2.875	\$23,000	\$2.875	\$1,000	\$24,000	\$3.000	\$3.000	
February	8,000.0	62.5	7,986.2	\$2.875	\$22,960	\$2.870	\$1,000	\$23,960	\$3.000	\$2.995	- 0.5¢
March	8,000.0	66.0	7,966.9	\$2.875	\$22,905	\$2.863	\$1,000	\$23,905	\$3.000	\$2.988	- 1.2¢
April	8,000.0	68.0	7,955.8	\$2.875	\$22,873	\$2.859	\$1,000	\$23,873	\$3.000	\$2.984	- 1.6¢
May	8,000.0	72.0	7,933.8	\$2.875	\$22,810	\$2.851	\$1,000	\$23,810	\$3.000	\$2.976	- 2.4¢
June	8,000.0	76.0	7,911.7	\$2.875	\$22,746	\$2.843	\$1,000	\$23,746	\$3.000	\$2.968	- 3.2¢
July	8,000.0	80.0	7,889.6	\$2.875	\$22,683	\$2.835	\$1,000	\$23,683	\$3.000	\$2.960	- 4.0¢
August	8,000.0	82.0	7,878.6	\$2.875	\$22,651	\$2.831	\$1,000	\$23,651	\$3.000	\$2.956	- 4.4¢
September	8,000.0	79.0	7,895.1	\$2.875	\$22,698	\$2.837	\$1,000	\$23,698	\$3.000	\$2.962	- 3.8¢
October	8,000.0	74.0	7,922.7	\$2.875	\$22,778	\$2.847	\$1,000	\$23,778	\$3.000	\$2.972	- 2.8¢
November	8,000.0	70.0	7,944.8	\$2.875	\$22,841	\$2.855	\$1,000	\$23,841	\$3.000	\$2.980	- 2.0¢
December	8,000.0	62.5	7,986.2	\$2.875	\$22,960	\$2.870	\$1,000	\$23,960	\$3.000	\$2.995	- 0.5¢

The key result is this: Viewed over an entire year, in which monthly fuel temperatures vary as shown in **Figure 23**, retail competition leads to adjustments in dealers’ target pump

prices per gross gallon (summarized in **Figure 28**) that exactly offset the temperature-induced expansion in fuel volume.

Figure 28.

Target retail prices per gallon fall as the fuel temperature increases.



Consequently, it makes no difference whether these transactions are conducted in terms of *net* gallons or *gross* gallons, insofar as a motorist's total annual outlay for gasoline (measured in net gallons) is concerned. This is shown in **Figure 29**, which starts by assuming that a consumer purchases the equivalent of 100 net gallons each month, for an annual total of 1,200 net gallons. At a retail price of \$3.000 per net gallon, the consumer's total annual outlay is \$3,600. But as shown in **Figure 29**, as the fuel temperature and volume increase, it requires a greater number of gross gallons to deliver the same 100 net gallons each month. But **Figure 29** also demonstrates that the consumer's total outlay will *not* increase, because retail competition induces an exactly offsetting decrease in a retailer's target pump price per gross gallon.

Figure 29.

A consumer's outlay is the same no matter whether net or gross units are used.

Month	Fuel temp (F.)	Total NET gallons purchased	Dealer's target retail price per NET gallon	Total cost of 100 NET gallons to consumer	GROSS equivalent of 100 NET gallons	Dealer's target retail price per GROSS gallon	Total cost of GROSS equivalent of 100 NET gallons
January	60.0	100.00	\$3.00	\$300	100.00	\$3.000	\$300
February	62.5	100.00	\$3.00	\$300	100.17	\$2.995	\$300
March	66.0	100.00	\$3.00	\$300	100.41	\$2.988	\$300
April	68.0	100.00	\$3.00	\$300	100.55	\$2.984	\$300
May	72.0	100.00	\$3.00	\$300	100.83	\$2.976	\$300
June	76.0	100.00	\$3.00	\$300	101.10	\$2.968	\$300
July	80.0	100.00	\$3.00	\$300	101.38	\$2.960	\$300
August	82.0	100.00	\$3.00	\$300	101.52	\$2.956	\$300
September	79.0	100.00	\$3.00	\$300	101.31	\$2.962	\$300
October	74.0	100.00	\$3.00	\$300	100.97	\$2.972	\$300
November	70.0	100.00	\$3.00	\$300	100.69	\$2.980	\$300
December	62.5	100.00	\$3.00	\$300	100.17	\$2.995	\$300
TOTAL		1,200.00		\$3,600	1209.11		\$3,600

The preceding illustrations are based on the assumption that the retailer takes delivery of 8,000 *gross* gallons each month. However, as shown in **Figure 30**, nothing of substance would change if it were assumed instead that these wholesale deliveries consist of 8,000 *net* gallons at \$2.875 per *net* gallon and that the dealer's target margin is \$0.125 per *net* gallon. The dealer's target retail price per *gross* gallon would still vary inversely with the average fuel temperature.

Figure 30.

Nothing changes if it is assumed that wholesale deliveries and dealer margins are in net gallons.

Month	Total GROSS gallons received	Fuel temp (F.)	Total NET gallons available for resale	Wholesale price per NET gallon	Cost to retailer of delivered fuel	Wholesale price per GROSS gallon	Target dealer margin per NET gallon	Target sales revenue	Target retail price per NET gallon	Target retail price per GROSS gallon	Difference in target GROSS price relative to January
January	8,000.0	60.0	8,000	\$2.875	\$23,000	\$2.875	\$1,000	\$24,000	\$3.000	\$3.000	
February	8,013.8	62.5	8,000	\$2.875	\$23,000	\$2.870	\$1,000	\$24,000	\$3.000	\$2.995	- 0.5¢
March	8,033.1	66.0	8,000	\$2.875	\$23,000	\$2.863	\$1,000	\$24,000	\$3.000	\$2.988	- 1.2¢
April	8,044.2	68.0	8,000	\$2.875	\$23,000	\$2.859	\$1,000	\$24,000	\$3.000	\$2.984	- 1.6¢
May	8,066.2	72.0	8,000	\$2.875	\$23,000	\$2.851	\$1,000	\$24,000	\$3.000	\$2.975	- 2.5¢
June	8,088.3	76.0	8,000	\$2.875	\$23,000	\$2.844	\$1,000	\$24,000	\$3.000	\$2.967	- 3.3¢
July	8,110.4	80.0	8,000	\$2.875	\$23,000	\$2.836	\$1,000	\$24,000	\$3.000	\$2.959	- 4.1¢
August	8,121.4	82.0	8,000	\$2.875	\$23,000	\$2.832	\$1,000	\$24,000	\$3.000	\$2.955	- 4.5¢
September	8,104.9	79.0	8,000	\$2.875	\$23,000	\$2.838	\$1,000	\$24,000	\$3.000	\$2.961	- 3.9¢
October	8,077.3	74.0	8,000	\$2.875	\$23,000	\$2.847	\$1,000	\$24,000	\$3.000	\$2.971	- 2.9¢
November	8,055.2	70.0	8,000	\$2.875	\$23,000	\$2.855	\$1,000	\$24,000	\$3.000	\$2.979	- 2.1¢
December	8,013.8	62.5	8,000	\$2.875	\$23,000	\$2.870	\$1,000	\$24,000	\$3.000	\$2.995	- 0.5¢

It also is important to notice what was *not* required in these illustrations. In particular, it was not required that a retailer start with a target pump price per net gallon (presumably, some markup over his wholesale price per net gallon), then measure the actual temperature of the fuel in his inventory, next perform the calculations to determine the increased volume of his net gallons beyond 231 cubic inches, and finally make the appropriate arithmetic adjustment to his preliminary target street price per net gallon, all in order to arrive at the actual price per gross gallon to be posted on his pumps. All the retailer actually needed to know was how many gross gallons he had in inventory, how much he paid for that inventory, and what gross margin he needed to seek in order to cover his other costs of doing business and to earn a competitive profit. Retail competition then led the retailer to make the appropriate adjustments to his target street price.

No “excess federal and state motor fuel taxes” are collected

Using this same analytical approach, it is straightforward to dispose of the charge by “hot fuel” activists that dealers “generate hidden profits” by overcharging their retail customers for federal and state motor vehicle fuel taxes.⁸⁶ The activists’ argument goes like this: Retailers purchase wholesale inventory – and pay applicable federal and state motor vehicle fuel taxes – on the basis of the net gallons delivered by the supplier. However, when these same retailers sell that fuel to their retail customers at higher temperatures, they sell more gallons than they

⁸⁶ *Kansas City Star*, “Loophole enhances ‘hot fuel’ profits,” November 12, 2006 <http://www.kansascity.com/128/v-print/story/38819.html>; “Second Consolidated Amended Complaint, *In re: Motor Fuel Temperature Sales Practices Litigation*, filed December 1, 2008 in U.S. District Court for the District of Kansas at pp. 4, 19-22, 32-33; and *Public Citizen*, “Fact Sheet on Hot Fuel”, December 14, 2006. http://www.citizen.org/cmep/energy_enviro_nuclear/electricity/Oil_and_Gas/articles.cfm?ID=16025

purchased at wholesale and on which their own federal and state fuel tax liabilities were calculated. Yet retailers require consumers to pay motor vehicle fuel taxes on these extra gallons, even though this results in more tax revenue than the retailers had to pay at the time of their wholesale purchases. The difference is undeserved profit to these retailers.

Figure 31.
Competition also adjusts the fuel taxes collected per gross gallon as the temperature changes.

Month	Total GROSS gallons received	Fuel temp (F.)	Total NET gallons purchased by retailer	Motor fuel taxes paid per NET gallon by dealer	Wholesale price per NET gallon less fuel taxes	Cost to retailer of delivered fuel	Target sales revenue	Target retail price per GROSS gallon (total)	Target retail price per GROSS gallon (net of fuel taxes)	Target fuel taxes per GROSS gallon	Difference in fuel taxes per GROSS gallon relative to January
January	8,000.0	60.0	8,000.0	\$0.378	\$2.497	\$23,000	\$24,000	\$3.000	\$2.622	\$0.378	
February	8,000.0	62.5	7,986.2	\$0.378	\$2.497	\$22,960	\$23,960	\$2.995	\$2.618	\$0.377	- 0.1¢
March	8,000.0	66.0	7,966.9	\$0.378	\$2.497	\$22,905	\$23,905	\$2.988	\$2.612	\$0.376	- 0.2¢
April	8,000.0	68.0	7,955.8	\$0.378	\$2.497	\$22,873	\$23,873	\$2.984	\$2.608	\$0.376	- 0.2¢
May	8,000.0	72.0	7,933.8	\$0.378	\$2.497	\$22,810	\$23,810	\$2.976	\$2.601	\$0.375	- 0.3¢
June	8,000.0	76.0	7,911.7	\$0.378	\$2.497	\$22,746	\$23,746	\$2.968	\$2.594	\$0.374	- 0.4¢
July	8,000.0	80.0	7,889.6	\$0.378	\$2.497	\$22,683	\$23,683	\$2.960	\$2.588	\$0.373	- 0.5¢
August	8,000.0	82.0	7,878.6	\$0.378	\$2.497	\$22,651	\$23,651	\$2.956	\$2.584	\$0.372	- 0.6¢
September	8,000.0	79.0	7,895.1	\$0.378	\$2.497	\$22,698	\$23,698	\$2.962	\$2.589	\$0.373	- 0.5¢
October	8,000.0	74.0	7,922.7	\$0.378	\$2.497	\$22,778	\$23,778	\$2.972	\$2.598	\$0.374	- 0.4¢
November	8,000.0	70.0	7,944.8	\$0.378	\$2.497	\$22,841	\$23,841	\$2.980	\$2.605	\$0.375	- 0.3¢
December	8,000.0	62.5	7,986.2	\$0.378	\$2.497	\$22,960	\$23,960	\$2.995	\$2.618	\$0.377	- 0.1¢

Figure 31 is the same as earlier **Figure 27**, except that it explicitly breaks out the \$0.378 in motor fuel taxes per net gallon⁸⁷ that were included in the \$2.875 per net gallon collected by the wholesale supplier. The key results are in the three rightmost columns: Just as before, the dealer’s target retail price per gross gallon decreases as the fuel temperature increases. But **Figure 31** also shows that the dollar amount of the U.S. and California fuel taxes per gross gallon also declines as the fuel warms. In January – with the fuel temperature at 60°F. – the retailer’s target pump price of \$3.000 per gross gallon includes 37.8 cents in taxes. But in each succeeding month, as the fuel temperature increases, the amount of fuel taxes collected with each gross gallon sold decreases, falling to 37.2 cents per gallon in August when the fuel temperature peaks at 82.0°F. If one assumes that a consumer purchases the equivalent of 100 net gallons per month, the adjustments to the dollar amount of fuel taxes collected per gross gallon that are summarized in **Figure 31** insure that the consumer pays no more and no less than \$37.80 each month in federal and state fuel taxes, regardless of the fuel temperature. This is shown in **Figure 32**.

⁸⁷ The sum of \$0.180 federal, \$0.183 California and \$0.015 underground storage tank taxes per gallon.

Figure 32.

Fuel taxes paid by consumer per net gallon remain constant.

Month	Fuel temperature (F.)	Total NET gallons purchased	Fuel taxes paid by consumer per NET gallon	Total fuel taxes paid by consumer per 100 NET gallons	GROSS equivalent of 100 NET gallons	Dealer's target fuel taxes per GROSS gallon	Total taxes collected per GROSS equivalent of 100 NET gallons
January	60.0	100.00	\$0.378	\$37.80	100.00	\$0.378	\$37.80
February	62.5	100.00	\$0.378	\$37.80	100.17	\$0.377	\$37.80
March	66.0	100.00	\$0.378	\$37.80	100.41	\$0.376	\$37.80
April	68.0	100.00	\$0.378	\$37.80	100.55	\$0.376	\$37.80
May	72.0	100.00	\$0.378	\$37.80	100.83	\$0.375	\$37.80
June	76.0	100.00	\$0.378	\$37.80	101.10	\$0.374	\$37.80
July	80.0	100.00	\$0.378	\$37.80	101.38	\$0.373	\$37.80
August	82.0	100.00	\$0.378	\$37.80	101.52	\$0.372	\$37.80
September	79.0	100.00	\$0.378	\$37.80	101.31	\$0.373	\$37.80
October	74.0	100.00	\$0.378	\$37.80	100.97	\$0.374	\$37.80
November	70.0	100.00	\$0.378	\$37.80	100.69	\$0.375	\$37.80
December	62.5	100.00	\$0.378	\$37.80	100.17	\$0.377	\$37.80
TOTAL		1,200.00		\$453.60	1209.11		\$453.60

Monte Carlo simulation of repeated retail purchases in the context of cross-sectional temperature variations.

The preceding section showed how retail competition adjusts pump prices for the expansion in fuel volumes induced by seasonal changes in average fuel temperatures. But “hot fuel” activists are also alarmed by temperature differences in the fuel being sold at the same point in time from different retailers in the same local area.⁸⁸

⁸⁸ Letter to the California Energy Commission from Judy Dugan, The Foundation for Taxpayer and Consumer Rights (FTCR) and oilwatchdog.org, February 8, 2008 (“The presentation by Henry Opperman at the open meeting Jan. 28 showed that, even in a small sample, stations within blocks of one another had gasoline temperature variations of up to 10 degrees F.”); “Consumer’s View of Mr. Ross Anderson’s ‘Comments on Fuel Deliver and [sic] Temperature Study,’” comments submitted to the California Energy Commission by John Siebert, Owner Operator independent Drivers Association, February 29, 2008 (“[T]he issue facing consumers is between buying only gross gallons in a market where fuel temperatures can vary 15 to 20 degrees within a five block area. Henry Opperman shared a fuel temperature map of Topeka, Kansas, at the NCWM interim meeting which illustrates this well.”)

In this section, I will show how a motorist's repeated purchases – over, say, a calendar year – are sufficient to protect against what is termed *cross-sectional variation* in fuel temperature in that motorist's local area.

Data on cross-sectional temperature variations.

Because of limitations in its design and execution, the *California Fuel Temperature Survey* did not gather the sort of data that would be needed to analyze this phenomenon in California. Consequently, the demonstration that follows is based on cross-sectional observations drawn from retailers located within approximately five miles of the center of Topeka, Kansas.⁸⁹ These data, consisting of 48 observations gathered on four separate occasions in 2007 and presented to the National Conference on Weights and Measures in 2008,⁹⁰ are summarized in **Figure 33**.⁹¹ For each observation, the statistic of interest is its deviation from the prevailing average (or mean) fuel temperature, because the possibility of such deviations are the basis for the concerns expressed by activists. When each actual observation is replaced by its deviation from the mean, it becomes feasible to aggregate all 48 observations into a single “meta-sample” of deviations from the mean of Topeka-area fuel temperatures.^{92, 93}

⁸⁹ Not “within *blocks* of one another” or “within a five *block* area”, as claimed by Ms. Dugan and Mr. Siebert respectively.

⁹⁰ Henry Oppermann, “Temperature Data from Weights and Measures Programs,” Presentation at the NCWM Interim Meeting, January 28, 2008, slides 12-15.

⁹¹ Nineteen measurements with a mean temperature of 50.6°F. were obtained during the January 8-12, 2007 period, followed by six observations each on April 16 and April 23, 2007 (with mean temperatures of 54.4° and 59.0°, respectively), and with seventeen more readings gathered during the December 4-8, 2007 interval (with a mean of 50.6°F.). One apparently anomalous observation taken in December 2007 (with a reported fuel temperature of 32.7°F.) was omitted from my analysis because it was nearly 10 degrees colder than the next coldest measurement. This omission had no material effect on the results reported in this paper.

⁹² It should be noted that the *range* in fuel temperatures at one point in time (calculated as the arithmetic difference between the warmest and coldest measurements) is of less interest. A hypothetical consumer would not face a choice between only the warmest and coldest fuel in the area; she could also randomly select from among any of the intermediate fuel temperatures available at the time.

⁹³ Since it is the *deviations* from the prevailing average fuel temperature – and not the temperatures themselves – that are of interest, it makes no particular difference that these 48 observations were recorded during relatively “cold” months.

Figure 33.

Fuel temperatures in the vicinity of Topeka, KS reported by Henry Oppermann.

January 8-12, 2007 (Mean = 50.6° F.)			April 16, 2007 (Mean = 54.4° F.)			April 23, 2007 (Mean = 59.0° F.)			December 4-8, 2007 (Mean = 50.6° F.)		
<i>Obs no</i>	<i>Temp</i>	<i>Devn</i>	<i>Obs no</i>	<i>Temp</i>	<i>Devn</i>	<i>Obs no</i>	<i>Temp</i>	<i>Dev</i>	<i>Obs no</i>	<i>Temp</i>	<i>Devn</i>
1	58.8	8.2	20	59.5	5.1	26	66.0	7.0	32	55.9	5.3
2	55.4	4.8	21	58.8	4.4	27	61.2	2.2	33	54.9	4.3
3	54.7	4.1	22	54.5	0.1	28	59.9	0.9	34	54.9	4.3
4	54.1	3.5	23	53.6	-0.8	29	56.3	-2.7	35	54.9	4.3
5	53.2	2.6	24	52.2	-2.2	30	55.6	-3.4	36	54.1	3.5
6	53.1	2.5	25	48.0	-6.4	31	55.2	-3.8	37	53.8	3.2
7	52.3	1.7							38	52.5	1.9
8	52.0	1.4							39	51.6	1.0
9	51.3	0.7							40	51.4	0.8
10	51.1	0.5							41	50.5	-0.1
11	50.7	0.1							42	50.4	-0.2
12	50.2	-0.4							43	49.3	-1.3
13	48.7	-1.9							44	49.3	-1.3
14	46.8	-3.8							45	47.7	-2.9
15	46.6	-4.0							46	44.4	-6.2
16	46.4	-4.2							47	42.3	-8.3
17	46.4	-4.2							48	42.3	-8.3
18	45.9	-4.7									
19	43.3	-7.3									

This derived “meta-sample” can be interpreted in either of two ways: It can be thought of as the possible departures from the average fuel temperature in a local competitive area that a consumer might encounter as she chooses randomly among all of the stations available in that area in order to fuel her vehicle. Or it can be interpreted as the possible departures from the average fuel temperature prevailing in the local area that a motorist might encounter if she made all her purchases at the *same* station but at random amounts of time since the dealer received his most recent wholesale delivery.⁹⁴

⁹⁴ This interpretation is based on the fact that retail stores in a particular local area tend to be supplied from the same wholesale terminal. As a result, any cross-sectional differences in fuel temperature among these stores would mostly be due to differences in the amount of time that has elapsed since they received a wholesale delivery. See the Testimony of R. Timothy Columbus before the Subcommittee on Domestic Policy of the House Committee on Oversight and Government Reform, June 8, 2007 at p. 3 (“[F]or the most part, all retailers in a particular market acquire product at a terminal facility which contains the co-mingled products of many manufacturers. The only “product differentiation” between products takes place as sellers inject different additives into the product as it is delivered from the terminal into a transport truck. In most metropolitan markets all retailers obtain their products from terminals supplied by the same common carrier pipeline, located in sufficiently close physical proximity as to experience the same ambient temperature, deliver them by trucks driving through

The question of interest is this: What is the probability that a consumer – who either randomly chooses among all of the available dealers in the local area or chooses to purchase from a specific retailer at random times since its most recent delivery – might as a matter of chance (or bad luck) end up with aggregate annual fuel purchases whose average temperature significantly exceeded the prevailing average fuel temperature in that area?

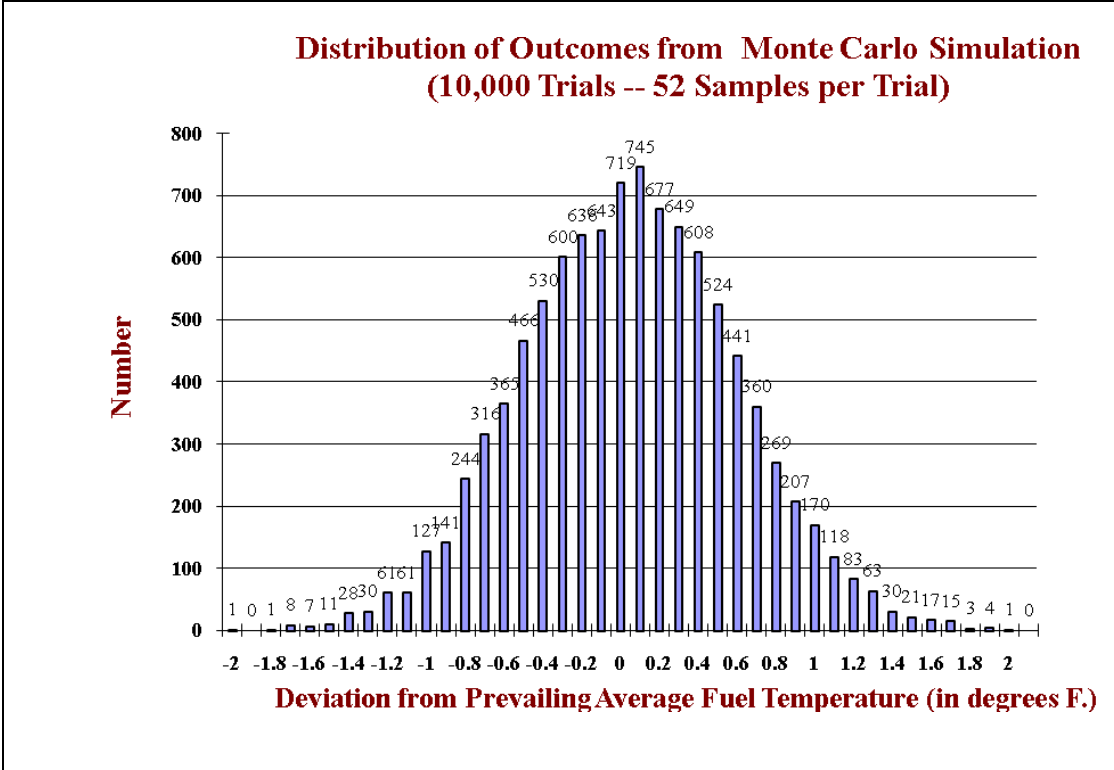
Monte Carlo simulation

This question can be addressed using a standard statistical technique known as *Monte Carlo simulation*, in which a computer is instructed to generate a large number of independent random “samples” by drawing from the same specified “population”. Here the “population” consists of the 48 deviations summarized in **Figure 33**, and the computer was instructed to make 52 “purchases” of 20 gallons each at temperatures drawn randomly from the “population” in **Figure 33** in order to simulate a consumer making weekly gasoline purchases totaling 1,040 gallons over an entire year. Following this random sampling, the computer was instructed to calculate the average temperature deviation for these 52 weekly purchases and 1,040 gallons, in order to determine how much temperature-induced expansion (or contraction) had been encountered by the consumer. Finally, the computer was instructed to repeat this entire process 10,000 times, in order to build up the database needed to determine how likely it was that a consumer might randomly wind up with annual fuel purchases whose average temperature significantly exceeded the prevailing average fuel temperature in the local area.

the same ambient air temperature, and deliver this product into storage tanks surrounded by ground of the same ambient ground temperature.”).

Resulting evidence on the effect of cross-sectional temperature variation.

Figure 34.
Distribution of outcomes from Monte Carlo simulation (52 x 20 gallons)



The results of the 10,000 Monte Carlo simulation trials are summarized in the histogram shown in **Figure 34**. The results are striking. In only *one* of the 10,000 trials – or one one-hundredth of one percent – was the average temperature of the consumer’s purchased fuel even 2.0°F warmer than the prevailing average temperature. This means, for example, that a consumer who purchased 1,040 gallons at \$3.00 per gallon over a year would face only one chance in 10,000 of “overpaying” by as much as \$4.31 in total over that year,⁹⁵ and no chance at all of paying more than that amount. Or, to select a different reference point, the probability is greater than 0.96 that the consumer’s total annual purchases are no more than 1° warmer or \$2.15 more expensive⁹⁶ than would be the case if all his purchases were made precisely at the prevailing average fuel temperature. **Figure 35** summarizes the probabilities that the average temperature of a consumer’s annual fuel purchases exceeds the average for the local area by particular deviations, measured in degrees, along with the additional costs these deviations would imply at various assumed gasoline prices.

⁹⁵ \$4.31 = (.00069) x (2°) x 1,040 x \$3.00.

⁹⁶ Again, assuming a retail price of \$3.00 per gallon.

Figure 35.

Results of Monte Carlo simulation assuming 52 20-gallon purchases in a year.

Cost of "Hot Fuel" Overcharges Due to Cross-Sectional Temperature Differences Assuming Total Annual Purchases of 1,040 Gallons (52 x 20 gallons)							
Degrees above local average	Number of Outcomes	Probability	Maximum gallons "lost"	Assumed Retail Price per Gallon			
				\$2.00	\$3.00	\$4.00	\$5.00
0.0 to 0.5	3,398	33.98%	0.18	\$0.36	\$0.54	\$0.72	\$0.90
0.5 to 1.0	1,801	18.01%	0.36	\$0.72	\$1.08	\$1.44	\$1.79
1.0 to 1.5	464	4.64%	0.54	\$1.08	\$1.61	\$2.15	\$2.69
1.5 to 2.0	60	0.60%	0.72	\$1.44	\$2.15	\$2.87	\$3.59
2.0 to 2.5	1	0.01%	0.90	\$1.79	\$2.69	\$3.59	\$4.49
2.5 to 3.0	0	0.00%	1.08	\$2.15	\$3.23	\$4.31	\$5.38
3.0 +	0	0.00%	1.26	\$2.51	\$3.77	\$5.02	\$6.28

The results are substantially the same if one were to posit either a consumer who makes only 26 biweekly purchases of 20 gallons in fuel (or 540 gallons in total) in a year (**Figures 36**) or a consumer who makes 104 (or twice-weekly) purchases (for 2,080 gallons) in a year (**Figures 37**).

Figure 36.

Results of Monte Carlo simulation assuming 26 20-gallon purchases in a year.

Cost of "Hot Fuel" Overcharges Due to Cross-Sectional Temperature Differences Assuming Total Annual Purchases of 520 Gallons (26 x 20 gallons)							
Degrees above local average	Number of Outcomes	Probability	Maximum gallons "lost"	Assumed Retail Price per Gallon			
				\$2.00	\$3.00	\$4.00	\$5.00
0.0 to 0.5	2,506	25.06%	0.18	\$0.36	\$0.54	\$0.72	\$0.90
0.5 to 1.0	1,828	18.28%	0.36	\$0.72	\$1.08	\$1.44	\$1.79
1.0 to 1.5	934	9.34%	0.54	\$1.08	\$1.61	\$2.15	\$2.69
1.5 to 2.0	267	2.67%	0.72	\$1.44	\$2.15	\$2.87	\$3.59
2.0 to 2.5	55	0.55%	0.90	\$1.79	\$2.69	\$3.59	\$4.49
2.5 to 3.0	12	0.12%	1.08	\$2.15	\$3.23	\$4.31	\$5.38
3.0 +	0	0.00%	1.26	\$2.51	\$3.77	\$5.02	\$6.28

Figure 37.

Results of Monte Carlo simulation assuming 104 20-gallon purchases in a year.

Cost of "Hot Fuel" Overcharges Due to Cross-Sectional Temperature Differences Assuming Total Annual Purchases of 2,080 Gallons (104 x 20 gallons)							
Degrees above local average	Number of Outcomes	Probability	Maximum gallons "lost"	Assumed Retail Price per Gallon			
				\$2.00	\$3.00	\$4.00	\$5.00
0.0 to 0.5	4,422	44.22%	0.18	\$0.36	\$0.54	\$0.72	\$0.90
0.5 to 1.0	1,429	14.29%	0.36	\$0.72	\$1.08	\$1.44	\$1.79
1.0 to 1.5	116	1.16%	0.54	\$1.08	\$1.61	\$2.15	\$2.69
1.5 to 2.0	2	0.02%	0.72	\$1.44	\$2.15	\$2.87	\$3.59
2.0 to 2.5	0	0.00%	0.90	\$1.79	\$2.69	\$3.59	\$4.49
2.5 to 3.0	0	0.00%	1.08	\$2.15	\$3.23	\$4.31	\$5.38
3.0 +	0	0.00%	1.26	\$2.51	\$3.77	\$5.02	\$6.28

The conclusion supported by these Monte Carlo simulations is that – because motorists make repeated fuel purchases over, say, a year – any cross-sectional variation in fuel temperature within a local competitive area that poses no significant issue.

Where are the supposed “hot fuel rip-off” profits?

The activists are unanimous in their assertions that U.S. retailers have been pocketing billions of dollars each year in hidden “hot fuel” profits, and that each year consumers are cheated of the same amounts.

This paper has shown how retail competition is sufficient to adjust dealer’s pump prices to compensate for the temperature-induced expansion of their fuel inventories. In the preceding section, this paper also has shown why consumers are not being “ripped off” by possible cross-sectional differences among fuel temperatures in local areas.

In view of these two showings, it is highly unlikely that the supposed “hot fuel rip-off” profits even exist. More to the point, the “hot fuel” activists have never attempted to prove independently the actual existence of these supposed hidden profits.

If it turns out that the predicted “hot fuel rip-off” profits themselves do not actually exist, then this should be taken as dispositive proof that the entire “hot fuel” controversy is a sham.

Equivalence of the “hot fuel” allegations and tacit collusion

Before proceeding with an analysis of the profitability of U.S. retailers of motor fuel and of the state-by-state implications of the supposed “hot fuel rip-off”, it is important to realize that those allegations are tantamount to a claim that U.S. retailers of motor fuel have tacitly colluded

with each other for eighty years to maintain their pump prices above competitive levels and to secretly retain the resulting “hot fuel” profits. As a matter of economics – both industrial organization and antitrust economics – the achievement and maintenance of such a collusive scheme is extraordinarily unlikely, because it would constitute the largest and longest-lived anticompetitive agreement ever achieved in the U.S. While it is not the purpose of this paper to offer a formal analysis and refutation of the collusive agreement implicit in the “hot fuel” allegations, there are several reasons to be highly skeptical that such an anticompetitive arrangement ever existed:^{97, 98}

- *Number and heterogeneity of the supposed participants.* In 2007, there were approximately 164,300 retail sellers of motor fuel in the U.S.⁹⁹ As one example, at least tens of thousands of these dealers would have been the principal direct beneficiaries of the “hot fuel rip-off”, while the remainder would have had to participate in its cover-up, even though there are serious conflicts of interest among all these retailers. Dealers in “cold” parts of the U.S. supposedly have their profits “ripped off” by consumers as the result of the same physical properties of motor fuel that underpin the “hot fuel” allegations. Why would these “cold state” retailers keep silent about the “hot fuel rip-off”, when it is *costing* each of them thousands of dollars every year? There also is a diversity of interest between retailers who are employees of the integrated refiner-marketers, on the one hand, and independent dealers, on the other. The employers of the former are motivated to minimize the profitability of the retail level, while independent dealers naturally would like to see that level be as profitable as possible.
- *Frequent entry, exit and turnover among the supposed participants.* No collusive agreement can simply be put on “autopilot” to continue indefinitely; for such an agreement to persist requires the active involvement of its participants to recruit and indoctrinate newcomers to the industry. The ownership and management of retail stores is in constant flux, with frequent entry, departures and turnover. The proponents of the

⁹⁷ The reader is referred to any of the several standard works on industrial organization and antitrust economics for a fuller discussion of these arguments and for citations to the primary literature. For example, see the following works and the citations: Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization* (3rd ed.), (Addison-Wesley, 2000) at pp. 121-150; W. Kip Viscusi, John M. Vernon and Joseph E. Harrington, Jr., *Economics of Regulation and Antitrust* (3rd ed.), (The MIT Press, 2001) at pp. 112-135; and Herbert Hovenkamp, *Economics and Federal Antitrust Law*, (West Publishing Co., 1985) at pp. 83-110.

⁹⁸ Arthur G. Fraas and Douglas F. Greer, “Market Structure and Price Collusion: An Empirical Analysis,” *26 Journal of Industrial Economics* (1977) at pp. 21-44; George A. Hay and Daniel Kelley, “An Empirical Survey of Price-Fixing Conspiracies,” *17 Journal of Law and Economics* (1974) at pp. 13-38; Peter Asch. and J. J. Seneca, “Is Collusion Profitable?,” *68 Review of Economics and Statistics* (1976) at pp. 1-12; and Valerie Y. Suslow, “Cartel contract duration: empirical evidence from inter-war international cartels,” *Industrial and Corporate Change*, 2005.

⁹⁹ National Petroleum News, *NPN Market facts 2008*. <<http://www.npnweb.com>>

“hot fuel” allegations never explain how the tacit collusion among retailers that is a necessary condition for the “success” of the “hot fuel rip-off” is maintained in the face of such turnover.

- *The withdrawal of major refiner-marketers from the retail end of the distribution chain.* The “hot fuel” activists are among the most vocal critics of so-called “Big Oil” and the latter’s supposed determination to squeeze the greatest possible profits out of consumers. At the same time, these activists claim that billions each year in “hot fuel” profits are being “ripped off” from motorists at the retail level. If this is the case, why would major refiner-marketers voluntarily seek to exit the retail end of the industry?^{100, 101}

But there are other bodies of evidence that strongly suggest that retailers have been incapable of maintaining pump prices above the competitive levels at which they earn only normal, competitive profit. Chief among these are retail “price wars” among dealers, and the manifest inability of retailers to maintain high pump prices when their wholesale prices recede following “spikes”.

The frequency of localized “price wars” among retailers is strong evidence against the existence of “hot fuel” profits. Such “price wars” erupt because rival retailers are unable to maintain and stabilize their respective prices at levels that are acceptable to them. Price wars devastate the profitability of participants. If rival retailers in a local competitive area cannot manage to prevent such frequent and costly “misunderstandings”, how is it that they nevertheless have been able to sequester and preserve their supposed “hot fuel” profits – and to avoid dissipating these profits through price wars – for decades? If retailers have succeeded in forming and maintaining their collusive “hot fuel” agreement, why do these same retailers engage in price wars with each other? Their inability to prevent price wars speaks volumes about the likelihood that these same retailers have formed and successfully maintained an agreement to extract “hot fuel” profits from their customers.

¹⁰⁰ Steve Everly, “There’s little gain in selling gas”, *Kansas City Star*, December 26, 2008: Gas retailing has long filled an awkward niche in the oil business. Federal lawyers compiling an antitrust case against Big Oil in the 1970s – a case that was eventually dropped by President Ronald Reagan – were prepared to argue that the oil industry’s retail stations weren’t viewed as profit centers in themselves. Instead, they were needed to dispose of huge amounts of profitable Mideast oil that the companies owned before those supplies began to be nationalized in the early 1970s. The loss of the Mideast oil made all those gas stations less necessary to their corporate owners, who increasingly viewed them as financial albatrosses. Indeed, the total number of U.S. gas stations has shrunk from 216,000 in 1970 to 162,000 today, even with three times as many vehicles on the road, according to NPN, a company that collects information on the industry. As the big oil companies lost interest in owning gas stations, they began to spin them off to independent operators.

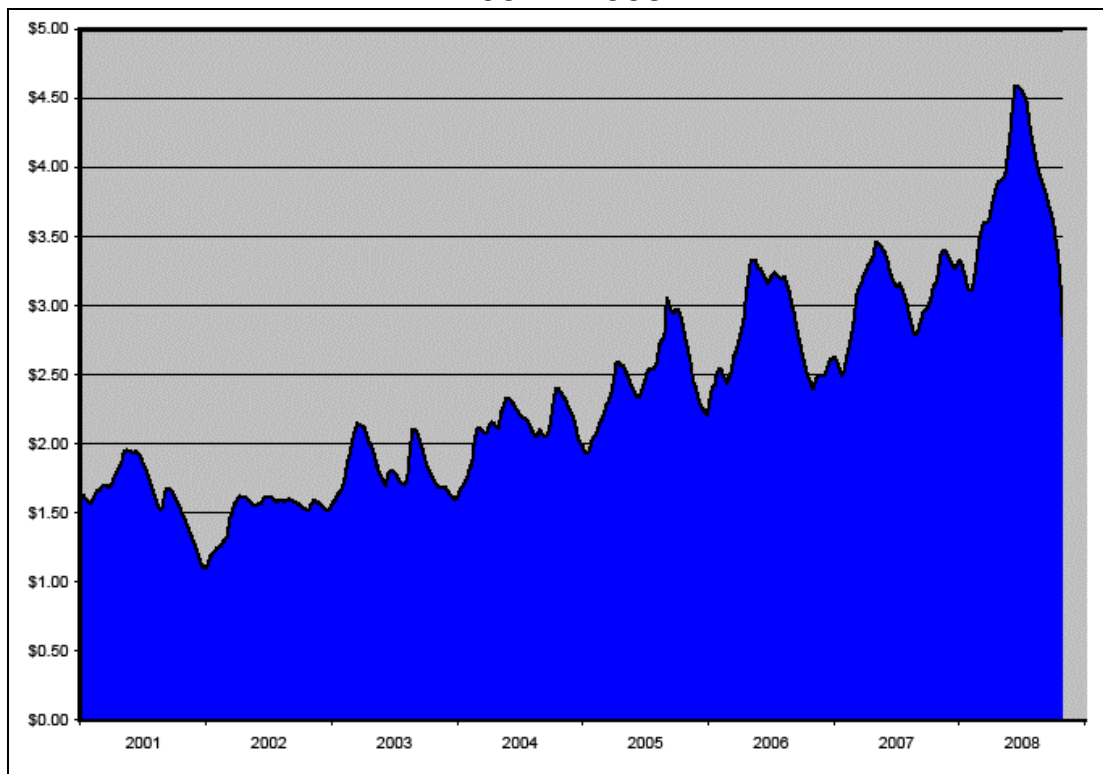
¹⁰¹ Judy Dugan, *OilWatchdog*, “Greed for pennies,” June 13, 2008. (“Exxon is selling off its 820 company-owned stations and 1,400 stations run by independent dealers on company-owned land.”) <http://www.oilwatchdog.org/articles/?storyId=20816>

If retailers really possessed the ability to collusively maintain their street prices above normal competitive levels – which, after all, is the essence of the “hot fuel rip-off” allegations – then why do they not similarly maintain prices above competitive levels when presented with an opportunity to do so by sudden increases in their wholesale prices that later are followed by reductions in those same wholesale prices?

A casual inspection of the recent history of California retail prices for regular unleaded gasoline shows a series of “spikes” – caused by such phenomena as international events, refinery incidents and shutdowns, weather, etc. – that regularly are followed by an easing of retail prices. See **Figure 38**.

Figure 38.

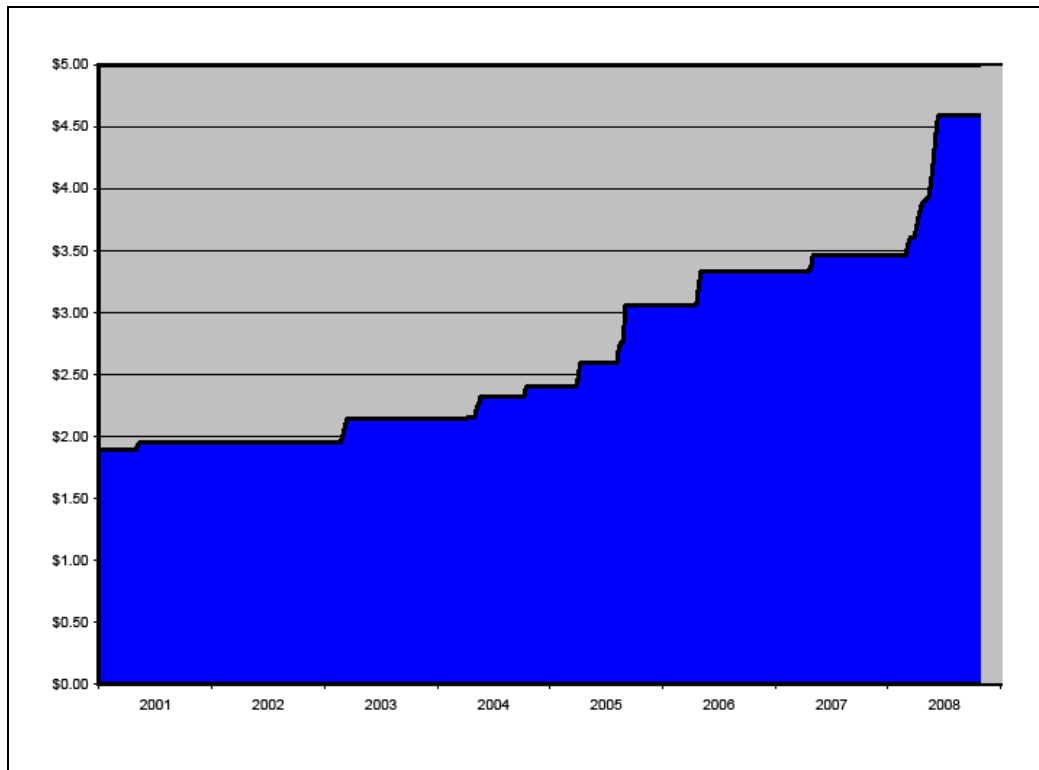
Average Price of Regular Unleaded Gasoline in California 2001 – 2008



Obviously, dealers would be far more profitable if they tacitly agreed *not* to let their retail prices subside following these episodes. For example – once such a spike in wholesale has given dealers the opportunity to raise their own prices – if retailers could *maintain* their higher pump prices at those levels even after their own wholesale prices have eased, the increase in their profitability would be enormous. This scenario is illustrated in **Figure 39**. The fact that this never happens speaks volumes about the supposed ability of California (and U.S.) dealers to successfully maintain their retail prices above competitive levels for decades.

Figure 39.
Hypothetical price of regular unleaded gasoline if retailers maintained higher prices.

**Average Price of Regular Unleaded Gasoline in California
2001 – Present**



The recent profitability of U.S. motor fuel retailers

But the strongest evidence against the existence of the “hot fuel rip-off” is the generally modest profitability of U.S. motor fuel retailers. The plain fact is that retail motor fuel stores are not as profitable as the “hot fuel rip-off” allegations would suggest.

U.S. data on the profitability of gasoline stations summarized in **Figure 40** support the conclusion that these retail businesses are not particularly profitable, regardless of whether they include convenience stores or not. Even the journalists most responsible for publicizing the supposed “hot fuel rip-off” acknowledge that retailers are not very profitable.^{102, 103}

¹⁰² Steve Everly, “There’s little gain in selling gas”, *Kansas City Star*, December 26, 2008:

Raj Singh is serving a customer who stops for gas and a Coke at the Independence Conoco station he manages. The customer asks: What’s it like selling some of the cheapest fuel in the country?

Figure 40.

Summary data on the profitability of the U.S. gasoline retailers.

	Apr 02 thru Mar 03	Apr 03 thru Mar 04	Apr 04 thru Mar 05	Apr 05 thru Mar 06	Apr 06 thru Mar 07	Five Year Average
Gasoline Stations with Convenience Stores (NAICS 447110)						
Operating Profit as % of Net Sales	1.0%	1.0%	0.7%	0.9%	0.8%	0.9%
Profit Before Taxes as % of Net Sales	1.2%	1.2%	0.9%	0.8%	0.8%	1.0%
Profit Before Taxes as % of Total Assets	3.5%	3.5%	3.9%	3.2%	4.5%	3.7%
Median	3.5%	3.5%	3.9%	3.2%	4.5%	3.7%
Lower	-0.5%	-0.3%	0.0%	0.3%	-1.3%	-0.4%
Other Gasoline Stations (NAICS 447190)						
Operating Profit as % of Net Sales	0.9%	1.2%	0.9%	1.6%	1.5%	1.2%
Profit Before Taxes as % of Net Sales	0.7%	1.1%	1.1%	1.4%	1.2%	1.1%
Profit Before Taxes as % of Total Assets	2.4%	3.9%	4.1%	5.2%	4.3%	4.0%
Median	2.4%	3.9%	4.1%	5.2%	4.3%	4.0%
Lower	-2.2%	0.3%	0.4%	1.1%	0.2%	0.0%

Source: RMA (Risk Management Association) Annual Statement Studies

“Dude, let me show you something,” Singh says, shoving a sheet of paper across the counter. Subtracting his wholesale gas costs and 36 cents in state and federal taxes from the pump price, his station makes about 2 cents a gallon.

But that’s before any other costs are subtracted. Figure in credit card fees, for example, and the station is losing money on every gallon sold.

“We are praying to God to help us any way he can,” he says.

¹⁰³ Judy Dugan, “Not the Gas Station’s Fault,” *OilWatchdog*, April 21, 2008: <http://www.oilwatchdog.org/articles/?storyId=19837>

“I imagine a fair number of drivers think the guy at the corner gas station is raking it in, with the price at the pump getting near – or beyond – \$4.00 a gallon. But it ain’t so. The *Oil Express* newsletter...which is aimed at fuel retailers, notes that the percentage of the sale price kept by gas station operators is down, not up:

When petroleum distributors and retailers talk about profit crunches, they often recollect 2002 as the worst of times, at least for the last fifteen years. But 2008 has brought the worst circumstances in a generation...At press time, year-to-date gross rack-to-retail margins for unleaded regular just slipped below 4% of the total sales price.... Taking into consideration higher overhead costs, and a larger percentage of gross margin eaten up by credit card fees, the first 105 days of 2008 appear to have no misery equal.

“So it’s not the guy actually taking your money who’s getting filthy rich.” <http://www.oilwatchdog.org/articles/?storyId=19837>

Figure 41.
Total "hot fuel" profits by state (Kansas City Star methodology).

TOTAL CONSUMER LOSSES AND GAINS IN 2006 DUE TO "HOT FUEL"							
(STATES AS RANKED BY THE KANSAS CITY STAR)							
STATE	AVERAGE FUEL TEMP (F.)	EFFECT ON RETAIL GAS CONSUMPTION IN MILLIONS OF GALLONS	2006 CONSUMERS' GAIN OR LOSS IN MILLIONS OF DOLLARS	STATE	AVERAGE FUEL TEMP (F.)	EFFECT ON RETAIL GAS CONSUMPTION IN MILLIONS OF GALLONS	2006 CONSUMERS' GAIN OR LOSS IN MILLIONS OF DOLLARS
California	75	158	-\$509	Rhode Island	59.8	-0.1	\$0.1
Texas	78	143	-\$416	West Virginia	59.6	-0.2	\$0.6
Florida	82	122	-\$367	Indiana	59.9	-0.3	\$0.9
Georgia	72	41	-\$123	Wyoming	55	-1.0	\$3
Arizona	82	39	-\$115	Washington	59.5	-1.0	\$3
Louisiana	77	28	-\$81	Montana	57	-0.9	\$3
North Carolina	69	25	-\$74	New Hampshire	58	-1.0	\$4
Alabama	72	22	-\$63	Vermont	54	-1.4	\$4
South Carolina	73	22	-\$61	South Dakota	54	-1.2	\$4
Tennessee	70	21	-\$60	North Dakota	53	-1.9	\$6
Virginia	66	16	-\$46	Alaska	47	-2.0	\$7
Mississippi	74	16	-\$46	Massachusetts	59	-2.0	\$7
Arkansas	71	11	-\$32	Maine	55	-2.5	\$7
Nevada	75	10	-\$31	Connecticut	59	-3.0	\$8
Oklahoma	69	11	-\$31	Nebraska	54	-3.0	\$10
New Jersey	63	8	-\$22	Iowa	57	-4.0	\$11
Maryland	64	7	-\$22	Ohio	59	-4.0	\$12
New Mexico	69	6	-\$17	Illinois	57	-9.0	\$29
Missouri	62	5	-\$15	Wisconsin	55	-9.3	\$29
Kentucky	63	5	-\$14	Michigan	57	-10.0	\$29
Kansas	65	4	-\$12	Minnesota	53	-13.0	\$37
Oregon	63	3.5	-\$10				
New York	61	3.0	-\$9				
Utah	63	3.0	-\$7				
Colorado	62	2.0	-\$7				
Hawaii *	86	2.0	-\$6				
Delaware	64	1.0	-\$3				
Pennsylvania	60.3	1.0	-\$3				
Washington, DC	66	0.7	-\$2				
Idaho	60.5	0.2	-\$0.6				
				Summary:			
				Consumer Gains in "Cold States" (\$ millions)			\$214
				Consumer Losses in "Hot States" (\$ millions)			-\$2,205
				Consumer Net Losses (\$ millions)			-\$1,991

Figure 41 reproduces the data in the chart published by the *Kansas City Star* that “documented” its claims regarding the amount of the supposed “hot fuel rip-off”.¹⁰⁴ For each state, **Figure 41** shows:

- The (estimated) average annual fuel temperature,
- The supposed aggregate annual effect of temperature expansion (or contraction) on the gasoline sales made by retail stores (measured in millions of gallons), and
- The total consumer loss (or gain) in millions of dollars supposedly resulting from that temperature expansion.

The data in **Figure 41** have been augmented (from the original chart published by the *Kansas City Star*) to include estimates for North Dakota¹⁰⁵ and South Dakota,¹⁰⁶ and to summarize the supposed aggregate “gains” and “losses” by U.S. consumers due to “hot fuel”. As shown by the summary in **Figure 41**, U.S. motor fuel retailers supposedly extracted \$1.991 billion from consumers in *net* “hot fuel” profits.¹⁰⁷ When this figure is divided by 167,500 (the *NPN Station Count* for 2006), the implication is that the average U.S. dealer enjoyed nearly \$12,000¹⁰⁸ in net “hot fuel” profits in 2006.

Viewed from the perspective of the country as a whole, these implied “hot fuel” profits per store are implausibly large in comparison with the actual average profitability of retail stores in the U.S. According to the *CEC Staff Report*, the *total annual pre-tax* profits of U.S. convenience stores – generated by *all* sales, not just of gasoline and diesel fuel – during the period from 1998 through 2007, averaged less than \$33,000.¹⁰⁹ This means that – if one accepts the logic of the *Kansas City Star* and the “hot fuel” activists – in 2006 the average dealer’s hidden “hot fuel” profit was more than one-third as large as his total reported pre-tax profit. It is

¹⁰⁴ *Kansas City Star*, “The Colder The Better – For The Consumer” (chart), August 27, 2006, p. A8.

¹⁰⁵ Assumed to have the same average fuel temperature as Minnesota. The calculated effect of “hot fuel” on retail gasoline consumption in North Dakota is based on total gasoline sales data for North Dakota published by the Energy Information Administration.

¹⁰⁶ Assumed to have the same average fuel temperature as Iowa. The calculated effect of “hot fuel” on retail gasoline consumption in South Dakota is based on total gasoline sales data for South Dakota from the Energy Information Administration.

¹⁰⁷ This is obtained by subtracting \$214 million in “consumer gains” in the “cold” states from the total of \$2.205 billion in supposed “consumer losses” in the “hot states” resulting from “hot fuel”.

¹⁰⁸ The exact result is \$11,887.

¹⁰⁹ *CEC Staff Report* at p. 83.

hard to imagine how this could go unnoticed by industry analysts and especially by tax authorities.

Figure 42.
"Hot fuel" profits per retailer by state (Kansas City Star methodology)

STATE	2006 CONSUMERS' GAIN OR LOSS IN MILLIONS OF DOLLARS	2006 AVERAGE RETAILER GAIN OR LOSS PER STORE	STATE	2006 CONSUMERS' GAIN OR LOSS IN MILLIONS OF DOLLARS	2006 NPN STATION COUNT	2006 AVERAGE RETAILER GAIN OR LOSS PER STORE
California	-\$509	\$51,638	Rhode Island	\$0.1	375	-\$267
Texas	-\$416	\$25,212	West Virginia	\$0.6	1,300	-\$462
Florida	-\$367	\$39,818	Indiana	\$0.9	1,684	-\$534
Georgia	-\$123	\$16,005	Wyoming	\$3	598	-\$5,017
Arizona	-\$115	\$52,511	Washington	\$3	3,228	-\$929
Louisiana	-\$81	\$19,843	Montana	\$3	900	-\$3,333
North Carolina	-\$74	\$10,493	New Hampshire	\$4	800	-\$5,000
Alabama	-\$63	\$11,455	Vermont	\$4	621	-\$6,441
South Carolina	-\$61	\$15,545	South Dakota	\$4	1,073	-\$3,728
Tennessee	-\$60	\$12,731	North Dakota	\$6	930	-\$6,452
Virginia	-\$46	\$9,892	Alaska	\$7	460	-\$15,217
Mississippi	-\$46	\$12,925	Massachusetts	\$7	2,700	-\$2,593
Arkansas	-\$32	\$9,697	Maine	\$7	1,436	-\$4,875
Nevada	-\$31	\$28,336	Connecticut	\$8	1,475	-\$5,424
Oklahoma	-\$31	\$8,857	Nebraska	\$10	1,542	-\$6,485
New Jersey	-\$22	\$6,665	Iowa	\$11	2,658	-\$4,138
Maryland	-\$22	\$9,378	Ohio	\$12	4,935	-\$2,432
New Mexico	-\$17	\$11,502	Illinois	\$29	5,100	-\$5,686
Missouri	-\$15	\$3,479	Wisconsin	\$29	4,126	-\$7,029
Kentucky	-\$14	\$3,992	Michigan	\$29	5,076	-\$5,713
Kansas	-\$12	\$4,800	Minnesota	\$37	3,656	-\$10,120
Oregon	-\$10	\$5,800				
New York	-\$9	\$1,277				
Utah	-\$7	\$6,341				
Colorado	-\$7	\$3,043				
Hawaii *	-\$6	\$18,293				
Delaware	-\$3	\$7,813				
Pennsylvania	-\$3	\$641				
Washington, DC	-\$2	\$16,529				
Idaho	-\$0.6	\$708				

Figure 42 takes the results in **Figure 41** one step farther by incorporating the *NPN Station Counts* for individual states and then calculating the “gain” or “loss” supposedly realized by the average retailer in each state due to “hot fuel”. According to the results reported in **Figure 42**, the average retailer in California and Arizona supposedly pocketed about \$51,500 and \$52,500, respectively, in “hot fuel” profits in 2006. Dealers in Florida supposedly received an average of about \$40,000 each, while Texas retailers averaged \$25,000 in annual “hot fuel”

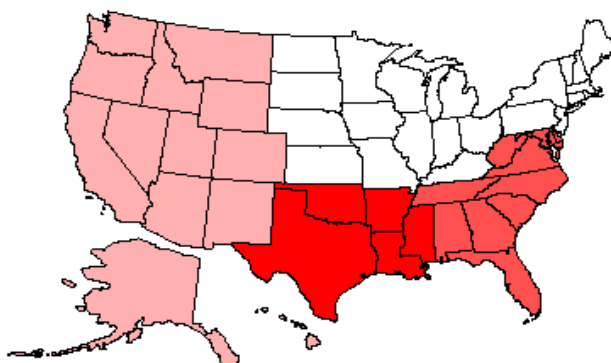
profits.¹¹⁰ These figures either significantly exceed – or are at least equivalent to – the average *total pre-tax profits* per convenience store noted in the *CEC Staff Report*. It strains credulity to think that no one – not the U.S. Commerce Department, the Internal Revenue Service or the retailers themselves – appears to have noticed these phenomenal results. At the same time, retailers in several states were significant “losers” as the result of the supposed tacit collusion among U.S. retailers to hide their “hot fuel” gains *and losses*. As shown in **Figure 42**, the average dealer in Minnesota suffered annual *losses* exceeding \$10,000, while the typical Alaska retailer lost over \$15,000 in 2006. It is difficult to understand how these retailers would have willingly accepted such losses – amounting to nearly one-third and one-half, respectively – of the typical convenience store’s *total pre-tax profit* – so that their brethren in warmer states could pocket their “hot fuel” profits.

The predicted geographic pattern of the “hot fuel rip-off” profits.

But an even more powerful test of the “hot fuel rip-off” allegations can be constructed - based on the calculations in **Figure 42** - by comparing the geographic differences in the average “hot fuel” profits per retail store to independent data on the actual profitability of retail gasoline stores by U.S. region. Such data are available from RMA (Risk Management Association) for the six regions of the U.S. shown in **Figure 43**. If these independent data do not reflect the regional differentials in per-station profitability that are predicted by the “hot fuel” allegations, this would raise particularly serious questions about the credibility of those allegations. On the other hand, if the state-by-state profitability patterns turn out to be consistent with the RMA data on retail store profitability by region of the U.S., this would tend to confirm the “hot fuel” allegations.

¹¹⁰ It is important to keep in mind that the per-store average gain and loss figures in **Figure 42** were constructed by *assuming* the truth of the “hot fuel” allegations; in no way do these figures *prove* that the “hot fuel rip-off” is a fact.

Figure 43.
Regions of the U.S. for which retailer profitability data are available.



<i>RMA Region</i>	<i>Avg Temp</i>	<i>States Included</i>
South Central	76	AR LA MS OK TX
Southeast	72	AL DC DE FL GA MD NC SC TN VA WV
West	64	AK AZ CA CO HI ID MT NM NV OR UT WA WY
Northeast	60	CT MA ME NH NJ NY PA RI VT
Central	59	IL IN KY MI OH
North Central	57	IA KS MN MO ND NE SD WI

Since independent data on the profitability of retail gasoline stores are available for the six regions of the U.S. shown in **Figure 43**, one can aggregate the *Kansas City Star* estimates of state-by-state average retail gains (or losses) per store from **Figure 42** into these same six regions, with the results that are depicted in **Figure 44**.

Figure 44.
Implied average retailer "hot fuel" profits by U.S. region.

	AVERAGE FUEL TEMPERATURE (DEGREES F.)	EFFECT ON RETAIL GAS CONSUMPTION IN MILLIONS OF GALLONS	2006 CONSUMERS' GAIN OR LOSS IN MILLIONS OF DOLLARS	2006 NPN STATION COUNT	2006 AVERAGE RETAILER GAIN OR LOSS PER STORE
West	64	181.8	-\$579	23,458	\$24,665
South Central	76	209	-\$606	30,941	\$19,586
Southeast	72	277.5	-\$820	46,892	\$17,496
Northeast	60	2.05	-\$4	22,436	\$174
Central	59	-18.3	\$57	20,302	-\$2,803
North Central	67	-23.4	\$70	20,797	-\$3,366

The variation among U.S. regions shown in **Figure 44** is particularly striking. If one accepts the truth of the “hot fuel” allegations and the calculations offered by the *Kansas City Star*, the unavoidable result is that the average retailer in the relatively-warmer *West*, *South Central* and *Southeast* regions of the U.S. should be *significantly* more profitable – by amounts ranging from \$17,000¹¹¹ to \$28,000¹¹² per year – than his counterparts in the three “cooler” regions (*North Central*, *Central* and *Northeast*). The question, then, is whether these *predicted* regional differences are consistent with the independent measures of gasoline station profitability in these same regions available from RMA.

Figure 45 facilitates this comparison by combining the average retailer gain or loss per store due to “hot fuel” (from **Figure 44**) to the profit rates reported by RMA for retailers in the same six regions. **Figure 45** compels the conclusion that there is something seriously amiss with the “hidden profits” implied by the “hot fuel” allegations.¹¹³ Measured by their profit before taxes (as a percent of sales) and by their median profit before taxes (as a percent of assets), the retail stores in the “hot” parts of the U.S. actually are no more profitable than their counterparts in the “cold” regions. These independent data cannot be reconciled with the implications of the “hot fuel” allegations.

¹¹¹ Gotten by comparing the average retailer gain or loss per store in the *Southeast* to that in the *Northeast*.

¹¹² The result of comparing the average retailer gain per store in the *West* to the average loss per store in the *North Central* region.

¹¹³ It should be added that only the transactions between retailers and consumers are at issue in the CEC study and in the “hot fuel” allegations, not the “upstream” sales from refiners to retail stations. In the U.S., there are approximately 168,000 retail stores (or stations) that are owned by over 50,000 separate companies and individuals. Only a distinct minority – well below 10 percent – of retail stations remain under the ownership and operation of so-called “Big Oil”. Moreover, that percentage continues to decline, as the “majors” (i.e., the integrated refiner-marketers) continue to shed their “company-owned” stores, apparently due to the comparatively unattractive profit levels available at the retail level.

But it is important to dispose of one possible rejoinder to the showing that the actual geographic pattern of retail store profitability does not match the pattern implied by the predicted state-by-state distribution of “hot fuel” overcharges. It might be argued that the failure to find these “hot fuel” overcharge profits at the retail level could be due to the fact that these profits have been captured by the integrated refiner-marketers through the manipulation of their dealer tankwagon pricing to squeeze retailers’ gross margins in warmer states.

However, a statistical test of the hypothesis that there is a systematic inverse relationship between each state’s average fuel temperature and its corresponding average retail margin (measured as the difference between average DTW prices and average retail prices) showed that there was no such relationship at all, much less one that was statistically significant.

Figure 45.
Implied average "hot fuel" profits vs. independent RMA data.

	2006 AVERAGE RETAILER GAIN OR LOSS PER STORE DUE TO "HOT FUEL" <i>(Kansas City Star)</i>	1998-2007 PROFIT BEFORE TAXES AS PERCENT OF SALES <i>(RMA)</i>	1998-2007 MEDIAN PROFIT BEFORE TAXES AS PERCENT OF ASSETS <i>(RMA)</i>
West	\$24,665	1.1%	4.1%
South Central	\$19,586	1.2%	4.8%
Southeast	\$17,496	1.3%	3.7%
Northeast	\$174	1.1%	5.0%
Central	-\$2,803	0.7%	4.0%
North Central	-\$3,366	1.0%	3.3%

So the question posed at the beginning of this section remains: What happened to the “hot fuel” profits? The only reasonable answer is that those “profits” never existed in the first place.

Concluding remarks

The “hot fuel” controversy and the *CEC Staff Report* should be seen as misguided attempts to lower the retail price of gasoline and diesel fuel by extracting revenue from dealers, without regard to the fact that – because of the highly competitive business environment within which they operate – these dealers’ margins already are razor thin, and in ignorance of the fact that the measures they urge would have no effect on consumers’ outlays for motor fuel.

Put differently, the *CEC Staff Report* evaluates possible solutions to a problem that never existed in the first place. The “hot fuel” controversy has been generated by activists’ claims that amount to nothing more than conjectures based on the thin foundation that motor fuel expands as its temperature increases. This has been combined with the erroneous assumption that all transactions involving motor fuel that are “upstream” from the consumer are conducted on a temperature-compensated basis.

In short, the “hot fuel allegations” are a myth, one that is readily apparent to anyone who seriously tries to investigate and test its implications. Retailers as a whole earn no more than normal competitive returns. There simply are no “hot fuel” profits to be recaptured and given to consumers via automatic temperature compensation. Given the structure and price and profit performance of the retail motor fuel industry, the “hot fuel” allegations are nonsensical as a matter of economics.

While the *CEC Staff Report* grudgingly comes to the correct conclusion that, overall, the net benefit of the proposed *ATC Retrofit* would be negative, it makes the question sound closer than it actually is.¹¹⁴ Because there would be *no* benefits whatever from the proposed *ATC Retrofit* – motorists would *not* enjoy “more fuel”, nor would they realize the supposed “increased price transparency benefits” – and because the *CEC Staff Report* has significantly underestimated its total cost, the economic case against the *ATC Retrofit* actually should be seen as overwhelming.¹¹⁵

This is not to say that adjusting retail prices for temperature-induced volume expansion is inappropriate. The point is that retail competition and repeated purchases by consumers *already* accomplish what the *ATC Retrofit* proposes to do. The difference is that relying on retail competition and the effect of repeated purchases has already been shown to work efficiently at no incremental cost. The *ATC Retrofit*, on the other hand, would impose significant incremental costs while providing no incremental benefits. Indeed, following implementation of the proposed *ATC Retrofit*, the only real beneficiaries would be the vendors of the needed equipment and services.

Despite the costs and confusion that likely would attend its introduction, the new reference temperature option also would accomplish nothing. This is because retail competition would quickly result in new, higher prices per “gallon” that keep constant consumers’ outlays for a given quantum of fuel, no matter whether actual fuel temperatures were close to that new reference temperature or differed substantially from it.

The conclusions that retail competition already adjusts pump prices for temperature variation and that any attempt to enlarge the unit by which retail fuel sales are measured will necessarily result in higher pump prices per unit are not original contributions of this paper. As evidenced by the quotations at its beginning, these conclusions have been offered and accessible at least as far back as Hawaii’s misguided initiative nearly forty years ago and as recently as the public workshops that preceded the *CEC Staff Report*.

¹¹⁴ *CEC Staff Report* at p. 3.

¹¹⁵ This point is important because some stakeholders suggest – notwithstanding the negative net benefits estimated by the CEC staff – that automatic temperature compensation nevertheless *should* be required in California, given the *CEC Staff Report’s* finding that the *ATC Retrofit* would impose increased costs of less than one cent per gallon. See letter to the California Energy Commission from Robert G. Harris, County of San Diego, December 19, 2008.

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Chapter 1. General Information

1.1. Scope

Routine verification of the net contents of packages is an important part of any weights and measures program to facilitate value comparison and fair competition. Consumers have the right to expect packages to bear accurate net content information. Those manufacturers whose products are sold in such packages have the right to expect that their competitors will be required to adhere to the same **laws and regulations, standards.**

The procedures in this handbook are recommended for use to verify the net quantity of contents of packages kept, offered, or exposed for sale, or sold by weight, measure (including volume, and dimensions), or count at any location (e.g., at the point-of-pack, in storage warehouses, retail stores, and wholesale outlets).

When and where to use package checking procedures?

An effective program will typically include testing at each of the following levels.

Point-of-pack

Testing packages at the “point-of-pack” has an immediate impact on the packaging process. Usually, a large number of packages of a single product are available for testing at one place. This allows the inspector to verify that the packer is following current good packaging practices. Inspection at the point-of-pack also provides the opportunity to educate the packer about the legal requirements that products must meet and may permit resolution of any net content issues or other problems that arise during the testing. Point-of-pack testing is not always possible because packing locations can be in other states or countries. Work with other state, county, and city jurisdictions to encourage point-of-pack inspection on products manufactured in their geographic jurisdictions. Point-of-pack inspections cannot entirely replace testing at wholesale or retail outlets, because point-of-pack inspections do not include imported products or the possible effects of product distribution and moisture loss. Point-of-pack inspections only examine the manufacturing process. Therefore, an effective testing program will also include testing at wholesale and retail outlets.

Wholesale

Testing packages at a distribution warehouse is an alternative to testing at the point-of-pack with respect to being able to test large quantities of and a variety of products. Wholesale testing is a very good way to monitor products imported from other countries and to follow up on products suspected of being underfilled based on consumer complaints or findings made during other inspections, including those done at retail outlets.

Retail

Testing packages at retail outlets evaluates the soundness of the manufacturing, distributing, and retailing processes of the widest variety of goods at a single location. It is an easily accessible, practical means for state, county and city jurisdictions to monitor packaging procedures and to detect present or potential problems. Generally, retail package testing is not conducive to checking large quantities of individual products of any single production lot. Therefore, follow-up inspections of a particular brand or lot code

number at a number of retail and wholesale outlets, and ultimately at the point-of-pack are extremely important aspects in any package-checking scheme. After the evaluation of an inspection lot is completed, the jurisdiction should consider what, if any, further investigation or follow-up is warranted. At the point-of-sale, a large number of processes may affect the quality or quantity of the product. Therefore, there may be many reasons for any inspection lot being out of compliance. A shortage in weight or measure may result from mishandling the product in the store, or the retailer's failure to rotate stock. Shortages may also be caused through mishandling by a distributor, or failure of some part of the packaging process. Shortages may also be caused by moisture loss (desiccation) if the product is packaged in permeable media. Therefore, being able to determine the cause of an error in order to correct defects is more difficult when retail testing is used.

(Amended 2002)

What products can be tested?

Any commodity sold by weight, measure, or count may be tested. The product to be tested may be chosen in several ways. The decision may be based on different factors, such as (1) marketplace surveys (e.g., jurisdiction-wide surveys of all soft drinks or breads), (2) surveys based on sales volume, or (3) audit testing (see Section 1.3. "Sampling Plans") to cover as large a product variety as possible at food, farm, drug, hardware stores, or specialty outlets, discount and department stores. Follow-up of possible problems detected in audit testing or in review of past performance tends to concentrate inspection resources on particular commodity types, brand names, retail or wholesale locations, or even particular neighborhoods. The expected benefits for the public must be balanced against the cost of testing. Expensive products should be tested because of their cost per unit. However, inexpensive items should also be tested because the overall cost to individual purchasers may be considerable over an extended period. Store packaged items, which are usually perishable and not subject to other official monitoring, should be routinely tested because they are offered for sale where they are packed. Products on sale and special products produced for local consumption should not be overlooked because these items sell quickly in large amounts.

Regardless of where the test occurs, remember that it is the inspector's presence in the marketplace through routine unannounced testing that ensures equity and fair competition in the manufacturing and distribution process. Finally, always follow up on testing to ensure that the problems are corrected; otherwise, the initial testing may be ineffective.

1.2. Package Requirements

The net quantity of content statement must be "accurate," but reasonable variations are permitted. Variations in package contents may be a result of deviations in filling. The limits for acceptable variation are based on current good manufacturing practices in the weighing, measuring, and packaging process. The first requirement is that accuracy is applied to the average net contents of the packages in the lot. The second requirement is applied to negative errors in individual packages. These requirements apply simultaneously to the inspection of all lots of packages except as specified in "Exceptions to the Average and Individual Package Requirements" in this section.

Inspection Lot

An "inspection lot" (called a "lot" in this handbook) is defined as a collection of identically labeled (except for quantity or identity in the case of random packages) packages available for inspection at one time. The collection of packages will pass or fail as a whole based on the results of tests on a sample drawn from ~~this collection~~ the lot. This handbook describes procedures to determine if the packages in an

“inspection lot” contain the declared net quantity of contents and if the individual packages variations are within acceptable limits.

Average Requirement

In general, the average net quantity of contents of packages in a lot must at least equal the net quantity of contents declared on the label. Plus or minus variations from the declared net weight, measure, or count are permitted when they are caused by unavoidable variations in weighing, measuring, or counting the contents of individual packages that occur in current good manufacturing practice. Such variations must not be permitted to the extent that the average of the quantities in the packages of a particular commodity or a lot of the commodity that is kept, offered, exposed for sale, or sold, is below the stated quantity. (See Section 3.7. “Pressed and Blown Glass Tumblers and Stemware” and Section 4.3. “Packages Labeled by Count of 50 Items or fewer” for exceptions to this requirement.)

Individual Package Requirement

The variation of individual package contents from the labeled quantity must not be “unreasonably large.” In this handbook, packages that are underfilled by more than the Maximum Allowable Variation specified for the package are considered unreasonable errors. Unreasonable shortages are not generally permitted, even when overages in other packages in the same lot, shipment or delivery compensate for such shortage. This handbook does not specify limits of overfilling, which is usually controlled by the packer **for economic and other reasons.**

Maximum Allowable Variation

The limit of **the “reasonable minus variation”** for an individual package is called a “Maximum Allowable Variation” (MAV). An MAV is a deviation from the labeled weight, measure, or count of an individual package beyond which the deficiency is considered **an unreasonable error.** Each sampling plan limits the number of negative package errors permitted to be greater than the MAV.

Deviations Caused by Moisture Loss or Gain

Deviations from the net quantity of contents caused by the loss or gain of moisture from the package are permitted when they are caused by ordinary and customary exposure to conditions that normally occur in good distribution practice and that unavoidably result in change of weight or measure. According to regulations adopted by the U.S. Environmental Protection Agency, no moisture loss is recognized on pesticides. (See Code of Federal Regulations 40 CFR Part 156.10.)

Why do we allow for moisture loss or gain?

Some packaged products may lose or gain moisture and, therefore, lose or gain weight or volume after packaging. The amount of ~~lost~~ moisture **loss** depends upon the nature of the product, the packaging material, the length of time it is in distribution, environmental conditions, and other factors. Moisture loss may occur even when manufacturers follow good distribution practices. Loss of weight “due to exposure” may include solvent evaporation, not just loss of water. For loss or gain of moisture, ~~apply~~ the moisture allowances **may be applied before or after the package errors are determined.**

To apply an allowance before determining package errors, adjust the Nominal Gross Weight (see Section 2.3. “Basic Test Procedure”) – Determine Nominal Gross Weight and Package Errors for Tare Sample, so the package errors are increased by an amount equal to the moisture allowance.

This approach is used to account for moisture loss in both the average and individual package errors.

It is also permissible to apply the moisture allowances after individual package errors and average errors are determined. For example, a sample of a product that could be subject to moisture loss might fail because the average error is minus or the error in several of the sample packages are found to be unreasonable errors (i.e., the package error is greater than the Maximum Allowable Variation permitted for the package's labeled quantity). ~~to both the maximum allowable variations permitted for individual packages and the average net quantity of contents before determining the conformance of a lot~~ You can apply an allowance after determining the errors by adding an amount equal to the moisture allowance so the adjusted average error and individual package errors provide for loss of moisture from the sample packages.

This handbook provides “moisture allowances” for some meat and poultry products, flour, and dry pet food. (See Chapter 2, Table 2.3. “Moisture Allowances”) These allowances are based on the premise that when the average net weight of a sample is found to be less than the labeled weight, but not by an amount that exceeds the allowable limit, either the lot is declared to be within the moisture allowance or more information must be collected before deciding lot compliance or noncompliance.

Test procedures for flour, some meat, and poultry are based on the concept of a “moisture allowance” also known as a “gray area” or “no decision” area. (See Section 2.3, “Basic Test Procedure– Calculations.”) When the average net weight of a sample is found to be less than the labeled weight, but not more than the boundary of the “gray area,” the lot is said to be in the “gray” or “no decision area.” The gray area is not a tolerance. More information must be collected before lot compliance or noncompliance can be decided. Appropriate enforcement should be taken on packages found short weight and outside of the “moisture allowance” or “gray area.”

(Amended 2002)

Exceptions to the Average and Individual Package Requirements

There is an exemption from the average requirement for packages labeled by count of 50 or fewer items. The reason for this exemption is that the package count does not follow a “normal” distribution even if the package is designed to hold the maximum count indicated by the label declaration (e.g., egg cartons and packages of chewing gum). Another exception permits an “allowable difference” in the capacity of glass tumblers and stemware because mold capacity doesn’t follow a normal distribution.

1.3. Sampling Plans

This handbook contains two sampling plans to use to inspect packages: “Category A” and “Category B.” Use the “Category B” Sampling Plans to test meat and poultry products at point-of-pack locations that are subject to U.S. Department of Agriculture Food Safety and Inspection Service (FSIS) requirements. When testing all other packages, use the “Category A” Sampling Plan.

Why is sampling used to test packages?

Inspections by weights and measures officials must provide the public with the greatest benefit at the lowest possible cost. Sampling reduces the time to inspect a lot of packages, so a greater number of items can be inspected. Net content inspection, using sampling plans for marketplace surveillance, protects consumers who cannot verify the net quantity of contents. This ensures fair trade practices and maintains

a competitive marketplace. It also encourages manufacturers, distributors, and retailers to follow good manufacturing and distribution practices.

Why is the test acceptance criteria statistically corrected, and what are the confidence levels of the sampling plans?

Testing a “sample” of packages from a lot instead of every package is efficient, but the test results have a “sampling variability” that must be corrected before determining if the lot passes or fails. The “Category A” sampling plans give acceptable lots a 97 % or better probability of passing. An “acceptable” lot is defined as one in which the “average” net quantity of contents of the packages equals or exceeds the labeled quantity. The “Category B” sampling plans give acceptable lots at least a 50 % probability of passing. The sampling plans used in this handbook are statistically valid. That means the test acceptance criteria are statistically adjusted, so they are both valid and legally defensible. This handbook does not discuss the statistical basis, risk factors, or provide the operating characteristic curves for the sampling plans. For information on these subjects, see explanations on “acceptance sampling” in statistical reference books.

Why random samples?

A randomly selected sample is necessary to ensure statistical validity and reliable data. This is accomplished by using random numbers to determine which packages are chosen for inspection. Improper collection of sample packages can lead to bias and unreliable results.

May audit tests and other shortcuts be used to identify potentially violative lots?

Shortcuts may be used to speed the process of detecting possible net content violations. These audit procedures may include the following: using smaller sample sizes, spot checks using tare lists provided by manufacturers, selecting samples without collecting a random sample. These and other shortcuts allow spot checking of more products than is possible with the more structured techniques, but do not take the place of “Category A” or “Category B” testing.

Can audit tests and other shortcuts be used to take enforcement action?

No. Do not take enforcement action using audit test results.

If, after an audit test, there is suspicion that a lot of packages is not in compliance, use the appropriate “Category A” or “Category B” sampling plan to determine if the lot complies with the package requirements.

1.4. Other Regulatory Agencies Responsible for Package Regulations and Applicable Requirements

In the United States, several federal agencies issue regulations regarding package labeling and net contents. The U.S. Department of Agriculture regulates meat and poultry. The Food and Drug Administration (FDA) regulates food, drugs, cosmetic products, and medical devices under the Food, Drug, and Cosmetic Act (FDCA) and the Fair Packaging and Labeling Act (FPLA). The Federal Trade Commission (FTC) regulates most non-food consumer packaged products as part of the agency’s responsibility under the FPLA. The Environmental Protection Agency (EPA) regulates pesticides. The Bureau of Alcohol, Tobacco, and Firearms (ATF) in the U.S. Department of the Treasury promulgates regulations for packaged tobacco and alcoholic beverages as part of its responsibility under the Federal Alcohol Administration Act.

Packaged goods produced for distribution and sale also come under the jurisdiction of state and local weights and measures agencies that adopt their own legal requirements for packaged goods. Federal statutes set requirements that pre-empt state and local regulations that are or may be less stringent or not identical to federal regulation depending on the federal law that authorizes the federal regulation. The application of Handbook 133 procedures occurs in the context of the concurrent jurisdiction among federal, state, and local authorities. Therefore, all agencies using this handbook should keep abreast of the revisions to federal agency regulations that may contain sampling or testing information not in the regulations at the time of publication of this handbook. See Appendix A, Table 1-1. “Agencies Responsible for Package Regulations and Applicable Requirements” for information on the responsible agencies for package regulations and the requirements of this handbook that must be used when testing products concurrently subject to pre-emptive federal regulations.

1.5. Assistance in Testing Operations

If the storage, display, or location of any lot of packages requires special equipment or an abnormal amount of labor for inspection, the owner or the operator of the business must supply the equipment and/or labor as required by the weights and measures official.

1.6. Health and Safety

This handbook cannot address all of the health and safety issues associated with its use. The inspector is responsible for determining the appropriate safety and health practices and procedures before starting an inspection (e.g., contact the establishment’s health and safety official). Comply with all handling, health, and safety warnings on package labels and those contained in any associated material safety data sheets. The inspector must also comply with federal, state, or local health and safety laws or other appropriate requirements in effect at the time and location of the inspection. Contact your supervisor to obtain information regarding your agencies safety and health policies and to obtain appropriate safety equipment.

1.7. Good Measurement Practices

The procedures in this handbook are designed to be technically sound and represent good measurement practices. To assist in documenting tests, we have included “model” inspection report forms designed to record the information.

Traceability Requirements for Measurement Standards and Test Equipment

Each test procedure presented in this handbook includes a list of the equipment needed to perform the inspection. The scales and other measurement standards used (e.g., balances, mass standards, volumetric, and linear measures) to conduct any test must be traceable to the National Institute of Standards and Technology (NIST). Standards must be used in the manner in which they were designed and calibrated for use.

Certification Requirements for Standards and Test Equipment

All measurement standards and test equipment identified in this handbook or associated with the test procedures must be calibrated or standardized before initial use. This must be done according to the **calibration procedures and other instructions found on NIST’s Laboratory Metrology and Calibration Procedures website at <http://ts.nist.gov/WeightsAndMeasures/CalibrationProcedures.cfm> in NIST Handbook 145, “Handbook for the Quality Assurance of Metrological Measurements,” or using** other recognized procedures (e.g., those adopted for use by a state weights and

measures laboratory). After initial certification, the standards must be routinely recertified according to your agency's measurement assurance policies.

Chapter 2. Basic Test Procedure – Gravimetric Testing

2.1. Gravimetric Test Procedure for Checking the Net Contents of Packaged Goods

The gravimetric test method uses weight measurement to determine the net quantity of contents of packaged goods. This handbook includes general test methods to determine the net quantity of contents of packages labeled in terms of weight and special test methods for packages labeled in terms of fluid measure or count. Gravimetric testing is the preferred method of testing most products because it reduces destructive testing while maximizing inspection resources.

2.2. Measurement Standards and Test Equipment

What type of scale is required to perform the gravimetric test method?

Use a scale (for this handbook the term scale includes balances) that has at least 100 scale divisions. It must have a load-receiving element of sufficient size and capacity to hold the packages during weighing. It also requires a scale division no larger than $\frac{1}{6}$ of the Maximum Allowable Variation (MAV) for the package size being weighed. The MAV/6 requirement is crucial to ensure that the scale has adequate resolution to determine the net contents of the packages. Subsequent references to product test criteria agreeing within one scale division are based on scale divisions that are equal to or only slightly smaller than the MAV/6.

Example: The MAV for packages labeled 113 g (0.25 lb) is 7.2 g (0.016 lb)
(See Appendix A, Table 2.5. “Maximum Allowable Variations (MAVs) for Packages Labeled by Weight.”)

MAV/6 is 1.2 g (0.002 lb). In this example, a 1 g (0.002 lb) scale division would be the largest unit of measure appropriate for weighing these packages.

How often should I verify the accuracy of a scale?

Verify the accuracy of a scale before each initial daily use, each use at a new location, or when there is any indication of abnormal equipment performance (e.g., erratic indications). Recheck the scale accuracy if it is found that the lot does not pass, so there can be confidence that the test equipment is not at fault.

Which accuracy requirements apply?

Scales used to check packages must meet the acceptance tolerances specified for their accuracy class in the current edition of NIST Handbook 44 (HB 44) “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices.” The tolerances for Class II and Class III digital scales are presented in HB 44, Section 2.20. “Scales.”

Note: If the package checking scale is not marked with a “class” designation, use Table 2-1. “Class of Scale” to determine the applicable tolerance.

What considerations affect measurement accuracy?

Always use good weighing and measuring practices. For example, be sure to use weighing and measuring equipment according to the manufacturer’s instructions and make sure the environment is

suitable. Place scales and other measuring equipment (e.g., flasks and volumetric measures) on a rigid support and maintain them in a level condition if being level is a requirement to ensure accuracy.

In testing, which tolerances apply to the scale?

Do not use a scale if it has an error that exceeds the specified tolerance in any of the performance tests described in the following section.

1. Determine the total number of divisions (i.e., the minimum increment or graduation indicated by the scale) of the scale by dividing the scale’s capacity by the minimum division.

Example: A scale with a capacity of 5000 g and a minimum division of 0.1 g has 50 000 divisions.

2. From Table 2-1. “Class of Scale”, determine the class of the scale using the minimum scale division and the total number of scale divisions.

Example: On a scale with a minimum division of 0.1 g and 50 000 total scale divisions the appropriate class of scale is "II."

Note: If a scale is used where the number of scale divisions is between 5001 and 10 000 and the division size is 0.1 g or greater and is not marked with an accuracy Class II marking, Class III scale tolerances apply.

Table 2-1. Class of Scale		
Value of Scale Division¹	Minimum and Total Number of Divisions	Class of Scale
1 mg to 0.05 g	At least 100, but not more than 100 000	II
0.1 g or more	More than 5000, but not more than 100 000	II
0.1 g to 2 g 0.000 2 lb to 0.005 lb 0.005 oz to 0.125 oz	More than 100, but not more than 10 000	III
5 g or more 0.01 lb or more 0.25 oz or more	More than 500, but not more than 10 000	III

¹On some scales, manufacturers designated and marked the scale with a verification division (e) for testing purposes (e = 1 g and d = 0.1 g). For scales marked Class II, the verification division is larger than the minimum displayed division. The minimum displayed division must be differentiated from the verification scale division by an auxiliary reading means such as a vernier, rider, or at least significant digit that is differentiated by size, shape, or color. Where the verification division is less than or equal to the minimum division, use the verification division instead of the minimum division. Where scales are made for use with mass standards (e.g., an equal arm balance without graduations on the indicator) the smallest mass standard used for the measurement is the minimum division.

3. Determine the tolerance from Table 2-2. “Acceptance Tolerances for Class of Scale based on Test Load in Divisions” in divisions appropriate for the test load and class of scale.

Example: Determine the number of divisions for any test load by dividing the value of the mass standard being applied by the minimum division indicated by the scale. For example, if the scale has a minimum division of 0.1 g and a 1500 g mass standard is applied, the test load is equal to 15 000 divisions (1500/0.1). On a Class II scale with a test load between 10 000 and 20 000 divisions, Table 2-2. “Acceptance Tolerances for Class of Scale based on Test Load in Divisions” indicates the tolerance is plus or minus one division.

Table 2-2. Acceptance Tolerances for Class of Scale based on Test Load in Divisions		
Test Load in Divisions		Tolerance
Class II Scale	Class III Scale	
0 to 5000	0 to 500	Plus or Minus 0.5 Division
5001 to 20 000	501 to 2 000	Plus or Minus 1 Division
20 001 or more	2001 to 4000	Plus or Minus 1.5 Divisions
Not Applicable	4001 or more	Plus or Minus 2.5 Divisions

Which performance tests should be conducted to ensure the accuracy of a scale?

Use the following procedures to verify the scale. The following procedures, based on those required in NIST Handbook 44, have been modified to reduce the amount of time required for testing scales in field situations.

Increasing-Load Test

Use certified mass standards to conduct an “increasing-load test” with all test loads centered on the load-receiving element. Start the test with the device on zero and progress with increasing test loads to a “maximum test load” of at least 10 percent more than the gross weight of the packages to be tested. Use at least three different test loads of approximately equal value to test the device up to the “maximum test load.” Verify the accuracy of the device at each test load. Include the package tare weight as one of the test points.

Decreasing-Load Test

For all types of scales, other than one with a beam indicator or equal-arm balance, conduct a “decreasing-load test” with all test loads centered on the load-receiving element. Use the same test loads used in the “increasing-load test” of this section, and start at the “maximum test load.” Remove the test loads in the reverse order of the increasing-load test until all test loads are removed. Verify the accuracy of the scale at each test load.

Shift Test

Use a test load equal to one-~~half~~**third** of the “maximum test load” used for the “increasing-load test.” For bench scales (see Diagram 1. “**Bench Scales or Balance**”) ~~place~~**apply** the test load **as nearly as possible at the center of each quadrant of the load receiving element as shown in Diagram 1. “Bench Scale or Balance.”** ~~in the center of four separate quadrants, equidistant between the center and edge of the load-receiving element and~~ **For Equal Arm Balances** determine the accuracy in each quadrant ~~for~~ **(see Diagram 2. “Equal-Arm Balance”).** For example, where the load-receiving element is

a rectangular or circular shape, place the test load in the center of the area represented by the shaded boxes in the following diagrams.

Diagram 1. Bench Scales or Balance

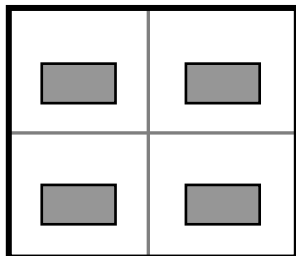
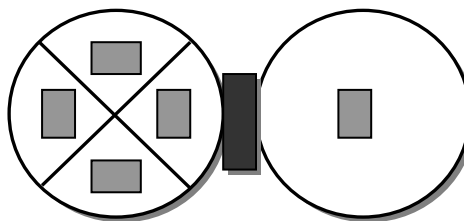


Diagram 2. Equal-Arm Balance



Return to Zero

Conduct the return to zero test whenever all the test weights from the scale are removed, check to ensure that it returns to a zero indication.

Which standards apply to other test equipment?

Specifications, tolerances, and other technical requirements for the other measurement standards and test equipment cited in this handbook are specified in the following NIST publications. These publications may be obtained from the Office of Weights and Measures or the U.S. Government Printing Office.

- Mass Standards – Use NIST Handbook 105-1, “Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures – Field Standard Weights (NIST Class F)” (1990)
- Volumetric Flasks and Cylinders – Use NIST Handbook 105-2, “Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures – Field Standard Measuring Flasks” (1996)
- Stopwatches – Use NIST Handbook 105-5, “Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures – Field Standard Stopwatches” (1997)
- Thermometers – Use NIST Handbook 105-6, “Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures – Specifications and Tolerances for Thermometers” (1997)

2.3. Basic Test Procedure

The following steps apply when gravimetrically testing any type of packaged product except Borax and glazed or frozen foods. If the tested products contain Borax, refer to Section 2.4, “Borax.” If glazed or frozen food is tested, refer to Section 2.6. “Drained Weight for Glazed or Frozen Foods.”

The Basic Test Procedure:

- 1. Identify and define the inspection lot.**
- 2. Select the sampling plan.**
- 3. Select the random sample.**
- 4. Measure the net contents of the packages in the sample.**
- 5. Evaluate compliance with the Maximum Allowable Variation (MAV) requirement.**
- 6. Evaluate compliance with the average requirement.**

Define the Inspection Lot

The official defines which packages are to be tested and the size of the inspection lot. The lot may be smaller or larger than the production lot defined by the packer. Only take action on the packages contained in the lot that has been defined.

Note: Normally, there will never be access to the entire “production lot” from a manufacturer. The “inspection lot” is selected from packages that are available for inspection/test at any location in the distribution chain.

Example: An inspection lot should consist of all of the cans of a single brand of peach halves, labeled with a net quantity of 453 g (1 lb). When packages are tested in retail stores, it is not necessary to sort by lot code. If lot codes are mixed during retail testing, be sure to record the lot codes for all of the packages included in the sample so that the inspector and other interested parties can follow up on the information. For special reasons, such as a large number of packages or the prior history of problems with the product or store, the inspector may choose to define a lot as only one type of packaged product (e.g., ground beef). Another reason to narrowly define the lot is if the results of an audit test indicate the possibility of a shortage in one particular lot code within a particular product.

What is the difference between standard and random weight packages?

Standard packages are those with identical net content declarations such as containers of soda in 2 L bottles and 2.26 kg (5 lb) packages of flour. “Random packages” are those with differing or no fixed patterns of weight, such as packages of meat, poultry, fish, or cheese.

Sampling Plans

Where are sampling plans located for “Category A” inspections?

Use Appendix A, Table 2-1. “Sampling Plans for Category A,” to conduct “Category A” inspections.

Where are sampling plans located for “Category B” inspections?

Use Appendix A, Table 2-2. “Sampling Plans for Category B,” to conduct “Category B” inspections.

Basic Inspection Procedure and Record Keeping

How are the specific steps of the Basic Test Procedure documented?

Use an official inspection report to record the inspection information. Attach additional worksheets, test

notes, and other information as needed. This handbook provides random and standard packaged products model inspection report forms in Appendix E, “Model Inspection Report Forms.” Refer to Appendix E for sample instructions to the complete the forms box numbers. Modify the model reports and the box numbers to meet your agency’s needs. Other formats that contain more or less information may be acceptable.

Note: Inspection reports should be legible and complete. Good recordkeeping practices typically include record retention for a specified period of time (e.g., 1 to 3 years).

- Record the product identity, packaging description, lot code, location of test, and other pertinent data.
- Record the labeled net quantity of contents in Box 1. Record both metric and inch-pound declarations if they are provided on the package label.

Example: If the labeled weight is 453 g (1 lb), record this in Box 1.

- When the declaration of net quantity on the package includes both the International System of Units (SI) (metric) and inch-pound units, the larger of the two declarations must be verified. The rounding rules in NIST Handbook 130, “Uniform Packaging and Labeling Regulations” permit packers to round declarations up or down based on their knowledge of their package filling targets and the accuracy of packaging equipment.

Determine the larger of the values by converting the SI declaration to inch-pound units, or vice versa, using conversion factors that are accurate to at least six places. Compare the values, and use the larger value in computing the nominal gross weight (see later steps). Indicate on the report which of the declarations are being verified when packages labeled with two units of measure are encountered.

Example: If the net weight declared on a package is 1 lb, the metric equivalent (accurate to six significant digits) is 453.592 g. Do not round down or truncate values in the calculations until the nominal gross weight is determined and recorded. If the package is also labeled 454 g, then the metric declaration is larger than the inch-pound declaration and should be used to verify the net contents of the package. The Basic Test Procedure does not prohibit the use of units of weight instead of dimensionless units when recording package errors, nor does it prohibit the use of net content computer programs to determine product compliance. Record the unit of measure in box 2. The unit of measure is the minimum division of the unit of measurement used to conduct the test. If a scale is used that reads to thousandths of a pound, the unit of measure is 0.001 lb even if the scale division is 0.002 lb or 0.005 lb.

Example: If the scale has a scale division of 0.5 g, the unit of measure is 0.1 g. If a weighed package that has an error of “- 0.5 g,” record the error as “- 5” using “dimensionless units.” If the scale indicates in increments of 0.002 lb, the unit of measure is 0.001 lb. If a weighed package has an error of “+0.016,” record the error as “+ 16” using “dimensionless units.” When using dimensionless units, multiply package errors by the unit of measure to obtain the package error in weight.

- Enter the appropriate MAV value in box 3 for the type of package (weight, volume, etc.), the labeled net contents, and the unit of measure.

Where are Maximum Allowable Variations found?

Find the MAV values for packages labeled by weight, volume, count, and measure in the tables listed below in Appendix A.

- packages labeled by weight See Table 2-5.
- packages labeled by volume liquid or dry See Table 2-6.
- packages labeled by count See Table 2-7.
- packages labeled by length, (width), or area See Table 2-8.
- packages bearing a USDA seal of inspection – Meat and Poultry See Table 2-9.
- textiles, polyethylene sheeting and film, mulch and soil labeled by volume, packaged firewood, and packages labeled by count with less than 50 items See Table 2-10.

How is the value of an MAV found?

Refer to the appropriate table of MAVs and locate the declared quantity that is on the package label in the column marked “Labeled Quantity.” Read across the table to find the value in the column titled “Maximum Allowable Variation.” Record this number in Box 3. Determine the MAV in dimensionless units and record in Box 4 on the Standard Package Report Form (a dimensionless unit is obtained by dividing the MAV recorded in Box 3 by the unit of measure recorded in Box 2). Refer to Appendix C. “Glossary,” for the definition of dimensionless units.

How many MAVs are permitted in a sample?

To find out how many minus package errors are permitted to exceed the MAV, (refer to Appendix A) see Column 4 in either Table 2-1. “Sampling Plans for Category A” or Table 2-2. “Sampling Plans for Category B.” Record this number in Box 8.

Random Sample Selection

How are sample packages selected?

Randomly select a sample from the inspection lot. Random number tables (see Appendix B. “Random Number Tables”) or a calculator that is able to generate random numbers may be used to identify the sample. If the packages for the sample are not randomly selected, the test results may not be statistically valid.

Note: If the inspector and the party that is ultimately responsible for the packing and declaration of net weight for the product agree to an alternative method of sample selection, document how the sample packages were selected as part of the inspection record.

How is the size of the “Lot” determined?

Count the number of packages comprising the inspection lot or estimate the size to within 5 % and record the inspection lot size in Box 5.

How is the sample size determined?

Refer to Appendix A. Table 2-1. “Sampling Plans for Category A” or Table 2-2. “Sampling Plans for Category B” to determine the sample size. In Column 1, find the size of the inspection lot (the number recorded in Box 5 of the report form). Read across from Column 1 to find the appropriate sample size in Column 2 and record this number in Box 6 of the report form.

Tare Procedures

What types of tare may be used to determine the net weight of package goods?

This handbook defines three types of tare for the inspection of packaged goods. The tare weight may vary considerably from package to package as compared with the variability of the package net contents, even for packages in the same production lot. Although this is not common for most packaging, the basic test procedure in this handbook considers the variation for all tare materials.

Used Dry Tare

Used Dry Tare is defined as follows: Used tare material that has been air dried, or dried in some manner to simulate the unused tare weight. It includes all packaging materials that can be separated from the packaged product, either readily (e.g., by shaking) or by washing, scraping, ambient air drying, or other techniques involving more than “normal” household recovery procedures, but not including laboratory procedures like oven drying. Labels, wire closures, staples, prizes, decorations, and such are considered tare. Used Dry Tare is available regardless of where the packages are tested. The net content procedures described in this handbook reference Used Dry Tare.

Note: When testing frozen foods with the Used Dry Tare approach, the frost found inside frozen food packages is included as part of the net contents.

Unused Dry Tare

If testing packages in retail store locations where they are packaged, and sold in small quantities to the ultimate consumers, the basic test procedure may be modified by using samples of the packaging material available in the store. Unused dry tare is defined as:

All unused packaging materials (including glue, labels, ties, etc.) that contain or enclose a product. It includes prizes, gifts, coupons, or decorations that are not part of the product.

Wet Tare

Effective October 9, 2008, wet tare procedures must not be used to verify the labeled net weight of packages subject to regulation by the United States Department of Agriculture (USDA). The Food Safety and Inspection Service (FSIS) adopted specific sections of the 2005 4th Edition of NIST HB 133 by reference but not the “wet tare” method for determining net weight compliance. FSIS considers the free-flowing liquids in packages of meat and poultry products, including single-ingredient, raw poultry products, to be integral components of these products (see Federal Register, September 9, 2008 [Volume 73, Number 175] [Final Rule – pages 52189-52193]).

If the jurisdiction uses wet tare to determine net weight, follow the procedures described below that reference Used Dry Tare, except make no effort to dry the tare material. If Wet Tare is used to verify the

net weight of packages ~~of fresh poultry, hot dogs, and franks that are subject to the USDA regulations~~, the inspector must allow for moisture loss. Wet Tare is defined as: Used tare material where no effort is made to dry the tare material. Free-flowing liquids are considered part of the tare weight.

How is a tare weight determined?

Except in the instance of applying unused dry tare, select the packages for the initial tare sample from the sample packages. Mark the first two (three or five) packages in the order the random numbers were selected; these packages provide the initial tare sample. Determine the gross weight of each package and record it in block a, “Gross Wt,” under the headings “Pkg. 1,” “Pkg. 2,” “Pkg. 3,” etc. on the report form. Except for aerosol or other pressurized packages, open the sample packages, empty, clean, and dry them as appropriate for the packaging material.

Does the inspection of aerosol containers require special procedures?

Yes, aerosol containers are handled differently for two reasons. First, regulations under the Uniform Packaging and Labeling Regulation in NIST HB 130 require that packages designed “to deliver” the product under pressure, “must state the net quantity of the contents that will be expelled when the instructions for use as shown on the container are followed.” This means that any product retained in aerosol containers after full dispersion is included in the tare weight. Second, aerosol containers must not be opened because they are pressurized; for safety reasons they should not be punctured or opened. When emptying aerosol containers to determine a tare weight, exhaust them in a well-ventilated area (e.g., under an exhaust hood or outdoors) at least 15 m (50 ft) from any source of open flame or spark.

To ensure that the container properly dispenses the product, read and follow any dispensing instructions on the package. If shaking during use is specified in the instructions, periodically shake (at least two or three times during expulsion of the product). If directions are not given, shake the container five times with a brisk wrist twisting motion. If the container has a ball agitator, continue the shaking procedure for one minute after the ball has shaken loose.

How is the tare of vacuum-packed coffee determined?

The gross weight of a can of vacuum-packed coffee will be more after the seal is broken and air enters the can. In the procedure to determine the tare weight of the packaging material, correct the gross weight determined for unopened cans as follows. Use the initial tare sample packages, weigh, and record the gross weight of the product-filled cans before and after breaking the vacuum seal. Compute the average gross weight difference (open weight minus sealed weight) and record this in Box 13a of the report form. The nominal gross weight equals the average tare weight minus the average difference in gross weights plus the labeled weight (Box 14): $\text{Box 13} - \text{Box 13a} + \text{Box 14}$.

How is it determined how many packages to select for the initial tare sample?

For the initial tare sample size, see Column 5 under initial tare sample size in Appendix A, Table 2-1. “Sampling Plans for Category A” or Column 3 under initial tare sample size in Appendix A, Table 2-2. “Sampling Plans for Category B₂.” Record the initial tare sample size in Box 7 on the report form.

Note: The initial tare sample size is considered the total tare sample size when the sample size is less than 12.

How are the tare sample and the tare weight of the packaging material determined?

1. Except for unused dry tare at the point-of-pack, first determine the tare weight for each package in the initial tare sample and record the value in Row b, “Tare Wt.” under the appropriate package number column.
2. For sample sizes of 12 or more, subtract the individual tare weights from the gross weights (Block a, minus Block b, on the report form) to obtain the net weight for each package and record these values in Block c, “Net Wt.,” on the report form.

Determine and record the “range of package errors” (called R_c) for the initial tare sample in Box 9 on the report form. (The range is the difference between the package errors.)

(Amended 2002)

3. Determine and record the “range of tare weights” (called R_t) in Box 10.
4. Compute the ratio R_c/R_t by dividing the value in Box 9 by the value in Box 10. Record the resulting value in Box 11. (R_c and R_t must both be in the same unit of measure or both in dimensionless units.)
5. Determine and record in Box 12 the total number of packages to be opened for the tare determination from either **Appendix A**, Table 2-3. **“Category A – Total Number of Packages to be Opened for or Table 2-4. “Determination – Number Include those Packages Opened for Initial Tare Sample.”**
 - In the first column (titled Ratio of R_c/R_t), locate the range in which the computed R_c/R_t falls. Then, read across to the column headed with the appropriate sample size.
 - If the total number of packages to open equals the number already opened go to step 6.
 - If the total number of packages to open is greater than the number of packages already opened, compute the number of additional packages to open for the tare determination and go to step 6. Enter the total number of tare samples in Box 12.
6. Determine the average tare weight using the tare weight values for all the packages opened and record the average tare weight in Box 13.

When and where is unused dry tare used, and how is it used to determine an average tare weight?

You may determine the average tare weight using samples of unused dry tare when testing meat, poultry, or any other products that are not subject to regulation of the Food and Drug Administration (FDA). You may use unused dry tare samples when conducting inspections at locations where the point-of-pack and sale are identical (e.g., store-packed products in a supermarket meat case). To determine unused dry tare at the point-of-sale, randomly select two (2) samples of unused dry tare, and weigh each separately. If there is no measurable variation in weight between the samples, proceed with the test using the weight of one of the samples. If the weight of the two (2) initial samples, randomly select three (3) additional tare samples and determine the average weight of all five (5) samples. Use this value as the average tare weight.

(Amended 2002)

Determine Nominal Gross Weight and Package Errors for Tare Sample

What is a nominal gross weight?

A nominal gross weight is used to simplify the calculation of package errors. To compute the nominal gross weight, add the average tare weight (recorded in Box 13) to the labeled weight (recorded in Box 1). To obtain the package error, subtract **the nominal gross weight from each a**-package's gross weight. ~~from the nominal gross weight.~~ The nominal gross weight is represented by the formula:

$$\text{Nominal gross weight} = \text{average tare} + \text{labeled weight}$$

How are individual package errors determined for the tare sample packages?

Determine the errors of the packages opened for tare by subtracting the nominal gross weight recorded in Box 14 from the individual package gross weights recorded for each package (Pkg 1, Pkg 2, etc.) in Block a, "Gross Wt." The nominal gross weight must be used, rather than the actual net weight, for each package to determine the package error. This ensures that the same average tare weight is used to determine the error for every package in the sample, not just the unopened packages.

- For standard packages, record the package error in the appropriate plus or minus column on the report form for each package opened for tare.
- For random packages, determine the package error for the tare sample using a nominal gross weight for each package so that all of the package errors are determined with the same tare weight value. Record the package error on the Random Package Report Form in the appropriate plus or minus column under Package Errors.

Note: Converting the package error to dimensionless units allows the inspector to record the package errors as whole numbers disregarding decimal points and zeroes in front and unit of measure after the number.

Example: If weighing in 0.001 lb increments, the unit of measure is also 0.001 lb. If the package error for the first package opened for tare is +0.008 lb, instead of recording 0.008 lb in the plus column, record the error as "8" in the plus column. If the second package error is +0.060 lb, record the package error as "60" in the plus column, and so on. (This section does not prohibit the use of units of weight or computer programs instead of dimensionless units.)

How are individual package errors determined for the other packages in the sample?

Compare the gross weight of each of the unopened sample packages with the nominal gross weight (Box 14). Record the package errors in the "Package Errors" section of the report form using either units of weight (lb or g) or dimensionless units.

How is the total package error computed?

Add all the package errors for the packages in the sample. Be sure to subtract the minus package errors from the plus package errors and to record the total net error in Box 15.

Evaluating Results

How is it determined if a sample passes or fails?

The following steps lead the inspector through the process to determine if a sample passes or fails. If the product is subject to moisture allowance, follow the procedures under “Moisture Allowances” in this Chapter to correct the MAV.

How is it determined if packages exceed the Maximum Allowable Variation?

Compare each minus package error with the MAV recorded in Box 3 or Box 4 (if using dimensionless units). Circle the package errors that exceed the MAV. These are “unreasonable errors.” Record the number of unreasonable minus errors found in the sample in Box 16.

How is it determined if the negative package errors in the sample exceed the number of MAVs allowed for the sample?

Compare the number in Box 16 with the number of unreasonable errors allowed (recorded in Box 8). If the number found exceeds the allowed number, the lot fails. Record in Box 17 whether the number of unreasonable errors found is less or more than allowed.

Note: If the total error recorded in Box 15 is a plus value and Box 17 is “No,” then the number of unreasonable errors is equal to or less than the number allowed (recorded in Box 8) and the lot passes.

How is the average error of the sample determined and does the inspected lot pass or fail the average requirement?

Determine the average error by dividing the total error recorded in Box 15 by the sample size recorded in Box 6. Record the average error in Box 18 if using dimensionless units or in Box 19 if using units of weight. Compute the average error in terms of weight (if working in dimensionless units up to this time) by multiplying the average error in dimensionless units by the unit of measure and record the value in Box 19.

1. If the average error is positive, the inspection lot passes the average requirement.
2. If the average error is negative, the inspection lot fails under a “Category B” test. Record in Box 20.
3. If the average error is a negative value when testing under the Sampling Plans for “Category A,” compute the Sample Error Limit (SEL) as follows:
 - Compute the Sample Standard Deviation and record it in Box 21.
 - Obtain the Sample Correction Factor from Column 3 of Appendix A. Table 2-1. “Sampling Plans for Category A” test. Record this value in Box 22.
 - Compute the Sample Error Limit using the formula:

$$\text{Sample Error Limit (Box 23)} = \text{Sample Standard Deviation (Box 21)} \times \text{Sample Correction Factor (Box 22)}$$

4. Compliance Evaluation of the Average Error:

- If the value of the Average Error (Box 18) is smaller than the SEL (Box 23), the inspection lot passes.
- If the value of the Average Error (disregarding the sign) (Box 18) is larger than the SEL (Box 23) the inspection lot fails. However, if the product is subject to moisture loss, the lot does not necessarily fail. Follow the procedures under “Moisture Allowances” in this Chapter.

Moisture Allowances

How is reasonable moisture loss allowed?

If the product tested is subject to moisture loss, provide for the moisture allowance by following the steps listed below.

Determine the value of the moisture allowance if the product is listed below.

What are the moisture allowances for flour, ~~and~~ dry pet food and other products? (See Table 2.3. “Moisture Allowances.”)

<u>Table 2.3. Moisture Allowances</u>		
<u>If you are verifying the labeled net weight of packages of:</u>	<u>The Moisture Allowance is:</u>	<u>Notes</u>
<u>Flour</u>	<u>3 %</u>	
<u>Dry pet food</u>	<u>3 %</u>	<u>Dry pet food means all extruded dog and cat foods and baked treats packaged in Kraft paper bags and/or cardboard boxes with a moisture content of 13 % or less at time of pack.</u>
<u>Borax</u>	<u>See Section 2.4.</u>	
<u>Wet Tare Only</u>		
<u>If you are using Wet Tare in verifying the net weight of packages of one of the products listed below:</u>	<u>The Moisture Allowance is:</u>	<u>Notice: Wet Tare must not be used in testing packages of meat and poultry subject to USDA regulations.</u>
<u>Fresh poultry</u>	<u>3 %</u>	<u>Fresh poultry is defined as poultry at a temperature of 3 °C (26 °F) that yields or gives when pushed with the thumb.</u>
<u>Franks or hotdogs</u>	<u>2.5 %</u>	
<u>Bacon, fresh sausage, and luncheon meats</u>	<u>0 %</u>	<u>For packages of bacon, fresh sausage, and luncheon meats, there is no moisture allowance if there is no free-flowing liquid or absorbent materials in contact with the product and the package is cleaned of clinging material. Luncheon meats are any cooked sausage product, loaves, jellied products, cured products, and any sliced sandwich-style meat. This does not include whole hams, briskets, roasts, turkeys, or chickens requiring further preparation to be made into ready-to-eat sliced product. When there is no free-flowing liquid inside the package and there are no absorbent materials in contact with the product, Wet Tare and Dried Used Tare are equivalent.</u>

The moisture allowance for flour and dry pet food is 3 % of the labeled net weight.

Note: Dry pet food means all extruded dog and cat foods and baked treat products packaged in Kraft paper bags and/or cardboard boxes with a moisture content of 13 % or less at the time of

~~pack.~~

What moisture allowance is used with Used Dry Tare when testing packages that bear a USDA Seal of Inspection?

There is no moisture allowance when inspecting meat and poultry from a USDA inspected plant when Used Dry Tare and a “Category A” sampling plan are used.

What moisture allowance is used with wet tare? ~~when testing packages bearing a USDA seal of inspection?~~

Effective October 9, 2008, wet tare procedures must not be used to verify the labeled net weight of packages subject to regulation by the United States Department of Agriculture. FSIS considers the free-flowing liquids in packages of meat and poultry products, including single-ingredient, raw poultry products, to be integral components of these products (see Federal Register, September 9, 2008 [Volume 73, Number 175] [Final Rule - pages 52189-52193])

See Table 2-3. “Moisture Allowances – Wet Tare Only.”

- ~~• Use the following guideline when testing meat and poultry from any USDA inspected plant using Wet Tare and a Category A sampling plan.~~
- ~~• For packages of fresh poultry that bear a USDA seal of inspection, the moisture allowance is 3.5% of the labeled net weight. For net weight determinations, only, fresh poultry is defined as poultry above 3 °C (26 °F). This is a product that yields or gives when pushed with the thumb.~~
- ~~• For packages of franks or hotdogs that bear a USDA seal of inspection, the moisture allowance is 2.5 % of the labeled net weight.~~
- ~~• For packages of bacon, fresh sausage, and luncheon meats that bear a USDA seal of inspection, there is no moisture allowance if there is no free-flowing liquid or absorbent materials in contact with the product and the package is cleaned of clinging material. Luncheon meats are any cooked sausage product, loaves, jellied products, cured products, and any sliced sandwich-style meat. This does not include whole hams, briskets, roasts, turkeys, or chickens requiring further preparation to be made into ready-to-eat sliced product. When there is no free-flowing liquid inside the package and there are no absorbent materials in contact with the product, Wet Tare and Dried Used Tare are equivalent.~~

When there is free-flowing liquid or absorbent packaging materials in contact with the product, all free liquid is part of the wet tare.

Calculations

How is moisture allowance computed and applied to the average error?

To compute moisture allowance, multiply the labeled quantity by the decimal percent value of the allowance.

Example: Labeled net quantity of flour is 907 g (2 lb)

Moisture Allowance is 3 % (0.03)

Moisture Allowance = 907 g (2 lb) x 0.03 = 27 g (0.06 lb) record this value in Box 13a.

How is a Moisture Allowance made prior to determining package errors?

If the Moisture Allowance is known in advance (e.g., flour and dry pet food) it can be applied by adjusting the Nominal Gross Weight (NGW) used to determine the sample package errors. The Moisture Allowance (MA) in Box 13a is subtracted from the NGW. The NGW which is the sum of the Labeled Net Quantity of Contents (LNQC e.g., 907 g) and the Average Tare Weight from Box 13 (for this example use an ATW of 14 g (0.03 lb)) to obtain an Adjusted Nominal Gross Weight (ANGW) which is entered in Box 14.

The calculation is: LNQC 907 g (2 lb) + ATW 14 g (0.03 lb) = 921 g (2.03 lb) - MA 27 g (0.06 lb) = ANGW of 918 g (1.97 lb) which is entered in Box 14.

Package errors are determined by subtracting the ANGW from the Gross Weights of the Sample Packages (GWSP).

The calculation is: GWSP – ANGW = Package Error.

Note: When the NGW is adjusted by subtracting the Moisture Allowance value(s) the Maximum Allowable Variation(s) is not changed. This is because the errors that will be found in the sample packages have been adjusted by subtracting the Moisture Allowance (e.g., 3 %) from the NGW. That increases the individual package errors by the amount of the moisture allowance (e.g., 3 %). If the value(s) of the MAV(s) were also adjusted it would result in doubling the allowance.

How is a Moisture Allowance made after determining package errors?

You can make adjustments when the value of the Moisture Allowance is determined following the test (e.g., after the sample fails or if a packer provides a reasonable a moisture allowance based on data obtained using a scientific method) using the following approach:

If the sample failed the Average and/or the Individual Package Requirements both of the following steps are applied.

If the sample failed the Average Requirement but has no unreasonable package errors only step 1 is used. If the sample passes the Average Requirement but fails because the sample included one or more Unreasonable Package Errors (UPEs) only step 2 is used.

1. Use the following approach to apply a Moisture Allowance to the sample after the test is completed. The Moisture Allowance (MA) is computed (e.g., 3 % x 907 g (2 lb) = 27 g (0.06 lb)

and added to the Sample Error Limit (e.g., if the SEL is 0.023 add 0.06 to obtain an Adjusted SEL of 0.083). The ASEL (Adjusted Sample Error Limit) is then compared to the Average Error of the Sample and:

- If the average error (disregarding sign) in Box 18 is smaller than the ASEL, the sample passes.
- If the average error (disregarding sign) in Box 18 is larger than the ASEL, the sample fails.

2. If a Moisture Allowance is to be applied to the Maximum Allowable Variation(s), the following method is recommended:

The Moisture Allowance (MA) is computed (e.g., 3 % x 907 g (2 lb) = 27 g (0.06 lb) and added to the value of the Maximum Allowable Variation(s) for the labeled net quantity of the package (e.g., MAV for 907 g (2 lb) is 31.7 g (0.07 lb) + 27 g (0.06 lb) = AMAV of 58.7 g). Compare each minus package error to the AMAV. Mark package errors that exceed the AMAV and record the number of UPE's found in the sample. If this number exceeds the number of unreasonable errors allowed, the sample fails.

~~How is the Maximum Allowable Variation corrected for the moisture allowance?~~

- ~~• Adjust the MAV by adding the moisture allowance to the MAV.~~

~~Example: 907 g (2 lb) package of flour: moisture allowance added to the MAV = 31.7 g (0.07 lb) (MAV for 907 g [2 lb] package) + 27 g (0.06 lb) moisture allowance = a corrected MAV of 58.7 g (0.13 lb)~~

- ~~• Correct MAV in dimensionless units by converting the moisture allowance to dimensionless units = 0.06 lb ÷ 0.001 lb = 60. Go to Box 4 and add the moisture allowance in dimensionless units to the MAV in dimensionless units.~~

~~Example: MAV = 70 (MAV for 2 lb where the unit of measure = 0.001 lb) + 60 (moisture allowance in dimensionless units) = 130. Minus package errors must exceed the MAV ± gray area before they are declared “unreasonable errors.”~~

- ~~• If the number of unreasonable errors exceeds the allowed number (recorded in Box 8), the inspection lot fails.~~

~~How is the average error for the moisture allowance corrected?~~

~~If the minus average error (Box 18) is larger (disregarding the sign) than the SEL (Box 23) and moisture loss applies, compare the difference between Box 18 and Box 23 with the moisture allowance recorded in Box 13a. (Make sure that all the values are in units of weight or in dimensionless units before making this comparison.) If Box 13a is larger than the difference between Box 18 and 23, then the lot is considered to be in the gray area.~~

~~Example: Box 13a for 2 lb flour is 60 (dimensionless units); Box 18 is 2 (dimensionless units); Box 23 is 0.550 (dimensionless units). The difference between Box 18 and Box 23 is 1.450 (dimensionless units). Since Box 13a is 60 (dimensionless units), Box 13a is larger than the difference between Box 18 and Box 23, the lot is~~

~~considered to be in the gray area and further investigation is necessary before ruling out moisture loss as the reason for shortweight.~~

What should you do when a sample is in the gray area?

When the average error of a lot of fresh poultry, franks, or hot dogs ~~from a USDA-inspected plant~~ is minus, but does not exceed the established “moisture allowance” or “gray area,” contact the ~~appropriate USDA official and/or packer or~~ plant management personnel to determine what information is available on the lot in question. Questions to the ~~USDA official and/or~~ plant management representative may include:

- (a) Is a quality control program in place?
- (b) What information is available concerning the lot in question?
- (c) If net weight checks were completed, what were the results of those checks?
- (d) What adjustments, if any, were made to the target weight?

Note: If ~~USDA or~~ the plant management has data on the lot, such data may help to substantiate that the “lot” had met the net content requirements at the point of manufacture.

This handbook provides “moisture allowances” for some meat and poultry products, flour, and dry pet food. These allowances are based on the premise that when the average net weight of a sample is found to be less than the labeled weight, but not by an amount that exceeds the allowable limit, either the lot is declared to be within the moisture allowance or further investigation can be conducted.

Deviations from net quantity of contents caused by the loss or gain of moisture from the package are permitted when caused by ordinary and customary exposure to conditions that occur under good distribution practices. If evidence is obtained and documented to prove that the lot was shipped from the packaging plant in a short-weight condition or was distributed under inappropriate or damaging distribution practices, appropriate enforcement action should be taken.

(Amended 2002)

2.4. Borax

How is it determined if the net weight labeled on packages of borax is accurate?

Use the following procedures to determine if packages of borax are labeled correctly. This procedure applies to packages of powdered or granular products consisting predominantly (more than 50 %) of borax. Such commodities are labeled by weight, but borax can lose more than 23 % of its weight due to moisture loss. However, it does not lose volume upon moisture loss, and this property makes possible a method of volume testing based on a density determination in the event that the net weight of the product does not meet the average or individual package requirements. This method may be used for audit testing to identify possible short-filling by weight at point-of-pack. Since the density of these commodities can vary at point-of-pack, further investigation is required to determine whether, such short filling has occurred.

Test Equipment

- Metal density cup with a capacity of 550.6 mL or (1 dry pt).
- Metal density funnel with slide-gate and stand.

- Scale or balance having a scale division not larger than 1 g or (0.002 lb).
- Rigid straightedge or ruler
- Pan suitable for holding overflow of density cup

Test Procedure

Follow Section 2.3. “Basic Test Procedures – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine product compliance.

1. If the lot does not comply by weight with the sampling plan requirements (either the average or individual package requirements), select the lightest package and record the net weight of this package.
2. Determine the weight of the density cup.
3. Place the density cup in the pan and put the funnel on top of the density cup. Close the funnel slide-gate.
4. Pour sufficient commodity into the funnel so that the density cup can be filled to overflowing.
5. Quickly remove the slide-gate from the funnel, allowing the commodity to flow into the density cup.
6. Carefully, without agitating the density cup, remove the funnel and level off the commodity with the ruler or straight edge. Hold the ruler or straight edge at a right angle to the rim of the cup, and carefully draw it back across the top of the density cup to leave an even surface.
7. Weigh the filled density cup. Subtract the weight of the density cup from the gross weight of the commodity plus the density cup to obtain the net weight of commodity in the cup.

How is the volume determined?

1. Multiply the net weight (in pounds) as found for the package under test by 550.6.
2. Divide the answer just obtained by the weight of the commodity in the density cup, step 7. The result is the net volume of commodity in the package in milliliters.
3. Compare the net volume of the commodity in the package with the volume declared on the package. The volume declaration ~~must not be located~~ appear on the principal display panel. Instead, it will appear on the back or side of the package and may appear as: ~~The following example is how the declaration of volume should appear.~~

Volume ____ cm³ per NIST
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Note: (1 mL = 1 cm³)

What action can be taken based on the results of the density test?

If the net volume of commodity in the lightest package equals or exceeds the declared volume on the package, treat the lot as being in compliance based on volume and take no further action. If the net volume of borax in the lightest package is less than the declared volume on the package, further compliance testing will be necessary. Take further steps to determine if the lot was in compliance with net weight requirements at point-of-pack or was short-filled by weight. To determine this, perform a laboratory moisture loss analysis to ascertain the weight of the original borax product when it was fully hydrated; obtain additional data at the location of the packager; and/or investigate the problem with the packager of the commodity.

2.5. The Determination of Drained Weight

Since the weight per unit volume of a drained product is of the same order of magnitude as that of the packaging liquid that is drained off, an “average nominal gross weight” cannot be used in checking packages of this type. The entire sample must be opened. The procedure is based upon a test method accepted by the U.S. Food and Drug Administration.

A tare sample is not needed because all the packages in the sample will be opened and measured.

The weight of the container plus drained-away liquid is determined. This weight is then subtracted from the gross weight to determine the package error.

Equipment

- Scales and weights recommended in Section 2.2. “Measurement Standards and Test Equipment” are suitable for the determination of drained weight.
- Sieves
 - For drained weight of 1.36 kg or (3 lb) or less, one 20 cm or (8 in) No. 8 mesh U.S. Standard Series Sieve, receiving pan, and cover
 - For drained weight greater than 1.36 kg or (3 lb), one 30 cm or (12 in) sieve, with same specifications as above

Note: A U.S. Standard Test Sieve with 11.2 mm ($7/16$ in) openings must be used for canned tomatoes.

- Stopwatch

Test Procedure

Follow the Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” or a “Category B” sampling plan in the inspection (depending on the location of test); select a random sample; then use the following test procedure to determine lot compliance.

1. Use **Appendix E. “Standards Pack Inspection Report.”** Fill out Boxes 1 through 8. Select the random sample. Determine and record on a worksheet the weight of the receiving pan.

2. Determine and record on a worksheet the gross weight of each individual package comprising the sample.
3. Pour the contents of the first package into the dry sieve with the receiving pan beneath it, incline sieve to an angle between 17° to 20° from horizontal to facilitate drainage, and allow the liquid from the product to drain into receiving pan for 2 minutes. (Do not shake or shift material on the sieve.) Remove sieve and product.
4. Weigh the receiving pan, liquid, wet container, and any other tare material. (Do not include sieve and product.) Record this weight as tare and receiving pan.
5. Subtract the weight of the receiving pan, determined in step 1, from the weight obtained in step 4 to obtain the package tare weight (which includes the weight of the liquid).
6. Subtract the tare weight, found in step 5, from the corresponding package gross weight determined in step 2 to obtain the drained weight of that package. Determine the package error (drained weight - labeled drained weight).
7. Repeat steps 3 through 6 for the remaining packages in the sample, cleaning and drying the sieve and receiving pan between measurements of individual packages.
8. Transfer the individual package errors to the Standard Pack Report form.
9. To determine lot conformance, return to Section 2.3. “Basic Test Procedures – Evaluating Results.”

2.6. Drained Weight for Glazed or Frozen Foods

How is the drained weight of frozen shrimp (e.g., 2.27 kg (5 lb) block of shrimp) and crabmeat determined?

When determining the net weight of frozen shrimp and crabmeat, use the test equipment and procedure provided below. Immerse the product (**e.g., a block of frozen shrimp**) directly in water in a mesh basket or open container to thaw (e.g., it is not placed in a plastic bag). Direct immersion does not result in the product absorbing moisture because the freezing process causes the tissue to lose its ability to hold water. Maintain the water temperature between 23 °C to 29 °C (75 °F to 85 °F). This is accomplished by maintaining a constant flow of warm water into the container holding the product (e.g., place a bucket in a sink to catch the overflow, and feed warm water into the bottom of the bucket through a hose). After thawing, drain the product on a sieve for 2 minutes and then weigh it.

Equipment

- Partial immersion thermometer or equivalent with 1 °C (2 °F) graduations and a -35 °C to +50 °C (-30 °F to +120 °F) accurate to ±1 °C (±2 °F)
- Water source and hose with an **an approximate flow rate of 4 L to 15 L (1 gal to 4 gal) per minute for thawing blocks and other products flow rate**
- Sink or other receptacle [i.e., **bucket with a capacity of approximately 15 L (4 gal)-bucket**] **for thawing blocks and other products**

- A wire mesh basket (**used for testing large frozen blocks of shrimp**) or other container that is large enough to hold the contents of 1 package (e.g., 2.27 kg or [5 lb] box of shrimp) and has openings small enough to retain all pieces of the product (e.g., an expanded metal test tube basket lined with standard 16 mesh screen)
- Number 8 mesh, 20 cm (8 in) or 30 cm (12 in) sieve
- Stopwatch

Test Procedure

Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” or a “Category B” sampling plan in the inspection (depending on the location of test); select a random sample; then use the following test procedure to determine lot compliance.

1. Place the unwrapped frozen shrimp or crabmeat in the wire mesh basket and immerse in a 15 L (4 gal) or larger container of fresh water at a temperature between 23 °C to 29 °C (75 °F to 85 °F). Submerge the basket so that the top of the basket extends above the water level.
2. Maintain a continuous flow of water into the bottom of the container to keep the temperature within the specified range.
3. As soon as the product thaws, determined by loss of rigidity, transfer all material to a sieve (20 cm [8 in] for packages less than 453 g [1 lb] or 30 cm [12 in] for packages weighing more than 453 g [1 lb]) and distribute it evenly over the sieve.
4. Without shifting the product, incline the sieve 30° from the horizontal position to facilitate drainage, and drain for 2 minutes.
5. At the end of the drain time, immediately transfer the product to a tared pan for weighing to determine the net weight.

How is the net weight of glazed~~raw~~ seafood and fish determined?

For glazed seafood and fish, determine the net weight after removing the glaze using the following procedure. Use this method for any frozen glazed food product.

Equipment

Use the equipment listed in Section 2.6. “Drained Weight for Glazed or Frozen Foods.”

Test Procedures

Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; and use the following test procedure to determine lot compliance.

1. Fill out a report form and select the random sample. A tare sample is not needed.
2. Weigh sieve and receiving pan. Record this weight on a worksheet as “sieve weight.”

3. Remove each package from low temperature storage; open it immediately and place the contents under a gentle spray of cold water. **Handle the product with care** to avoid ~~breaking breakage. the product~~. Continue the **spraying process** until all ice glaze, that is seen or felt is removed. In general, the product should remain rigid; however, the ice glaze on certain products, usually smaller sized commodities, sometimes cannot be removed without defrosting the product. Nonetheless, remove the glaze, because it is a substantial part of the package weight.
(Amended 2002)
4. Transfer the product to the weighed sieve. Without shifting the product, incline the sieve to an angle of 17° to 20° to facilitate drainage and drain (into waste receptacle or sink) for exactly 2 minutes.
5. Place the product and sieve on the receiving pan and weigh. Record this weight on a worksheet as the “sieve + product weight.”
6. The net weight of product is equal to the weight of the pan plus the sieve plus the product (recorded in step 5) minus the “sieve weight” (recorded in step 2). Record the product net weight on the worksheet. The package error is equal to the net weight of the product as measured minus the labeled weight. Record the package error on the worksheet and transfer it to the report form.
7. Repeat steps 3 through 6 for each package in the sample, cleaning and drying the sieve and the receiving pan between package measurements.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results.”

Chapter 3. Test Procedures – For Packages Labeled by Volume

3.1. Scope

What types of packaged goods can be tested using these procedures?

Use this procedure to determine the net contents of packaged goods labeled in fluid volume such as milk, water, beer, oil, paint, distilled spirits, soft drinks, juices, liquid cleaning supplies, or liquid chemicals. This chapter also includes procedures for testing the capacities of containers such as paper cups, bowls, glass tumblers, and stemware.

What types of packages are not covered by these procedures?

These procedures do not cover berry baskets and rigid-dry measures that are covered by specific code requirements in NIST Handbook 44. “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices.”

When can the gravimetric test procedure be used to verify the net quantity of contents of packages labeled by volume?

The gravimetric procedure may be used to verify the net quantity of contents of packages labeled in volume when the density (density means the weight of a specific volume of liquid determined at a reference temperature) of the product being tested does not vary excessively from one package to another.

What procedure is followed if the gravimetric test procedure cannot be used?

Test each package as described in Section 3.3. “Volumetric Test Procedure for Liquids.”

What considerations besides density affect measurement accuracy?

In addition to possible package-to-package variations in product density, the temperature of the liquid will affect the volume of product. The product will expand or contract based on a rise or fall in product temperature.

Example: The volume of a liquid cleaning product might be 5 L (1.32 gal) at 20 °C (68 °F) and 5.12 L (1.35 gal) at 25 °C (77 °F), which represents a 2.2 % change in volume.

Note: This extreme example is for illustrative purposes, a 2.2 % volume change will not occur in normal testing.

What reference temperature should be used to determine the volume of a liquid?

Use the reference temperature specified in Table 3-1. “Reference Temperatures for Liquids” to determine volume. When checking liquid products labeled by volume using the gravimetric procedure, maintain the packages used to determine product densities at reference temperatures. If testing the packages in a sample volumetrically, each package in the sample must be maintained at or corrected to the reference temperature when its volume is determined.

Note. When checking liquid products using a volumetric or gravimetric procedure, the temperature of the samples must be maintained at the reference temperature ± 2 °C (± 5 °F).

If the Liquid Commodity is	Then, the reference temperature is
Frozen food labeled by volume (e.g., fruit juice)	-18 °C (0 °F)
Beer	3.9 °C (39.1 °F)
Food that must be kept refrigerated (e.g., milk and other dairy products. Usually labeled “Keep Refrigerated”)	4.4 °C (40 °F)
Distilled spirits or petroleum	15 °C (60 °F)
Unrefrigerated products (e.g., includes liquids sold unchilled, such as soft-drinks and wine)	20 °C (68 °F)

3.2. Gravimetric Test Procedure for Liquids

Equipment

- A scale that meets the requirements in Chapter 2, Section 2.2. “Measurement Standards and Test Equipment.”

Note: To verify that the scale has adequate resolution for use, it is first necessary to determine the density of the liquid; next verify that the scale division is no larger than MAV/6 for the package size under test. The smallest graduation on the scale must not exceed the weight value for MAV/6.

Example: Assume the inspector is using a scale with 1 g (0.002 lb) increments to test packages labeled 1 L (33.8 fl oz) that have an MAV of 29 mL (1 fl oz). Also, assume the inspector finds that the weight of 1 L of the liquid is 943 g (2.078 lb). This will result in an MAV/6 value in weight of 4.715 g (0.010 lb):

$$29 \text{ mL}/6 = 4.8 \text{ mL} \qquad (1 \text{ fl oz}/6 = 0.166 \text{ fl oz})$$

$$943 \text{ g}/1000 \text{ mL} = 0.943 \text{ g/mL} \qquad (2.078 \text{ lb}/33.6 \text{ fl oz} = 0.0618 \text{ lb/fl oz})$$

$$4.8 \text{ mL} \times 0.943 \text{ g/mL} = 4.5264 \text{ g} \qquad (0.166 \text{ fl oz} \times 0.0618 \text{ lb/fl oz} = 0.010 \text{ lb})$$

In this example, the 1 g (0.002 lb) scale division is smaller than the MAV/6 value of 4.5264 g (0.010 lb) so the scale is suitable for making a density determination.

- A partial immersion thermometer (or equivalent) with a range of -35 °C to $+50$ °C (30 °F to 120 °F), at least 1 °C (1 °F) graduations, and with a tolerance of ± 1 °C (± 2 °F)
- Volumetric measures

Example: When checking packages labeled in SI units, flask sizes of 100 mL, 200 mL, 500 mL, 1 L, 2 L, 4 L, and 5 L and a 50 mL cylindrical graduate with 1 mL divisions may be used. When checking packages labeled in inch-pound units the use of measuring

flasks and graduates with capacities of gill, half-pint, pint, quart, half-gallon, gallon, and a 2 fl oz cylindrical graduate, graduated to ½ fl dr is recommended.

- Defoaming agents may be necessary for testing liquids such as beer and soft drinks that effervesce or are carbonated. Two such products are Hexanol or Octanol (Capryl Alcohol).

Note: The mention of trade or brand names does not imply that these products are endorsed or recommended by the U.S. Department of Commerce over similar products commercially available from other manufacturers.

- Bubble level at least 15.24 cm (6 in) in length
- Stopwatch

Test Procedure

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection. Select a random sample; then use the following procedure to determine lot compliance.
2. Bring the sample packages and their contents to the reference temperature as specified in Table 3-1. “Reference Temperatures for Liquids.” To determine if the liquid is at its reference temperature, immerse the thermometer in the liquid before starting the test. Verify the temperature again immediately after the flask and liquid is weighed. If the product requires mixing for uniformity, mix it before opening in accordance with any instructions specified on the package label. Shaking liquids, such as flavored milk, often entraps air that will affect volume measurements, so use caution when testing these products. Often, less air is entrapped if the package is gently rolled to mix the contents.
3. For milk, select a volumetric measure equal to or one size smaller than the label declaration. For all other products, select a volumetric measure that is one size smaller than the label declaration. For example, if testing a 1 L bottle of juice or a soft drink, select a 500 mL volumetric measure.

(Amended 2004)

Note: When determining the density of milk, if the product from the first container does not fill the volumetric measure to the nominal capacity graduation, product may be added from another container as long as product integrity is maintained (i.e., brand, identity, lot code, and temperature).

4. Prepare a clean volumetric measure to use according to the following procedures:
 - Because flasks are ordinarily calibrated on a “to deliver” basis, they must be “wet down” before using. Immediately before use, fill the volumetric flask(s) or graduate with water. The water should be at the reference temperature of the product being tested. Fill the flask(s) with water to a point slightly below the top graduation on the neck. The flask should be emptied in 30 seconds (± 5 seconds). Tilt the flask gradually so the flask walls are splashed as little as possible **as the flask** is emptied. When the main flow stops, the flask should be nearly inverted. Hold the flask in this position for 10 seconds more and touch off the drop of water that adheres to the tip. If necessary, dry the outside of the flask. The flask or graduate is then ready to fill with liquid from a package. This is called the “wet down” condition.

Note: When using a volumetric measure that is calibrated “to contain,” the measure must be dry before each measurement.

- If the liquid effervesces or foams when opened or poured (such as carbonated beverages), add two drops of a defoaming agent to the bottom of the volumetric measure before filling with the liquid. If working with a carbonated beverage, make all density determinations immediately upon placing the product into the standard. This reduces the chance of volume changes occurring from the loss of carbonization.
 - Before making additional measurements of a liquid, use water to wash or rinse and prepare the volumetric measure. Between each two measurements of liquid from the sample packages, prepare the volumetric measure as described above, dry the outside of the flask, and drain the volumetric measure as described in earlier paragraphs of this section, as appropriate.
5. If the flask capacity is equal to the labeled volume, pour the liquid into the volumetric measure tilting the package to a nearly vertical position. If the flask capacity is smaller than the package’s labeled volume, fill the flask to its nominal capacity graduation. If conducting a volumetric test, drain the container into the volumetric measure for 1 minute after the stream of liquid breaks into drops.
 6. Position the volumetric measure on a level surface at eye level. For clear liquids, place a material of some dark color outside the flask immediately below the level of the meniscus. Read the volume from the lowest point of the meniscus. For opaque liquids, read volume from the center top rim of the liquid surface.
 7. Use the gravimetric procedure to determine the volume if the limit specified for the difference in density is not exceeded.
 - Select a volumetric measure equal to or one size smaller than the labeled volume (depending on the product) and prepare it as described in step 4 of this section. Then determine and record its empty weight.
 - Determine acceptability of the liquid density variation, using two packages selected for tare according to Section 2.3. “Basic Test Procedure – Tare Procedures” as follows:
 - Determine the gross weight of the first package.
 - Pour the liquid from the first package into a volumetric measure exactly to the nominal capacity marked on the neck of the measure.
 - Weigh the filled volumetric measure and subtract its empty weight to obtain the weight of the liquid. Determine density by dividing the weight of the liquid by the capacity of the volumetric measure.
 - Determine the weight of the liquid from a second package using the same procedure.
 - If the difference between the densities of the two packages exceeds one division, use the volumetric procedure in Section 3.3. “Volumetric Test Procedure for Liquids.”

How is “nominal gross weight” determined?

Determine the “nominal gross weight” as follows:

1. Determine the Average Used Dry Tare Weight of the sample according to provisions of Section 2.3. “Basic Test Procedure – Tare Procedures.”
2. Calculate the Average Product Density by adding the densities of the liquid from the two packages and dividing the sum by two.
3. Calculate the “nominal gross weight” using the following formula if the flask capacity is equal to the labeled volume:

Nominal Gross Weight = (Average Product Density [in weight units]) + (Average Used Dry Tare Weight)

Note: If the flask size is smaller than the labeled volume, the following formula is used:

Nominal Gross Weight = (Average Product Density x [Labeled Volume/Flask Capacity]) + (Average Used Dry Tare Weight)

How are the errors in the sample determined?

1. Weigh the remaining packages in the sample.

Subtract the nominal gross weight from the gross weight of each package to obtain package errors in terms of weight. All sample packages are compared to the nominal gross weight.

2. To convert the average error or package error from weight to volume, use the following formula:

$$\text{Package Error in Volume} = \frac{\text{Package Error in Weight}}{\text{Average Product Density Per Volume Unit of Measure}}$$

Evaluation of Results

Follow the procedures in Chapter 2, Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

3.3. Volumetric Test Procedure for Liquids

How is the volume of liquid contained in a package determined volumetrically?

Follow steps 1 through 6 in Section 3.2. “Gravimetric Test Procedure for Liquids” for each package in the sample.

How are the errors in the sample determined?

Read the package errors directly from the graduations on the measure. The reference temperature must be maintained within ± 2 °C (± 5 °F) for the entire sample.

Evaluation of Results

Follow the procedures in Chapter 2, Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

3.4. Other Volumetric Test Procedures

What other methods can be used to determine the net contents of packages labeled by volume?

Depending on how level the surface of the commodity is, use one of two headspace test procedures. Use the first headspace test procedure to determine volume where the liquid has a smooth surface (e.g., oils, syrups, and other viscous liquids). Use the second procedure to determine volume where the commodity does not have a smooth surface (e.g., mayonnaise and salad dressing).

Test Procedure

Before conducting any of the following volumetric test procedures follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following procedure to determine lot compliance.

Test Equipment

- Micrometer depth gage (ends of rods fully rounded) 0 mm to 225 mm (0 in to 9 in) or longer
- Level (at least 15 cm (6 in) in length)
- Laboratory pipets and/or buret
 - Class A 500 mL buret that conforms to ASTM E287-~~94~~ **2(2007)**, “Standard Specification for Laboratory Glass Graduated Burets”
 - Class A Pipets, calibrated “to deliver” that conform to ASTM E969-~~95-02~~ **(2007)**, “Standard Specification for Glass Volumetric (Transfer) Pipets”
- Volumetric measures
- Water
- Rubber bulb syringe
- Plastic disks that are 3 mm ($\frac{1}{8}$ in) thick with diameters equal to the seat diameter or larger than the brim diameter of each container to be tested. The diameter tolerance for the disks is 50 μm (± 0.05 mm [± 0.002 in]). The outer edge should be smooth and beveled at a 30° angle with the horizontal to 800 μm (0.8 mm [$\frac{1}{32}$ in]) thick at the edge. Each disk must have a 20 mm ($\frac{3}{4}$ in) diameter hole through its center and a series of 1.5 mm ($\frac{1}{16}$ in) diameter holes 25 mm (1 in) **apart around the periphery of the disk and 3 mm ($\frac{1}{8}$ in) from the outer edge. All edges must be smooth.**
- Stopwatch

- **Partial immersion thermometer (or equivalent) with a range of $-35\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ ($30\text{ }^{\circ}\text{F}$ to $120\text{ }^{\circ}\text{F}$), at least $1\text{ }^{\circ}\text{C}$ ($1\text{ }^{\circ}\text{F}$) graduations, and with a tolerance of $\pm 1\text{ }^{\circ}\text{C}$ ($\pm 2\text{ }^{\circ}\text{F}$)**

How is the volume of oils, syrups, and other viscous liquids that have smooth surfaces determined?

1. Make all measurements on a level surface.
2. Bring the temperature of both the liquid and the water to be used to measure the volume of the liquid to the reference temperature specified in Table 3-1. “Reference Temperatures for Liquids.” **Verify with a thermometer that product has maintained the reference temperature.**
3. Measure the headspace of the package at the point of contact with the liquid using a depth gauge with a fully rounded, rather than a pointed, rod end. If necessary, support the package to prevent the bottom of the container from distorting.
4. Empty, clean, and dry the package.
5. Refill the container with water measured from a volumetric standard to the original liquid headspace level measured in step 3 of this section until the water touches the depth gauge.
6. Determine the amount of water used in step 5 of this section to obtain the volume of the liquid and calculate the “package error” based on that volume.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results,” to determine lot conformance.

3.5. Mayonnaise and Salad Dressing

Volumetric Headspace Test Procedure

Use the volumetric headspace procedure described in this section to determine volume when the commodity does not have a smooth surface (e.g., mayonnaise, salad dressing, and other water immiscible products without a level liquid surface). The procedure guides the inspector to determine the amount of headspace above the product in the package and the volume of the container. Determine the product volume by subtracting the headspace volume from the container volume. Open every package in the sample.

1. Make all measurements on a level surface.
2. Bring the temperature of both the commodity and the water used to measure the volume to the appropriate temperature designated in Table 3-1. “Reference Temperatures for Liquids.”
3. Open the first package and place a disk larger than the package container opening over the opening.
4. Measurement Procedure
 - Deliver water from a flask (or flasks), graduate, or buret, through the central hole in the disk onto the top of the product until the container is filled. If it appears that the contents of the flask may overflow the container, do not empty the flask. Add water until all of the air in the container has

been displaced and the water begins to rise in the center hole of the disk. Stop the filling procedure when the water fills the center disk hole and domes up slightly due to the surface tension. Do not add additional water after the level of the water dome has dropped.

- If the water dome breaks on the surface of the disk, the container has been overfilled and the test is void; dry the container and start over.
5. To obtain the headspace capacity, record the volume of water used to fill the container and subtract 1 mL (0.03 fl oz), which is the amount of water held in the hole in the disk specified.
 6. Empty, clean, and dry the package container.
 7. Repeat steps 4 and 5 of this section. Refill the package container with water measured from a volumetric measure to the maximum capacity of the package, subtract 1 mL (0.03 fl oz), and record the amount of water used as the container volume; and
 8. From the container volume determined in step 7 of this section, subtract the headspace capacity in step 5 of this section to obtain the measured volume of the product and calculate the “package error” for that volume where “package error” equals labeled volume minus the measured volume of the product.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.”

3.6. Goods Labeled by Capacity – Volumetric Test Procedure

What type of measurement equipment is needed to perform the headspace test procedures?

Use the test equipment in Section 3.4. “Other Volumetric Test Procedures” (except for the micrometer depth gage) to perform these test procedures.

How is it determined if goods labeled by capacity meet the average and individual requirements?

Before conducting any of the following volumetric test procedures, refer to Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.

1. Make all measurements on a level surface.
2. When testing goods labeled by capacity, use water at a reference temperature of $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ ($68\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$).
3. Select a sample container and place a disk larger than the container opening over the opening.
4. Measurement Procedure
 - Add water to the container using flask (or flasks), graduate, or buret corresponding to labeled capacity of the container. If it appears that the contents of the flask may overflow the container, do not empty the flask. Add water until all of the air in the container has been displaced and the

water begins to rise in the center hole of the disk. Stop filling the container when the water fills the center disk hole and domes up slightly due to the surface tension.

- If the water dome breaks on the surface of the disk, the container has been overfilled and the test is void; dry the container and start over.
 - Record the amount of water used to fill the container and subtract 1 mL (0.03 fl oz) (this is the amount of water held in the hole in the disk specified) to obtain the total container volume.
5. Test the other containers in the sample according to the procedures in step 4 of this section.
 6. To determine package errors, subtract the total container volume obtained in steps 4 and 5 of this section from the labeled capacity of the container.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot compliance.

3.7. Pressed and Blown Glass Tumblers and Stemware

What requirements apply to pressed and blown glass tumblers and stemware?

This handbook provides a tolerance to the labeled capacity of glass tumblers and stemware. The average requirement does not apply to the capacity of these products. See Table 3-2. “Allowable Differences for Pressed and Blown Glass Tumblers and Stemware.”

How is it determined if tumblers and stemware meet the individual package requirement?

Follow **Section 2.3**. “Basic Test Procedure – Define the Inspection Lot” and determine which sampling plan to use in the inspection, select a random sample, and then use the following volumetric test procedure to determine container capacity and volume errors.

What type of measuring equipment is needed to perform the test procedures?

Use the equipment specified in Section 3.4. “Other Volumetric Test Procedures,” (except for the micrometer depth gage) to perform these test procedures.

What are the steps of the test procedure?

Follow steps 1 through 6 in Section 3.6. “Goods Labeled by Capacity – Volumetric Test Procedure.”

How is it determined if the samples conform to the allowable difference?

Compare the individual container error with the allowable difference that applies in Table 3-2. “Allowable Differences for Pressed and Blown Glass Tumblers and Stemware.” If a package contains more than one container, all of the containers in the package must meet the allowable difference requirements in order for the package to pass.

Table 3-2. Allowable Differences for Pressed and Blown Glass Tumblers and Stemware	
Unit of measure	
If the capacity in metric units is:	Then the allowable difference is:
200 mL or less	± 10 mL
More than 200 mL	± 5 % of the labeled capacity
If the capacity in inch-pound units is:	Then the allowable difference is:
5 fl oz or less	± ¼ fl oz
More than 5 fl oz	± 5 % of the labeled capacity

Evaluation of Results

Count the packages in the sample with volume errors greater than the allowable difference and compare the resulting number with the number given in Column 3.

- If the number of containers in the sample with errors exceeding the allowable difference exceeds the number allowed in Column 3, the lot fails.
- If the number of packages with errors exceeding the allowable difference is less than or equal to the number in Column 3, the lot passes.

Note: The average capacity error is not calculated because the lot passes or fails based on the individual volume errors. Act on the individual units containing errors exceeding the allowable difference individually even though the lot passes the requirement.

3.8. Volumetric Test Procedure for Paint, Varnish, and Lacquers – Non-aerosol

How is the volume of paint, varnish, and lacquers contained in a package determined?

Use one of three different test methods depending upon the required degree of accuracy and the location of the inspection. The procedures include both retail and in-plant audits and a “possible violation” method, which is designed, for laboratory or in plant use because of cleanup and product collection requirements. The procedures are suitable to use with products labeled by volume and packaged in cylindrical containers with separate lids that can be resealed.

Equipment

- A scale that meets the requirements in Section 2.2. “Measurement Standards and Test Equipment”
- Volumetric measures
- Micrometer depth gage (ends of rods fully rounded), 0 mm to 225 mm (0 in to 9 in)
- Diameter (Pi) tape measure, 5 cm to 30 cm (2 in to 12 in)
- Spanning bar, 2.5 cm by 2.5 cm by 30 cm or (1 in by 1 in by 12 in)
- Rule, 30 cm (12 in)

- Paint solvent or other solvent suitable for the product being tested
- Cloth, 30 cm (12 in) square
- Wood, 5 cm (2 in) thick, by 15 cm (6 in) wide, by 30 cm (12 in) long
- Rubber mallet
- Metal disk, 6.4 mm ($\frac{1}{4}$ in) thick and slightly smaller than the diameter of package container bottom.
- Rubber spatula
- Level at least 15 cm (6 in) in length
- Micrometer (optional)
- Stopwatch

What test procedure is used to conduct a retail audit test?

Conduct a retail audit using the following test procedure that is suitable for checking cylindrical containers up to 4 L (1 gal) in capacity. Use step 2 in the retail audit test procedure with any size container, but step 3 must be used for containers with capacities of 4 L (1 gal). The method determines the volume of a single can in the sample selected as most likely to contain the smallest volume of product. Do not empty any containers because only their critical dimensions are being measured.

How accurate is the dimensional test procedure?

The configuration of the bottom of the can, paint clinging to the lid, and slight variations in the wall and label thicknesses of the paint container may produce an uncertainty estimated to be at least 0.6 % in this auditing procedure. Therefore, this method is recommended solely to eliminate from more rigorous testing those packages that appear to be full measure. Use the violation procedures when the volume determined in step 10 is less than the labeled volume or in any case where short measure is suspected.

What worksheets make data recording easier?

Use the following format to develop worksheets to perform audits and determine the volume when checking paint. Follow the procedure and it will indicate the column in which the various measurements made can be recorded.

Example: Audit Worksheet for Checking Paint – Add additional rows as needed										
1. Can Height	Can Diameter				6. Avg Liquid Diameter	7. Avg Liquid Level	8. Avg Container Depth	9. Avg Liquid Depth	10. Volume*	
	2. Top	3. Middle	4. Bottom	5. Average						

*10. Volume = 0.7854 x 6 x 6 x 9

Note: When the following instructions require recording a measurement, refer to the numbered columns in the “Audit Worksheet for Checking Paint“ shown above.

How is a retail audit test performed?

1. Select a random sample. A tare sample is not needed.
2. For containers less than 4 L or (1 gal): measure the outside diameter of each container near its middle to the closest 0.02 mm (0.001 in). Use a diameter tape measure to record the measurements in Column 3. Place the containers on a level surface and using the micrometer depth gage, record their heights in Column 1 on the worksheet. If the range of outside diameters exceeds 0.125 mm (0.005 in) or the range in heights exceeds 1.58 mm (0.062 5 in), do not use this procedure. If the ranges are within the specified limits, weigh all cans in the sample, select the container with the lightest gross weight, and remove its lid. Continue with step 4 below.
3. For 4 L (1 gal) containers: gross weigh each package in the sample. Select the package with the lightest gross weight and remove its lid.
4. Use a direct reading diameter tape measure to measure the outside diameter of the selected container near its top, middle (already measured if step 2 was followed), and bottom to the closest 0.02 mm (0.001 in). Record these measurements in Columns 2, 3, and 4. Add the three diameter values and divide by three to obtain the average diameter and record this value in Column 5.
5. If a micrometer is available, measure the wall and the paper label thickness of the container; otherwise, assume the wall and label thicknesses given in Table 3-3. “Thickness of Paint Can Walls and Labels” below:

Table 3-3. Thickness of Paint Can Walls and Labels	
Can Size	Wall Thickness
4 L (1 gal)	250 µm (0.25 mm) [0.010 in]
2 L (½ gal)	250 µm (0.25 mm) [0.010 in]
1 L (1 qt)	230 µm (0.23 mm) [0.009 in]
500 mL (1 pt)	230 µm (0.23 mm) [0.009 in]
250 mL	200 µm (0.20 mm) [0.008 in]
Label Thickness* for all can sizes: 100 µm (0.10 mm) [0.004 in] (*Paper only – ignore labels lithographed directly onto the container)	

Subtract twice the thickness of the wall of the can and paper label from the average can diameter (step 4) to obtain the average liquid diameter. Record the liquid diameter in Column 6.

6. On a level surface, place the container on the circular metal disk that is slightly smaller in diameter than the lower rim of the can so the bottom of the container nests on the disk to eliminate any “sag” in the bottom of the container.
7. Place the spanning bar and depth gage across the top of the paint can and mark the location of the spanning bar on the rim of the paint container. Measure the distance to the liquid level, to the nearest 20 μm (0.02 mm) (0.001 in), at three points in a straight line. Take measurements at points approximately 1 cm ($\frac{3}{8}$ in) from the inner rim for cans 12.5 cm (5 in) in diameter or less (and at 1.5 cm [$\frac{1}{2}$ in] from the rim for cans exceeding 12.5 cm [5 in]) in diameter and at the center of the can. Add the three readings and divide by three to obtain the average distance to the liquid level in the container. Record the average distance to the liquid level in Column 7.
8. Measure the distance to the bottom of the container at three points in a straight line in the same manner as outlined in step 7. Add the three readings and divide by three to obtain the average height of the container and record it in Column 8.
9. Subtract the average distance to the liquid level (Column 7) from the average height of the container (Column 8) to obtain the average height of the liquid column and record it in Column 9.
10. Determine the volume of paint in the container by using the following formula:

$$\text{Volume} = 0.7854 D^2 H$$

Where D = average liquid diameter (Column 6) and H = average liquid height (Column 9)

11. Record this value in Column 10. If the calculated volume is less than labeled volume, go to the Violation Procedure.

How is an in-plant audit conducted?

Use the following procedures to conduct an in-plant audit inspection. This method applies to a container that probably contains the smallest volume of product. Duplicate the level of fill with water in a can of the same dimensions as the one under test. Use this method to check any size of package if the liquid level is within the measuring range of the depth gage. If any paint is clinging to the sidewall or lid, carefully scrape the paint into the container using a rubber spatula.

1. Follow steps 1 through 6 of the retail audit test.
2. Place the spanning bar and depth gage across the top of the paint can. Measure the liquid level at the center of the surface and record the level in Column 7.

3. Select an empty can with the same bottom configuration as the container under test and with a diameter and height equal to that of the container under test within plus or minus the following tolerances:
 - a. For 500 mL or (1 pt) cans – within 25 μm (0.025 mm) (0.001 in)
 - b. For 1 L or (1 qt) cans – within 50 μm (0.05 mm) (0.002 in)
 - c. For 2 L or ($\frac{1}{2}$ gal) cans – within 75 μm (0.075 mm) (0.003 in)
 - d. For 4 L or (1 gal) cans – within 100 μm (0.1 mm) (0.004 in)

Set the empty can on a level work surface with a circular metal disk that is slightly smaller in diameter than the bottom can rim underneath the can to eliminate sag. Set up the spanning bar and depth gage as in step 2 above. Fill the container with water from a volumetric measure of the same volume as the labeled volume. Measure the distance to the liquid level at the center of the container and record this level in Column 7 below the reading recorded in step 2. If this distance is equal to or greater than the distance determined in step 2, assume that the package is satisfactory. If the distance is less than the distance determined in step 2, the product may be short measure. Use the “Violation Procedure” in the next section when the audit test indicates that short measure is possible.

Violation Procedure

How is it determined if the containers meet the package requirements?

Use the following method if the liquid level is within the measuring range of the micrometer. The first step is to follow the “Basic Test Procedure” in Section 2.3. Define the inspection lot to determine which “Category A” sampling plan to use; select a random sample; and then use the following procedure. The steps noted with an (*) are required if there is paint adhering to the lid and it cannot be removed by scraping into the can.

1. Do not shake or invert the containers selected as the sample. Determine the gross weight of these packages and record in Column 2 of the “Example Worksheet for Possible Violation in Checking Paint” below.

Example Worksheet for Possible Violation in Checking Paint – Add additional rows as needed								
1. Labeled Volume	2. Gross Weight	3. Lid Paint Weight (Wet - Dry)	4. Liquid Level	5. Tare	6. Water Volume	7. Net Wt. = 2 - 5	8. Weight of Labeled Volume = 7 x 1 ÷ 6	9. Package Volume = 6 + [(3 ÷ 7) x 6]

Record the labeled volume of the first tare sample package in Column 1 of the worksheet. Use a circular metal disk to eliminate can “sag” and remove the lid. If paint clings to the lid of the container, scrape it off with a spatula.

- 2.* If paint that adheres to the lid cannot be completely removed by scraping the paint into the can, determine the weight of the lid plus any adhering paint. Clean the paint lid with solvent and weigh again. Subtract the clean lid weight from the lid weight with paint to determine the weight of the paint adhering to the lid. Record this weight in Column 3.

3. Place the spanning bar and depth gage across the top of the paint can. Mark the location of the spanning bar on the rim of the paint container. Measure the distance to the liquid level at the center of the container to the nearest 20 μm (0.02 mm) (0.001 in). Record the distance in Column 4.
4. Empty and clean the sample container and lid with solvent; dry and weigh the container and lid. Record the tare weight in Column 5.
5. Set up the container in the same manner as in step 1.
6. Place the spanning bar at the same location on the rim of the paint container as marked in step 3. With the depth gage set as described in step 3, deliver water into the container in known amounts until the water reaches the same level occupied by the paint as indicated by the depth gage. Record this volume of water (in mL or fl oz) in Column 6 of the worksheet. This is the volume occupied by the paint in the container. Follow steps, 7a, 8a, and 9a if scraping does not remove the paint from the lid. In order to determine if gravimetric testing can be used to test the other packages in the sample, follow only steps 7, 8, and 9 when no paint adheres to the lid.
7. Subtract the weight of the container (Column 5) from the gross weight (Column 2) to arrive at the net weight of paint in the selected container. Record the net weight in Column 7 of the worksheet.

7a* Subtract the weight of the container (Column 5) and the weight of product on the lid (Column 3) from the gross weight (Column 2) to arrive at the net weight of paint in the container. Record in Column 7 (excluding the weight of the paint on the lid).

8. Calculate the weight of the labeled volume of paint (for the first package opened for tare = on the lid).

$$\text{net weight (Column 7) x labeled volume (Column 1) } \div \text{ volume of paint in can (Column 6)}$$

Record this value in Column 8.

8a* Calculate the package volume =

$$\frac{\text{volume in can (Column 6) + (lid paint weight [Column 3] x volume in can [Column 6] / net weight [Column 7])}}{\text{volume in can [Column 6] / net weight [Column 7]}}$$

Record it in Column 9 of the worksheet.

9. Calculate the package error. Use the following formula if paint does not adhere to the lid:

$$\text{Package error} = (\text{Column 6 value}) - (\text{labeled volume})$$

9a* Use the following formula if paint does adhere to the lid and will not come off by scraping.

$$\text{Package error} = (\text{Column 9 value}) - (\text{labeled volume})$$

10. Repeat steps 1 through 9 for the second package chosen for tare.

When can a gravimetric procedure be used?

A gravimetric procedure is used if the weights of the labeled volume for the first two packages do not

differ from each other by more than one division on the scale (if they meet this criterion, check the rest of the sample gravimetrically and record in Column 8).

How is “nominal gross weight“ determined?

Determine the “Nominal Gross Weight“ for use with Chapter 2, Section 2.3. “Basic Test Procedure” as follows:

The nominal gross weight equals the sum of the average weight of the labeled volume (average of values recorded in Column 8) plus the average tare (average of values recorded in Column 3) for the packages selected for tare. Note that the weight of a given volume of paint often varies considerably from container to container; therefore, volumetric measurements may prove necessary for the entire sample.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedures – Evaluating Results” to determine lot conformance.

3.9. Testing Viscous Materials – Such As Caulking Compounds and Pastes

How are viscous materials such as caulking compounds and paste tested?

Use the following procedure for any package of viscous material labeled by volume. It is suitable for very viscous materials such as cartridge-packed caulking compounds, glues, pastes, and other similar products. It is best to conduct this procedure in a laboratory using a hood to ventilate solvent fumes. If used in the field, use in a well ventilated area. Except for the special measurement procedures to determine the weight of the labeled volume, this procedure follows the basic test procedure. For each weight of a known volume determination, pack a portion of the packaged product into a pre-weighed cup of known volume (called a “density cup” or “pycnometer”) and weigh. From the weight of the known volume, determine the weight of the labeled volume. Compare the nominal gross weight with the gross weight to determine the package error.

What type of measurement equipment is needed to test packages of caulk, pastes, and glues?

- A scale that meets the requirements in Section 2.2. “Measurement Standards and Test Equipment.”
- Pycnometer, a vessel of known volume used for weighing semifluids. The pycnometer can be bought or made. If it is made, refer to it as a “density cup.” To make a 150 mL or 5 fl oz density cup, cut off the lip of a 150 mL beaker with an abrasive saw and grind the lip flat on a lap wheel. The slicker plate is available commercially. Calibrate the density cup gravimetrically with respect to the contained volume using the procedure in ASTM E42—~~9401~~**(2007)**, “Standard Practice for Calibration of Laboratory Volumetric Apparatus.”
- Appropriate solvents (water, Stoddard solvent, kerosene, alcohol, etc.)
- Caulking gun (for cartridge packed products)

How is a pycnometer prepared for use?

Before using, weigh and calibrate the pycnometer (or the density cup and slicker plate) with respect to volume (mL or fl oz). If applicable, comply with any special instructions furnished by the manufacturer to calibrate a pycnometer that has not been calibrated. It is not necessary to reweigh or recalibrate for each test; however, mark the pieces of each unit to prevent interchange of cups and slicker plates.

How is it determined if the containers meet the package requirements?

1. ~~First, Follow the “Basic Test Procedure” in~~ Section 2.3. **“Basic Test Procedure.** – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then, use the following procedure to determine lot compliance.
2. Weigh a calibrated pycnometer and slicker plate and record as “pycnometer weight” and record this weight and the volume of the pycnometer.
3. Determine the gross weight of the first package and record the weight value. Open the package and transfer the product to the pycnometer by filling it to excess. Use a caulking gun to transfer product from the caulking cartridges. If using a pycnometer, cover it with a lid and screw the cap down tightly. Excess material will be forced out through the hole in the lid, so the lid must be clean. If using a density cup, place the slicker plate over $\frac{3}{4}$ of the cup mouth, press down and slowly move the plate across the remainder of the opening. With the slicker plate in place, clean all the exterior surfaces with solvent and dry.
4. Completely remove the product from the package container; clean the package container with solvent; dry and weigh it to determine the tare weight.
5. Weigh the filled pycnometer or filled density cup with slicker plate and record this weight. Subtract the weight of the empty pycnometer from the filled weight to determine the net weight of the product contained in the pycnometer and record this weight.
6. Clean the pycnometer and repeat steps 3, 4, and 5 for the second package in the tare sample.

Determine acceptability of the density variation on the two packages selected for tare. If the difference between the densities of both packages exceeds one division of the scale, do not use the gravimetric procedure to determine the net quantity of contents. Instead, use the procedure in steps 9 and 10.

Note: If the gravimetric procedure can be used, perform steps 8 and 10.

7. Calculate the weight of product corresponding to the labeled volume of product according to the following formula:

$$\text{Weight of Product in Pycnometer} \div \text{Pycnometer Volume} = \text{Product Density}$$

8. Test each package individually by determining the product density in each package using the pycnometer and record the gross, tare, and net weight of each package. Subtract the weight of the labeled volume (determined for each package) from the net weight of product to arrive at each individual package error in units of weight.
9. Convert the package errors to units of volume using the following formula:

$$\text{Package Error (volume)} = \frac{(\text{Package Error [weight]} \times \text{Pycnometer Volume})}{(\text{Weight of Product in Pycnometer})}$$

10. Record the package errors on the report form using an appropriate unit of measure.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluation Results” to determine lot conformance.

3.10. Peat Moss

How are packages of peat and peat moss labeled by compressed volume tested?

Measure the dimensions of the compressed material to determine if it contains the labeled quantity.

How are packages of peat and peat moss labeled by uncompressed volume tested?

Use the following method to test peat moss sold using an uncompressed volume as the declaration of content. The procedure is based on ASTM D2978-~~90~~03, “Standard Method of Test for Volume of Processed Peat Materials.”

Equipment

- 12.7 mm (or ½ in) sieve.
- Use one of the following measures as appropriate for the package size. (Refer to Table 3-4. “Specifications for Test Measures for Mulch and Soils” for additional information on test measure construction.)
 - 28.3 L (1 ft³) measure with inside dimensions of 30.4 cm (12 in) by 30.4 cm (12 in) by 30.4 cm (12 in). Mark the inside of the measure with horizontal lines every 1.2 cm (½ in) so that package errors can be directly determined.
 - 100 L (3.5 ft³) measure with inside dimensions of 50 cm (19.68 in) by 50 cm (19.68 in) by 40 cm (15.74 in). The inside of the measure should be marked with horizontal lines every 1.2 cm (½ in) so that package errors can be directly determined.
- Straight edge, 50.8 cm (20 in) in length.
- Sheet for catching overflow of material.
- Level (at least 15.24 cm (6 in) in length).

How is it determined if the packages meet the requirements in this handbook?

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then, use the following procedure to determine lot compliance.

2. Open each package in turn, remove the contents, and pass them through the sieve directly into the measuring container (overfilling it). Use this method for particulate solids (such as soils or other garden materials) labeled in cubic dimensions or dry volume. Some materials may not pass through the sieve for peat moss; in these instances, separate the materials by hand (to compensate for packing and settling of the product after packaging) before filling the measure.

Note: Separated material (product not passing through the sieve) must be included in the product volume.

Shake the measuring container with a rotary motion at one rotation per second for 5 seconds. Do not lift the measuring container when rotating it. If the package contents are greater than the measuring container capacity, level the measuring container with a straight edge using a zigzag motion across the top of the container. Empty the container. Repeat the filling operations as many times as necessary, noting the partial fill of the container for the last quantity delivered using the interior horizontal markings as a guide. Record the total volume.

3. To compute each package error, subtract the labeled quantity from the total volume and record it.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

3.11. Mulch and Soils Labeled by Volume

What products are defined as mulch and soil?

- Mulch is defined as “any product or material except peat or peat moss that is advertised, offered for sale, or sold for primary use as a horticultural, above-ground dressing, for decoration, moisture control, weed control, erosion control, temperature control, or other similar purposes.”
- Soil is defined as “any product or material, except peat or peat moss that is advertised or offered for sale, or sold for primary use as a horticultural growing media, soil amendment, and/or soil replacement.”

What type of measurement equipment is needed to test packages of mulch and soil?

- A test measure appropriate for the package size that meets the specifications for test measures in Table 3-4. “Specifications for Test Measures for Mulch and Soils.”

Table 3-4. Specifications for Test Measures for Mulch and Soils					
Nominal Volume of Test Measure	Interior Wall Dimensions*			Marked Intervals on Interior Walls ***	Volume Equivalent of Marked Intervals
	Length	Width	Height**		
30.2 L (1.07 ft ³) for testing packages that contain less than 28.3 L (1 ft ³ or 25.7 dry qt)	203.2 mm (8 in)		736.6 mm (29 in)	<u>12.7 mm</u> <u>(½ in)</u>	524.3 mL (32 in ³)
28.3 L (1 ft ³)	<u>304.8 mm (12 in)</u>				1 179.8 mL (72 in ³)
56.6 L (2 ft ³)	<u>406.4 mm</u> <u>(16 in)</u>	<u>228.6 mm</u> <u>(9 in)</u>	<u>1219.2 mm</u> <u>(48 in)</u>		
84.9 L (3 ft ³)					
<p>Measures are typically constructed of <u>12.7 mm</u> 1.27 cm (½ in) marine plywood. A transparent sidewall is useful for determining the level of fill, but must be reinforced if it is not thick enough to resist distortion. If the measure has a clear front, place the level gage at the back (inside) of the measure so that the markings are read over the top of the mulch.</p> <p>Notes: * Other interior dimensions are acceptable if the test measure approximates the configuration of the package under test and does not exceed a base configuration of the package cross-section. ** The height of the test measure may be reduced, but this will limit the volume of the package that can be tested. *** When lines are marked in boxes, they should extend to all four sides of the measure if possible to improve readability. It is recommended that a line indicating the MAV level also be marked to reduce the possibility of reading errors when the level of the mulch is at or near the MAV.</p>					

- Drop cloth/polyethylene sheeting for catching overflow of material.
- Level (at least 15 cm [6 in] in length).

How is it determined if the packages meet the package requirements?

Use the following procedure:

1. Follow the Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection, select a random sample, then use the following procedure to determine lot conformance.
2. Open each package in turn. Empty the contents of the package into a test measure and level the contents by hand. Do not rock, shake, drop, rotate, or tamp the test measure. Read the horizontal marks to determine package net volume.

Note: Some types of mulch are susceptible to clumping and compacting. Take steps to ensure that the material is loose and free flowing when placed into the test measure. Gently roll the bag before opening to reduce the clumping and compaction of material.

3. Exercise care in leveling the surface of the mulch/soil and determine the volume reading from a position that minimizes errors caused by parallax.

How are package errors determined?

Determine package errors by subtracting the labeled volume from the package net volume in the measure. Record each package error.

$$\text{Package Error} = \text{Package Net Volume} - \text{Labeled Volume}$$

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

Note: In accordance with Appendix A, Table 2-10. Exceptions to the Maximum Allowable Variations for Textiles, Polyethylene Sheeting and Film, Mulch and Soil Labeled by Volume, Packaged Firewood and Packages Labeled by Count with Fewer than 50 Items, apply an MAV of 5 % of the declared quantity to mulch and soil sold by volume. When testing mulch and soil with a net quantity in terms of volume, one package out of every 12 in the sample may exceed the 5 % MAV (e.g., one in a sample of 12 packages; two in a sample of 24 packages; four in a sample of 48 packages.) However, the sample must meet the average requirement of the “Category A” Sampling Plan.

3.12. Ice Cream Novelties

Note: The following procedure can be used to test packaged products that are solid or semisolid and that will not dissolve in, mix with, absorb, or be absorbed by the fluid into which the product will be immersed. For example, ice cream labeled by volume can be tested using ice water or kerosene as the immersion fluid.

How are ice cream novelties inspected to see if the labeled volume meets the package requirements?

Use the following volume displacement procedure that uses a displacement vessel specifically designed for ice cream novelties such as ice cream bars, ice cream sandwiches, or cones. The procedure determines the volume of the novelty by measuring the amount of water displaced when the novelty is submerged in the vessel. Two displacements per sample are required to subtract the volume of sticks or cups.

The procedure first determines if the densities of the novelties are the same from package to package (in the same lot) so that a gravimetric test can be used to verify the labeled volume. If a gravimetric procedure is used, compute an average weight for the declared volume from the first two packages and weigh the remainder of the sample. If the gravimetric procedure cannot be used, use the volume displacement procedure for all of the packages in the sample.

Equipment

- A scale that meets the requirements in Section 2.2. “Measurement Standards and Test Equipment.”
- Volumetric measures

Displacement vessel with dimensions that is appropriate for the size of novelties being tested. Figure 3-1. Example of a Displacement Vessel shows an example of a displacement vessel. It includes an interior baffle that reduces wave action when the novelty is inserted and the downward angle of the overflow spout reduces dripping. Other designs may be used.

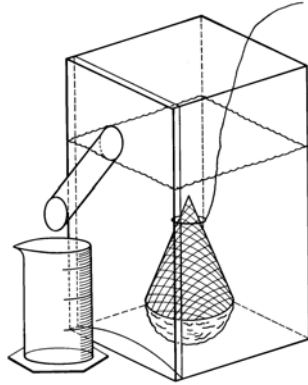


Figure 3-1. Example of a Displacement Vessel

Note: This displacement vessel can be constructed or similar devices may be obtained from any Laboratory Equipment or Science Education suppliers. The U.S. Department of Commerce does not endorse or recommend any particular device over similar commercially available products from other manufacturers.

- Thin wire, clamp, or tongs
- Freezer or ice chest and dry ice
- Single-edged razor or sharp knife (for sandwiches only)
- Ice water/kerosene maintained at 1 °C (33 °F) or below
- Indelible marker (for ice pops only)
- Level, at least 15.24 cm (6 in) in length
- A partial immersion thermometer (or equivalent) with a range of -1 °C to +50 °C (30 °F to 120 °F), at least 1 °C (1 °F) graduations, and with a tolerance of ± 1 °C (± 2 °F)
- A table-top, laboratory-type jack of sufficient size to hold the displacement vessel
- Stopwatch

Test Procedure

Follow the in Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following procedure to determine lot compliance.

1. Maintain the samples at the reference temperature for frozen products that is specified in Table 3-1. “Reference Temperatures for Liquids” (i.e., -18 °C [0 °F]). Place the samples in the freezer or ice chest until they are ready to be tested, and then remove packages from the freezer one at a time.
2. According to the type of novelty, prepare the sample products as follows:
 - Ice-pop. Mark on the stick(s) with the indelible marker the point to which the pop will be submerged in the ice water. (After the ice-pop contents have been submerged, remove the novelty to determine the volume of the stick.)
 - Cone. Make a small hole in the cone below the ice cream portion to allow air to escape.
 - Sandwich. Determine whether the declared volume is (a) the total volume of the novelty (that is, including the cookie portion) or (b) the volume of the ice-cream-like portion only. If the declared volume is the volume of only the ice-cream-like portion, shave off the cookie with a razor or knife, leaving some remnants of cookie to ensure that no ice cream is accidentally shaved off. Work quickly, and return the novelty to the freezer before the sandwich softens.
 - Cup. Remove the cap from the cup. (After the cup and novelty contents have been submerged, remove the novelty from the cup to determine the volume of the cup.)

How is it determined if the ice cream novelty packages meet the requirements in this handbook?

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following procedure to determine lot compliance.
2. Fill the displacement vessel with ice water until it overflows the spout. Allow it to sit until dripping stops. Raise the displacement vessel as necessary and place the graduate beneath the spout.
3. Remove a package from the freezer, determine its gross weight and record it.
4. Submerge the novelty as suggested until it is below the surface level of the water.
 - Ice-pop. Use a clamp, tongs, or your fingers to hold the stick(s) and submerge the pop to the level marked in step 2 of the Test Procedures.
 - Cone. Shape the wire into a loop, and use it to push the cone, headfirst (ice cream portion first) into the ice water. Do not completely submerge the cone immediately: let water fill the cone through the hole made in step 2 of the Test Procedures before completely submerging the novelty.
 - Sandwich or cup. Skewer the novelty with the thin wire or form a loop on the end of the wire to push the sandwich or ice-cream portion or cup completely below the liquid level.
5. Record the total water volume in the graduate. For a cone or sandwich, record the water volume as the net volume and go to step 7. For ice-pops or cups, record the water volume in the graduate as the gross volume and go to step 6.

6. Refill the displacement vessel with water to overflowing and reposition the empty graduate under the spout.
 - Ice-pop. Melt the ice pop off the stick or sticks. Submerge the stick or sticks to the line marked in step 4. Record the volume of tare material (i.e., stick) by measuring the water displaced into the graduate. The net volume for the ice-pop is the gross volume recorded in step 5 minus the volume of the tare materials in this step. Record this volume as the “volume of novelty.” To determine the error in the package, subtract the labeled quantity from the volume of novelty.
 - Cup. Remove the novelty from the cup. Rinse the cup, and then submerge it in the displacement vessel. Small pinholes in the base of the cup can be made to make submersion easier. Record the volume of water displaced into the graduate by the cup as the volume of tare material. The net volume for the novelty is the gross volume determined in step 5 minus the volume of the tare materials determined in this step. Record this as the net volume of the novelty. To determine the error in the package, subtract the labeled quantity from the volume of novelty.
7. Clean and air-dry the tare materials (sticks, wrappers, cup, lid, etc.). Weigh and record the weight of these materials for the package.
8. Subtract the tare weight from the gross weight to obtain the net weight and record this value.
9. Compute the weight of the labeled volume for the package using the following formula and then record the weight:

$$\text{Product Density} = (\text{weight in item 3}) \div (\text{the total water volume in step 5})$$
$$\text{Weight of labeled volume} = (\text{labeled volume}) \times (\text{Product Density})$$

10. Repeat steps 3 through 9 for a second package.
11. If the weight of the labeled volume in steps 9 and step 10 differ from each other by more than one division on the scale, the gravimetric test procedure cannot be used to test the sample for compliance. If this is the case, steps 2 through 6 for each of the remaining packages in the sample must be used to determine their net volumes and package errors. Then go to evaluation of results.

How is “nominal gross weight“ determined?

1. Use Section 2.3. “Basic Test Procedure – Tare Procedure” to determine the Average Used Dry tare Weight of the sample.
2. Using the weights determined in step 11 calculate the Average Product Weight by adding the densities of the liquid from the two packages and dividing the sum by two.
3. Calculate the “nominal gross weight“ using the formula:

$$\text{Nominal Gross Weight} = \text{Average Product Weight} + \text{Average Used Dry Tare Weight}$$

How are the errors in the sample determined?

1. Weigh the remaining packages in the sample.
2. Subtract the nominal gross weight from the gross weight of each package to obtain package errors in terms of weight.

Note: Compare the sample packages to the nominal gross weight.

3. Follow Section 2.3. “Basic Test Procedure.”

To convert the average error or package error from weight to volume, use the following formula:

$$\text{Package Error in Volume} = (\text{Package Error in Weight}) \div (\text{Product Density})$$

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

3.13. Fresh Oysters Labeled by Volume

What requirements apply to packages of fresh oysters labeled by volume?

Packaged fresh oysters removed from the shell must be labeled by volume. The maximum amount of permitted free liquid is limited to 15 % by weight. Testing the quantity of contents of fresh oysters requires the inspector to determine total volume, total weight of solids and liquid, and the weight of the free liquid.

Equipment

- A scale that meets the requirements in Section 2.2. “Measurement Standards and Test Equipment”
- Volumetric measures
- Micrometer depth gage (ends of rods fully rounded), 0 mm to 228 mm (0 in to 9 in)
- Strainer for determining the amount of drained liquid from shucked oysters. Use as a strainer a flat bottom metal pan or tray constructed to the following specifications:
 - Sides: 5.08 cm (2 in)
 - Area: 1935 cm² (300 in²) or more for each 3.78 L (1 gal) of oysters **(Note: Strainers of smaller area dimensions are permitted to facilitate testing smaller containers.)**

- Perforations:
 - Diameter: 6.35 mm (¼ in)
 - Location: 3.17 cm (1¼ in) apart in a square pattern, or perforations of equivalent area and distribution.

- Spanning bar, 2.54 cm by 2.54 cm by 30.48 cm (1 in by 1 in by 12 in)
- Rubber spatula
- Level, at least 15.24 cm (6 in) in length
- Stopwatch

How is it determined if the containers meet the package requirements?

Follow the Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then, use the following test procedure to determine lot compliance.

1. Determine and record the gross weight of a sample package.
2. Set the container on a level surface and open it. Use a depth gage to determine the level of fill. Lock the depth gauge. Mark the location of the gauge on the package.
3. Weigh a dry 20.32 cm or 30.48 cm (8 in or 12 in) receiving pan and record the weight. Set strainer over the receiving pan.
4. Pour the contents from the container onto the strainer without shaking it. Tip the strainer slightly and let it drain for 2 minutes. Remove strainer with oysters. It is normal for oysters to include mucous (which is part of the product) that will not pass through the strainer, so do not force it.
5. Weigh the receiving pan and liquid and record the weight. Subtract the weight of the dry receiving pan from the weight of pan and liquid to obtain the weight of free liquid and record the value.
6. Clean, dry, and weigh the container and record the tare weight. Subtract the tare weight from the gross weight to obtain the total weight of the oysters and liquid and record this value.
7. Determine and record the percent of free liquid by weight as follows:

$$\text{Percent of free liquid by weight} = [(\text{weight of free liquid}) \div (\text{weight of oysters} + \text{liquid})] \times 100.$$

8. Set up the depth gauge on the dry package container as in step 2. Pour water from the flasks and graduate as needed to re-establish the level of fill obtained in step 2. Add the volumes delivered as the actual net volume for the container and record the value.

Note: Some containers will hold the declared volume only when filled to the brim; they may have been designed for other products, rather than for oysters. If the net volume is short-measure (per step 8), determine if the container will reach the declared volume only if filled to the brim. Under such circumstance, the package net volumes will all be short measure because the container cannot be filled to

the brim with a solid and liquid mixture. A small headspace is required in order to get the lid into the container without losing any liquid.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure” Evaluating Results to determine lot conformance.

3.14. Determining the Net Contents of Compressed Gas in Cylinders

What type of compressed gases may be tested with these procedures?

These procedures are for industrial compressed gas. Compressed gas may be labeled by weight (for example, Liquefied Petroleum [LP] gas, or carbon dioxide) or by volume. Acetylene, liquid; oxygen, nitrogen, nitrous oxide, and argon are all filled by weight. Acetylene is sold by liters or by cubic feet. Helium, gaseous oxygen, nitrogen, air, and argon are filled according to pressure and temperature tables.

What type of test procedures must be used?

Checking the net contents of compressed gas cylinders depends on the method of labeling; those labeled by weight are generally checked by weight. Cylinders filled by using pressure and temperature charts must be tested using a pressure gauge that is connected to the cylinder. Determine the volume using the pressure and temperature of the cylinder.

Should any specific safety procedures be followed?

Yes, be aware of the hazards of the high pressure found in cylinders of compressed gas. An inspector should handle compressed gas only if the inspector has been trained and is knowledgeable regarding the product, cylinder, fittings, and proper procedures (see *Compressed Gas Association [CGA] pamphlet P-1, “Safe Handling of Compressed Gases in Containers,”* for additional information). Additional precautions that are necessary for personal safety are described in the CGA Handbook of Compressed Gases. All personnel testing compressed gases should have this manual for reference and be familiar with its contents. It is essential that the inspector be certain of the contents before connecting to the cylinder. Discharging a gas or cryogenic liquid through a system for which the material is not intended could result in a fire and/or explosion or property damage due to the incompatibility of the system and the product. Before connecting a cylinder to anything, be certain of the following:

- Always wear safety glasses.
- The cylinder is clearly marked or labeled with the correct name of the contents and that no conflicting marks or labels are present. Do not rely on the color of the cylinder to identify the contents of a cylinder. Be extremely careful with all gases because some react violently when mixed or when coming in contact with other substances. For example, oxygen reacts violently when it comes in contact with hydrocarbons.
- The cylinder is provided with the correct Compressed Gas Association (CGA) connection(s) for the product. A proper connection will go together smoothly; so excessive force should not be used. Do not use an adapter to connect oxygen to non-oxygen cleaned equipment. When a cylinder valve is opened to measure the internal pressure, position the body away from the pressure gauge blowout plug or in front of the gauge if the gauge has a solid cast front case. If

the bourdon tube should rupture, do not be in a position to suffer serious injuries from gas pressure or fragments of metal.

- Thoroughly know the procedure and place emphasis on safety precautions before attempting any tests. Do not use charts referred to in the procedure until the necessary training has been completed. When moving a cylinder, always place the protective cap on the cylinder. Do not leave spaces between cylinders when moving them. This can lead to a “domino” effect if one cylinder is pushed over.
- Open all valves slowly. A failure of the gauge or other ancillary equipment can result in injuries to nearby persons. Remember that high gas pressure can propel objects with great force. Gas ejected under pressure can also cause serious bodily injuries if someone is too close during release of pressure.
- One of the gauges will be reserved for testing oxygen only and will be prominently labeled “For Oxygen Use Only.” This gauge must be cleaned for oxygen service and maintained in that “clean” condition. The other gauge(s) may be used for testing a variety of gases if they are compatible with one another.
- Observe special precautions with flammable gas in cylinders in addition to the several precautions necessary for the safe handling of any compressed gas in cylinders. Do not “crack” cylinder valves of flammable gas before connecting them to a regulator or test gauge. This is extremely important for hydrogen or acetylene.

What type of measurement equipment is needed to test cylinders of compressed gas?

- Use a scale that meets the requirements in Section 2.2. “Measurement Standards and Test Equipment.” Use a wooden or non-sparking metal ramp to roll the cylinders on the scale to reduce shock loading.
- Two calibrated precision bourdon tube gauges or any other approved laboratory-type pressure-measuring device that can be accurately read within plus or minus 40 kPa (5 psi). A gauge having scale increments of 200 kPa (25 psi) or smaller shall be considered as satisfactory for reading within plus or minus 40 kPa (5 psi). The range of both gauges shall be a minimum of 0 kPa to 23 MPa (0 psi to 5000 psi) when testing cylinders using standard industrial cylinder valve connections. These standardized connections are listed in “CGA Standard V-1, Standard for Compressed Gas Cylinder Valve Outlet and Inlet for use with Gas Pressures up to 21 MPa (3000 psi).” For testing cylinders with cylinder valve connections rated for over 21 MPa (3000 psi), the test gauge and its inlet connection must be rated at 14 MPa (2000 psi) over the maximum pressure that the connection is rated for in CGA V-1. **Note:** There are standard high-pressure industrial connections on the market that are being used up to their maximum pressure of 52 MPa (7500 psi).

Note: Any gauge or connectors used with oxygen cylinders must be cleaned for oxygen service, transported in a manner which will keep them clean and never used for any other gas including air or oxygen mixtures. Oxygen will react with hydrocarbons and many foreign materials that may cause a fire or explosion.

- An approved and calibrated electronic temperature measuring device or three calibrated mercury-in-glass thermometers having either a digital readout or scale division of no more than 1 °F

(0.5 °C). The electronic device equipped with a surface temperature sensor is preferred over a mercury-in-glass thermometer because of its shorter response time.

- Two box-end wrenches of 29 mm (1¹/₈ in) for oxygen, nitrogen, carbon dioxide, argon, helium, and hydrogen and 22 mm (⁷/₈ in) for some sizes of propane. All industrial CGA connections are limited to these two hex sizes. Avoid using an adjustable wrench because of the tendency to round the edges of the fittings, which can lead to connections not being tightened properly.
- Use a separate gauge and fitting for each gas to be tested. If adapters must be used, do not use on oxygen systems.

Test Procedure for Cylinders Labeled by Weight

How is it determined if the containers meet the package requirements using the gravimetric test procedure?

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.
2. The cylinder should be marked or stenciled with a tare weight. The marked value may or may not be used by the filling plant when determining the net weight of those cylinders sold or filled by weight. If there is a tare weight marked on the net contents tag or directly on the cylinder, then an actual tare weight was determined at the time of fill. If there is no tare weight marked on a tag or on the cylinder, then the stamped or stenciled tare weight is presumed to have been used to determine the net contents.

Note: Check the accuracy of the stamped tare weights on empty cylinders whenever possible. The actual tare weight must be within (a) ½ % of the stamped tare weight for 9.07 kg (20 lb) tare weights or less or (b) ¼ % of the stamped tare weight for greater than 9.07 kg (20 lb) tare weights. (See NIST Handbook 130, “Method of Sale Regulation.”)

3. Place cylinder on scale and remove protective cap. The cap is not included in the tare weight. Weigh the cylinder and determine net weight, using either the stamped or stenciled tare weight, or the tare weight marked on the tag. Compare actual net weight with labeled net weight, or use the actual net weight to look up the correct volume declaration (for Acetylene Gas), and compare that with the labeled volume.

Note: The acetone in acetylene cylinders is included in the tare weight of the cylinder. Therefore, as acetylene is withdrawn from the cylinder, some acetone will also be withdrawn, changing the tare weight.

Most producers will replace acetone in the cylinder before the cylinder is refilled, filling the cylinder with acetone to the stamped tare weight. Other producers, although not following recommended procedures, do not replace the acetone until it drops to a predetermined weight. In the latter situation, the refilling plant must note the actual tare weight of the cylinder and show it on the tag containing the net content statement or on the cylinder itself. Refer to tables for acetylene if necessary (if the acetylene is labeled by volume).

Test Procedure for Cylinders Labeled by Volume

How is it determined if the containers meet the package requirements using the volumetric test procedure?

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.
2. Determine the temperature of the cylinders in the sample. Place the thermometer approximately halfway up a cylinder in contact with the outside surface. Take the temperature of three cylinders selected at random and use the average temperature of the three values.
3. Using the appropriate pressure gauge, measure the pressure of each cylinder in the sample.
4. Determine the cylinder nominal capacity from cylinder data tables or from the manufacturer. (These tables must be obtained in advance of testing.)
5. Using NIST Technical Note 1079 “Tables of Industrial Gas Container Contents and Density for Oxygen, Argon, Nitrogen, Helium, and Hydrogen” determine the value (SCF/CF) from the content tables at the temperature and pressure of the cylinder under test.
6. Multiply the cylinder nominal capacity by the value (SCF/CF) obtained from the content tables. This is the actual net quantity of gas.
7. Subtract the labeled net quantity from the actual net quantity to determine the error.

Evaluation of Results

Follow Section 2.3. “Basic Test Procedures – Evaluating Results” to determine lot conformance.

3.15. Volumetric Test Procedure for Packaged Firewood with a Labeled Volume of 113 L (4 ft³) or Less

How are packages of firewood tested?

Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample, then use the test procedure provided in Section 3.17. **“Crosshatched Firewood”** to determine lot compliance.

Equipment

- Linear Measure. Take all measurements in increments of 0.5 cm ($\frac{3}{16}$ in) or less and round up.
- Binding Straps. Binding Straps are used to hold wood bundles together if the bundles need to be removed from the package/wrapping material.

How is it determined if the containers meet the package requirements?

Unless otherwise indicated, take all measurements without rearranging the wood or removing it from the package. If the layers of wood are crosshatched or not ranked in discrete sections in the package, remove the wood from the package re-stack and measure accordingly.

3.16. Boxed Firewood

How is the volume of firewood contained in a box determined?

Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot conformance.

1. Open the box to determine the average height of wood within the box; measure the internal height of the box. Take three measurements (record as “d₁, d₂...etc.”) along each end of the stack. Measure from the bottom of a straight edge placed across the top of the box to the highest point on the two outermost top pieces of wood and the center-most top piece of wood. Round measurements down to the nearest 0.5 cm (¹/₈ in). If pieces are obviously missing from the top layer of wood, take additional height measurements at the highest point of the uppermost pieces of wood located at the midpoints between the three measurements on each end of the stack. Calculate the average height of the stack by averaging these measurements and subtracting from the internal height of the box according to the following formula.

$$\text{Average Height of Stack} = \frac{(\text{Internal Height of Box}) - (\text{sum of measurements})}{(\text{number of measurements})}$$

2. Determine the average width of the stack of wood in the box by taking measurements at three places along the top of the stack. Measure the inside distance from one side of the box to the other on both ends and in the middle of the box. Calculate the average width.

$$\text{Average Width} = \frac{(W_1 + W_2 + W_3)}{(3)}$$

3. To determine the average length of the pieces of wood, remove the wood from the box and select the five pieces with the greatest girth. Measure the length of each of the five pieces from center-to-center. Calculate the average length of the five pieces.

$$\text{Average Length} = \frac{(L_1 + L_2 + L_3 + L_4 + L_5)}{(5)}$$

4. Calculate the volume of the wood within the box. Use dimensions for height, width, and length.

$$\text{Volume in liters} = (\text{height in cm} \times \text{width in cm} \times \text{length in cm}) \div (1000)$$

$$\text{Volume in cubic feet} = (\text{height in inches} \times \text{width in inches} \times \text{length in inches}) \div (1728)$$

5. For boxes of wood that are packed with the wood ranked in two discrete sections perpendicular to each other, calculate the volume of wood in the box as follows: (1) determine the average height, width, and length as in 1, 2 and 3 above for each discrete section, compute total volume, and (2) total the calculated volumes of the two sections. Take the width measurement for Volume 2 (V_2) from the inside edge of the box adjacent to V_2 to the plane separating V_1 and V_2 . Compute total volume by adding Volume 1 (V_1) and V_2 according to the following formula.

$$\text{Total Volume} = V_1 + V_2$$

6. Follow Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

3.17. Crosshatched Firewood

How must the volume of stacked or crosshatched firewood be measured?

Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; and use the following test procedure to determine lot compliance.

1. Stack the firewood in a ranked and well-stowed geometrical shape that facilitates volume calculations (i.e., rectangular). The number of measurements for each dimension given below is the minimum that should be taken.
2. Determine the average measurements of the stack:
 - Height: Start at one end of the stack; measure the height of the stack on both sides at four equal intervals. Calculate and record the average height.
 - Length: Start at the base of the stack; Measure the length of the stack in four equal intervals. Calculate and record the average length.
 - Width: Select the five pieces with the greatest girth. Measure the length of the pieces, calculate and record the average piece length. (3)

Calculate Volume:

$$\text{Volume in liters} = (\text{Avg. Height [cm]} \times \text{Avg. Width [cm]} \times \text{Avg. Length in [cm]}) \div 1000$$

$$\text{Volume in cubic feet} = (\text{Avg. Height [in]} \times \text{Avg. Width [in]} \times \text{Avg. Length [in]}) \div 1728$$

3. Follow Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

3.18. Bundles and Bags of Firewood

How is the volume of bundles and bags of firewood measured?

Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.

1. Average area of ends: **secure** a strap around each end of the bundle or bag of wood to prevent movement during testing and to provide a definite perimeter. Use two or more straps to secure the wood.
2. Set one end of the bundle or bag on tracing paper large enough to cover the end completely. Draw a line around the perimeter of the bundle or bag on the tracing paper.
3. Transfer the tracing paper to a template graduated in square centimeters or square inches. Count the number of square centimeters or square inches that are enclosed within the perimeter line. Estimate portions of square centimeters or square inches not completely within the perimeter line to the nearest one-quarter square inch.
4. Repeat this process on the opposite end of the bundle or bag.
5. Calculate the Average Area:

$$\text{Average Area} = (\text{Area 1} + \text{Area 2}) \div 2$$

6. Average length of the pieces of wood – select the five pieces with the greatest girth and measure the length of the pieces. Calculate the average length of the pieces of wood:

$$\text{Average Length} = (L_1 + L_2 + L_3 + L_4 + L_5) \div 5$$

7. Calculate Volume:

$$\text{Volume in liters} = (\text{Average Area [cm}^2\text{]} \times \text{Average Length [cm]}) \div 1000$$

$$\text{Volume in cubic feet} = (\text{Average Area [in}^2\text{]} \times \text{Average Length [in]}) \div 1728$$

Evaluation of Results

Follow Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

Note: Specified in Appendix A, Table 2-10. “Exceptions to the Maximum Allowable Variations for Textiles, Polyethylene Sheeting and Film, Mulch and Soil Labeled by Volume, Packaged Firewood, and Packages Labeled by Count with Fewer than 50 Items.” – maximum allowable variations for individual packages are not applied to packages of firewood.

Chapter 4. Test Procedures – Packages Labeled by Count, Linear Measure, Area, Thickness, and Combinations of Quantities

4.1. Scope

What types of packaged goods can be tested using these procedures?

Use these procedures to determine the net contents of products sold by count, area, thickness, and linear measure. If a package includes more than one declaration of quantity, each declaration must meet the package requirements.

Can the gravimetric test procedure be used to verify the net quantity of contents of packages labeled by count and linear measure?

Use the gravimetric procedure (below) to test products sold by measure or count if the density of the product does not vary excessively from one package to another.

What procedures may be used if the gravimetric test procedure cannot be used?

Open each package in the sample and measure or count the items.

4.2 Packages Labeled by Count

How are packages labeled by count tested?

If the labeled count is 50 items or less fewer, use Section 4.3. “Packages Labeled with 50 Items or Fewer.” If the labeled count is more than 50 items, see Section 4.4. “Packages Labeled by Count of More than 50 Items.”

How to determine if a gravimetric test procedure be used to verify the labeled count of a package?

Yes, if the scale being used is sensitive enough to determine the weight of individual items. Use the following procedures to determine if the sample packages can be tested gravimetrically.

1. For packages labeled with a count of 84 or higher, calculate the weight equivalent for the MAV/6 for the labeled count of the package. MAV/6 must be at least equal to one-half scale division on a mechanical scale or one division on a digital scale.
2. For packages with a labeled count of 83 or fewer, when each unit weighs at least 2 scale divisions, consider the scale acceptable.

Example: According to Appendix A, Table 2-7. Maximum Allowable Variations (MAVs) for Packages Labeled by Count – the MAV is 7 for a package labeled with a count of 250 items. The scale should be capable of measuring differences corresponding to MAV/6 or, in this example, the weight of one item.

- If the scale meets the appropriate requirement, gravimetric testing can be used to determine package count or,
- If the scale does not meet the criteria, count the content in each package in the sample.

4.3. Packages Labeled with 50 Items or Fewer

Test Procedure

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.
2. Open the packages and count the number of items in each. Record the number of packages that contain fewer than the labeled count.

Evaluation of Results

1. For the sample size indicated in Column 1 of Appendix A, Table 2-11. “Accuracy Requirements for Packages Labeled by Low Count of (50 or fewer) and Packages Given Tolerance (Glass and Stemware),” refer to Column 2 to determine the number of packages that are allowed to contain fewer than the labeled count.
2. If the number of packages in the sample that contain fewer than the labeled count exceeds the number permitted in Column 2, the sample and the lot fail to meet the package requirement.

Note: For statistical reasons, the average requirement does not apply to packages labeled by count of 50 or fewer items, and the MAV does not apply to the lot. It only applies to the packages in the sample.

3. Maximum Allowable Variations: The MAVs listed in Appendix A, Table 2-7. “Maximum Allowable Variations (MAVs) for Packages Labeled by Count” define the limits of reasonable variation for an individual package even though the MAV is not directly used in the sampling plan. Individual packages that are undercount by more than the MAV are considered defective. Even if the sample passes, these should be repacked, relabeled, or otherwise handled.

Example: If testing a lot of 160 packages of pencils labeled “50 pencils,” choose a random sample of 12 packages from the lot. If the scale cannot discriminate between differences in count, open every package and count the pencils. For example, assume the 12 package counts are: 50, 52, 50, 50, 51, 53, 52, 50, 50, 50, 47, and 50.

Because only one package contains fewer than 50 pencils, the sample passes the test (refer to Appendix A. Table 2-11. “Accuracy Requirements for Packages Labeled by Low Count [50 or Fewer] and Packages Given Tolerances [Glass and Stemware]”). However, the package containing 47 pencils should not be introduced into commerce even though the lot complies with the package requirements because it is undercount by more than the MAV (1 item)

permitted in Appendix A, Table 2-7. “Maximum Allowable Variations (MAVs) for Packages Labeled by Count.”

4.4. Packages Labeled by Count of More than 50 Items

Test Procedures

There are two procedures to determine count without opening all packages in the sample. Both use the weight of a counted number of items in the package. If the weight of discrete items or numbers of items in a package varies, the packaged items must be counted rather than weighed.

Equipment

Use a scale that meets the requirements in Section 2.2. “Measurement Standards and Test Equipment.”

Audit Procedure

Use this procedure to audit lots of packages labeled by count of more than 50 items, but the precision of this procedure is only $\pm 1\%$. Determine the lot compliance based on actual count or the violation procedure.

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.
2. Select an initial tare sample according to Section 2.3. “Basic Test Procedure – Tare Procedures.”
3. Gross weigh the first package in the tare sample and record this weight.
4. Select the number of items from the first tare package that weighs the greater:
 - 10 % of the labeled count; or
 - a quantity equal to at least 50 minimum divisions on the scale.

Example: Using a scale with 1 g divisions, the selected count must weigh at least 50 grams. If a scale with 0.001 lb divisions is used, the selected count must weigh at least 0.05 lb. Record the count and weight.

5. Calculate the weight of the labeled count using the following formula:

$$\text{Weight of the Labeled Count} = (\text{labeled count} \times \text{weight of items in step 4}) \div (\text{count of items in step 4})$$

Record the result as “labeled count weight.”

6. Gross weigh the remaining packages of the tare sample and keep contents of opened packages separated in case all of the items must be counted.
7. Determine the Average Used Dry Tare Weight of the sample according to Section 2.3. “Basic Test Procedure – Tare Procedures.”

8. The weight of the labeled count plus the average tare weight represents the “nominal gross weight.”
9. Subtract the nominal gross weight from the gross weight of the individual packages and record the errors.

$$(\text{Package error [weight]}) = (\text{actual package gross weight}) - (\text{nominal gross weight})$$

10. Convert the package errors in units of weight to count:

$$\text{Package error (count)} = (\text{Package error [weight]} \times \text{labeled count}) \div (\text{labeled count weight})$$

Round any fractional counts up to whole items in favor of the packager. Record the package error in units of count. Compute the average error.

- If the average error is minus, go to the “procedure to use if the inspector suspects the lot violates the package requirements” below.
- If the average error is zero or positive, the sample is presumed to conform to the package requirements.

Procedures to use if the inspector suspects the lot violates the package requirements

If possible, use the gravimetric procedure to determine compliance. To minimize the number of packages to be opened, combine the measurement of the weight of the number of units in the package with the determination of tare. Therefore, it will not be necessary to open more packages than the tare sample. If the audit procedure in this section has been used, the possible violation procedure below can be followed with the same sample if package contents have been kept separate and can still be counted. Use the following steps to determine if the sample passes or fails.

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance. Use a scale that meets the criteria specified in 4.2. “Packages Labeled by Count.”
2. Select an initial tare sample according to Section 2.3. “Basic Test Procedure – Tare Procedures.”
3. Gross weigh the packages selected for the tare sample and record these weights. Open these packages and determine the tare and net weights of the contents, and count the exact number of items in the packages. Record this information.
4. Calculate and record the weights of the labeled counts for the first two packages using the formula:

$$\text{Weight of labeled count} = (\text{labeled count}) \times (\text{contents weight} \div \text{contents count})$$

To avoid round off errors, carry at least two extra decimal places in the calculation until the weight of the labeled count is obtained. To use the gravimetric procedure, the difference in weights of the labeled counts of the two packages must not exceed one scale division.

- If the difference in weights exceeds this criterion, determine the actual count per package for every package in the sample recording plus and minus errors. Then, follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.
 - If the difference is within the criterion, average the weights of the labeled count and go on to step 5.
5. Determine the Average Used Dry Tare Weight of the sample according to provisions in Section 2.3. “Basic Test Procedure – Tare Procedures.”
 6. Determine and record the nominal gross weight by adding the average weight of the labeled count of items in the package step 4 to the average tare weight step 5.
 7. Weigh the remaining packages in the sample, subtract the nominal gross weight from the gross weight of the individual packages, and record the errors.

$$\text{Package Error (weight)} = (\text{Actual Package Gross Weight}) - (\text{Nominal Gross Weight})$$

8. Look up the MAV for the package size from Appendix A, Table 2-7. “Maximum Allowable Variations (MAVs) for Packages Labeled by Count” and convert it to weight using the formula:

$$\text{MAV (weight)} = (\text{MAV (count)} \times \text{Avg. Wt. of Labeled Count [from step 4]}) \div (\text{Labeled Count})$$

Convert the MAV to dimensionless units by dividing the MAV (weight) by the unit of measure and record.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluation Results” to determine lot conformance.

Convert back to count when completing the report form using the following formula:

$$\text{Avg. Pkg. Error (count)} = (\text{Avg. Pkg. Error [dimensionless units]} \times (\text{Unit of Measure}) \times (\text{Labeled Count}) \div (\text{Avg. Weight of Labeled Count})$$

4.5. Paper Plates and Sanitary Paper Products

How are the labeled dimensions of paper plates and sanitary paper products verified?

Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following procedure to determine lot compliance.

The following procedures are used to verify the size of paper plates and other products. The following procedure may be used to verify the size declarations of other disposable dinnerware.

Note: Do not distort the item's shape during measurement.

The count of sanitary paper products cannot be adequately determined by weighing. Variability in sheet weight and core weight requires that official tests be conducted by actual count. However, weighing can be a useful audit method. These products often declare total area as well as unit count and sheet size. If the actual sheet size measurements and the actual count comply with the average requirements, the total area declaration is assumed correct.

Equipment

- Steel tapes and rules. Determine measurements of length to the nearest division of the appropriate tape or rule.

- Metric Units:

For labeled dimensions 40 cm or less, Linear Measure: 30 cm in length, 1 mm divisions; or a 1 m rule with 0.1 mm divisions, overall length tolerance of 0.4 mm.

For labeled dimensions greater than 40 cm, 30 m tape with 1 mm divisions.

- Inch-pound Units:

For labeled dimensions 25 in or less, use a 36 in rule with $\frac{1}{64}$ in or $\frac{1}{100}$ in divisions and an overall length tolerance of $\frac{1}{64}$ in.

For dimensions greater than 25 in, use a 100 ft tape with $\frac{1}{16}$ in divisions and an overall length tolerance of 0.1 in.

- Measuring Base

Note: A measuring base may be made of any flat, sturdy material approximately 38 cm (15 in) square. Two vertical side pieces approximately 3 cm (1 in) high and the same length as the sides of the measuring base are attached along two adjoining edges of the measuring base to form a 90° corner. Trim all white borders from two or more sheets of graph paper (10 divisions per centimeter or 20 divisions per inch). Place one sheet on the measuring base and position it so that one corner of graph paper is snug in the corner of the measuring base and vertical sides. Tape the sheet to the measuring base. Overlap other sheets on the first sheet so that the lines of top and bottom sheet coincide, expanding the graph area to a size bigger than plates to be measured; tape these sheets to the measuring base. Number each line from the top and left side of base plates: 1, 2, 3, etc.

How are paper products inspected?

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.
2. Select an initial tare sample according to Section 2.3. “Basic Test Procedure – Tare Procedure.”
3. Open each package and select one item from each.

Note: Some packages of plates contain a combination of different-sized plates. In this instance, take a plate of each declared size from the package to represent all the plates of that size in the package. For example, if three sizes are declared, select three different plates from each package.

How are paper products measured?

Note: Occasionally, packages of plates declared to be one size contain plates that can be seen by inspection to be of different sizes in the same package. In this instance, select the smallest plate and use the methods below to determine the package error. If the smallest plate is not short measure by more than the MAV, measure each size of plate in the package and calculate the average dimensions.

Example: If 5 plates measure 21.41 cm (8.43 in) and 15 measure 21.74 cm (8.56 in), the average dimension for this package of 20 plates is 21.66 cm (8.53 in).

4. For paper plates: place each item on the measuring base plate (or use the linear measure) with the eating surface down so two sides of the plate touch the sides of the measuring base. For other products, use either the measuring base or a linear measure to determine actual labeled dimensions (e.g., packages of napkins, rolls of paper towels). If testing folded products, be sure that the folds are pressed flat so that the measurement is accurate.
5. If the measurements reveal that the dimensions of the individual items vary, select at least 10 items from each package. Measure and average these dimensions. Use the average dimensions to determine package error in step 5 below.
6. The package error equals the actual dimensions minus the labeled dimensions.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

4.6. Special Test Requirements for Packages Labeled by Linear or Square Measure (Area)

Are there special measurement requirements for packages labeled by dimensions?

Yes, products labeled by length (such as yarn) or area, often requires the application of tension to the ends of the product in order to straighten the product before measuring. When testing yarn and thread apply tension and use the specialized equipment specified in ASTM D1907-~~9~~ **07**, “Standard Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method,” in conjunction with the sampling plans and package requirements described in this handbook.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

4.7. Polyethylene Sheeting

Which procedures are used to verify the declarations on polyethylene sheeting and bags?

Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.

Note: Most polyethylene products are sold by length, width, thickness, area, and net weight.

Equipment

- A scale that meets the requirements in Section 2.2. “Measurement Standards and Test Equipment.”
- Steel tapes and rules determine measurements of length to the nearest division of the appropriate tape or rule.
 - Metric Units:

For labeled dimensions 40 cm or less, Linear Measure: 30 cm in length, 1 mm divisions; or a 1 m rule with 0.1 mm divisions, overall length tolerance of 0.4 mm.

For labeled dimensions greater than 40 cm, 30 m tape with 1 mm divisions.
 - Inch-pound Units:

For labeled dimensions 25 in or less, use a 36 in rule with $\frac{1}{64}$ in or $\frac{1}{100}$ in divisions and an overall length tolerance of $\frac{1}{64}$ in.

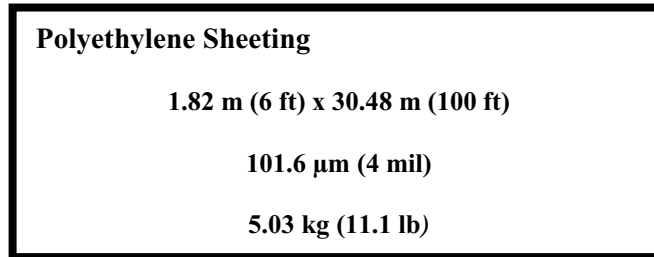
For dimensions greater than 25 in, use a 100 ft tape with $\frac{1}{16}$ in divisions and an overall length tolerance of 0.1 in.
- Deadweight dial micrometer (or equal) equipped with a flat anvil, 6.35 mm or ($\frac{1}{4}$ in) diameter or larger, and a 4.75 mm ($\frac{3}{16}$ in) diameter flat surface on the head of the spindle. The anvil and spindle head surfaces should be ground and lapped, parallel to within 0.002 mm (0.0001 in), and should move on an axis perpendicular to their surfaces. The dial spindle should be vertical, and the dial should be at least 50.8 mm (2 in) in diameter. The dial indicator should be continuously graduated to read directly to 0.002 mm (0.0001 in) and should be capable of making more than one revolution. It must be equipped with a separate indicator to indicate the number of complete revolutions. The dial indicator mechanism should be fully jeweled. The frame should be of sufficient rigidity that a load of 1.36 kg (3 lb) applied to the dial housing, exclusive of the weight or spindle presser foot, will not cause a change in indication on the dial of more than 0.02 mm (0.001 in). The indicator reading must be repeatable to 0.0012 mm (0.00005 in) at zero. The mass of the probe head (total of anvil, weight 102 g or [3.6 oz], spindle, etc.) must be 113.4 g (4 oz). The micrometer should be operated in an atmosphere free from drafts and fluctuating temperature and should be stabilized at ambient room temperature before use.

- Gage blocks covering the range of thicknesses to be tested should be used to check the accuracy of the micrometer
- T-square

Test Procedure

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.
2. Be sure the product is not mislabeled. Check the label declaration to confirm that all of the declared dimensions are consistent with the required standards. The declaration on sheeting, film, and bags shall be equal to or greater than the weight calculated by using the formulas below. Calculate the final value to four digits and declare to three digits dropping the final digit (e.g., if the calculated value is 2.078 lb, then the declared net weight is truncated to 2.07 lb).

Example Label:



3. Use the following formulas to compute a target net weight. The labeled weight should equal or exceed the target net weight or the package is not in compliance.

- For metric dimensions:

$$\text{Target Mass in Kilograms} = (T \times A \times D) \div 1\,000$$

Where: T = nominal thickness in centimeters

A = nominal length in centimeters x nominal width (the nominal width for bags is twice the labeled width) in centimeters

D = density in grams per cubic centimeter*

- For inch-pound dimensions:

$$\text{Target Weight in Pounds} = T \times A \times D \times 0.03613$$

Where: T = nominal thickness in inches;

A = nominal area; that is the nominal length in inches x nominal width (the nominal width for bags is twice the labeled width) in inches;

D = density in grams per cubic centimeter; 0.03613 is a factor for converting $\frac{\text{g}}{\text{cm}^3}$ to $\frac{\text{lb}}{\text{in}^3}$.

*Determined by ASTM Standard D1505-~~98~~ **03**, “Standard Method of Test for Density of Plastics by the Density Gradient Technique.” For the purpose of this handbook, the minimum density shall be 0.92 g/cm^3 when the actual density is not known.

Evaluation

1. Perform the calculations as shown in the following samples. If the product complies with the label declaration, go to step 2.

Sample Calculations

- For metric units:

$$(0.01016 \text{ cm} \times [(1.82 \text{ m} \times 100 \frac{\text{cm}}{\text{m}}) \times (30.48 \text{ m} \times 100 \frac{\text{cm}}{\text{m}})] \times 0.92 \frac{\text{g}}{\text{cm}^3}) \div 1000 \frac{\text{g}}{\text{kg}} \\ = \text{a target net mass of } 5.18 \text{ kg}$$

In this example, the labeled net mass of 5.03 kg does not meet the target net mass, so the product is not in compliance.

- For inch-pound units:

$$(0.004 \text{ in}) \times [(6 \text{ ft} \times 12 \frac{\text{in}}{\text{ft}}) \times (100 \text{ ft} \times 12 \frac{\text{in}}{\text{ft}})] \times 0.92 \frac{\text{g}}{\text{cm}^3} \times 0.03613 = \text{a target net weight of } 11.48 \text{ lb}$$

In this example, the labeled net weight of 11.1 lb does not meet the target net weight, so the product is not in compliance.

1. Select packages for tare samples. Determine and record the gross weights of the initial tare sample.
2. Extend the product in the sample packages to their full dimensions and remove by hand all creases and folds.

3. Measure the length and width of the product to the closest 3 mm ($\frac{1}{8}$ in). Make all measurements at intervals uniformly distributed along the length and width of the sample and record the results. Compute the average length and width, and record.
 - With rolls of product, measure the length of the roll at three points along the width of each roll and measure the width at a minimum of 10 points along the length of each roll.
 - For folded products, such as drop cloths or tarpaulins, make three length measurements along the width of the sample and three width measurements along the length of the sample.
4. Determine and record the average tare weight according to Section 2.3. “Basic Test Procedures – **Tare Procedures.**”

Evaluation of Results – Length, Width, and Net Weight

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine the lot conformance requirements for length, width, and weight.

- If the sample fails to meet the package requirements for any of these declarations, no further measurements are necessary. The lot fails to conform.
- If the sample meets the package requirements for the declarations of length, widths, and weight, go to step 6 to verify the thickness declaration.

Measure the thickness of the plastic sheet with a micrometer using the following guide. Place the micrometer on a solid level surface. If the dial does not read zero with nothing between the anvil and the spindle head, set it at zero. Raise and lower the spindle head or probe several times; it should indicate zero each time. If it does not, find and correct the cause before proceeding.

- Take measurements at five uniformly distributed locations across the width at each end and five locations along each side of each roll in the sample. If this is not possible, take measurements at five uniformly distributed locations across the width product for each package in the sample.

When measuring the thickness, place the sample between the micrometer surfaces and lower the spindle head or probe near, but outside, the area where the measurement will be made. Raise the spindle head or probe a distance of 0.008 mm to 0.01 mm (0.000 3 in to 0.000 4 in) and move the sheet to the measurement position. Drop the spindle head onto the test area of the sheet.

Read the dial thickness two seconds or more after the drop, or when the dial hand or digital readout becomes stationary. This procedure minimizes small errors that may occur when the spindle head or probe is lowered slowly onto the test area.

For succeeding measurements, raise the spindle head 0.008 mm to 0.01 mm (0.000 3 in to 0.000 4 in) above the rest position on the test surface, move to the next measurement location, and drop the spindle head onto the test area. Do not raise the spindle head more than 0.01 mm (0.000 4 in) above its rest position on the test area. Take measurements at least 6 mm ($\frac{1}{4}$ in) or more from the edge of the sheet.

- Repeat step 6 above on the remaining packages in the sample and record all thickness measurements. Compute and record the average thickness for the individual package and apply the following MAV requirements.

Evaluation of Results – Individual Thickness

- No measured thickness of polyethylene labeled 25 μm (1 mil) or greater should be less than 80 % of the labeled thickness.
- No measured thickness of polyethylene labeled less than 25 μm (1 mil) should be less than 65 % of the labeled thickness.

Count the number of values that are smaller than specified MAVs (0.8 x labeled thickness if 25 μm [1 mil] or greater or 0.65 x labeled thickness, if less than 25 μm [1 mil]). If the number of values that fail to meet the thickness requirement exceeds the number of MAVs permitted for the sample size, the lot fails to conform to requirements. No further testing of the lot is necessary. If the number of MAVs for thickness measurements is less than or equal to the number permitted for the sample size, go on to Evaluation of Results – Average Thickness.

Evaluation of Results – Average Thickness

The average thickness for any single package should be at least 96 % of the labeled thickness. This is an MAV of 4 %. Circle and count the number of package average thickness values that are smaller than 0.96 x labeled thickness. If the number of package average thicknesses circled exceeds the number of MAVs permitted for the sample size, the lot fails to conform to requirements. No further testing of the lot is necessary. If the number of MAVs for package average thickness is less than or equal to the number of MAVs permitted for the sample size, proceed to Section 2.3. “Basic Test Procedure – Evaluating Results” to determine if the lot meets the package requirements for average thickness.

4.8. Packages Labeled by Linear or Square (Area) Measure

Equipment

- Use a scale that meets the requirements in Section 2.2. “Measurement Standards and Test Equipment.” Calculate the length or area of packaged product corresponding to $\text{MAV}/6$. If there is no suitable weighing device, all of the packages in the sample must be opened and measured.
- Steel tapes and rules – determine measurements of length to the nearest division of the appropriate tape or rule.

➤ Metric Units:

For labeled dimensions 40 cm or less, Linear Measure: 30 cm in length, 1 mm divisions; or a 1 m rule with 0.1 mm divisions, overall length tolerance of 0.4 mm.

For labeled dimensions greater than 40 cm, 30 m tape with 1 mm divisions.

➤ Inch-pound Units:

For labeled dimensions 25 in or less, use a 36 in rule with $\frac{1}{64}$ in or $\frac{1}{100}$ in divisions and an overall length tolerance of $\frac{1}{64}$ in.

For dimensions greater than 25 in, use a 100 ft tape with $\frac{1}{16}$ in divisions and an overall length tolerance of 0.1 in.

- T-square

Test Procedure

1. Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.
2. Select an initial tare sample according to Section 2.3. “Basic Test Procedure – Tare Procedures.”
3. Gross weigh the first package in the tare sample and record this weight.
4. Determine and record the measurements (to the nearest division of the appropriate tape or rule) of the packaged goods (length, width, area; depending upon which dimensions are declared on the label) and weigh the goods from the first package opened for tare determination.

➤ Calculate and record the weight of the labeled measurements using the following formula:

$$\text{Weight of the labeled measurement} = (\text{labeled measurement}) \times (\text{contents weight}) \div (\text{contents measurement})$$

➤ Look up and record the MAV in units of length or area measure (given in Appendix A, Table 2-8. “Maximum Allowable Variations for Packages Labeled by Length, (Width) or Area”

Note: See Appendix A, Table 2-10. “Exceptions to the MAVs for Textiles, and Polyethylene Sheeting and Film.

5. Determine and record the tare weight of the first package opened.
6. Determine and record the measurements (length, width, area; depending upon which dimensions are declared on the label) of the product in the second package chosen for tare determination (to the nearest division of the appropriate tape or rule). Determine and record the tare weight of this package.
7. Calculate and record the weight of the labeled measurement for the second package using the following formula:

$$\text{Weight of the labeled measurement} = (\text{labeled measurement}) \times (\text{contents weight}) \div (\text{contents measurement})$$

The weights of the labeled measurement for two packages must not differ by more than one division on the scale. If they do, open all packages in the sample, measure individually, and compare them against the labeled measure to determine the package errors. If the criterion is met, go to step 8.

8. Calculate the average weight of the labeled measurement and record.
9. Determine and record the average tare weight according to Section 2.3. “Basic Test Procedure – Tare Procedures.”
10. Compute and record the nominal gross weight by adding the average weight of the labeled measurements to the average tare weight.
11. Compute package errors according to the following formula:

$$\text{Package error (weight)} = (\text{actual package gross weight}) - (\text{nominal gross weight})$$

12. Convert the MAV to units of weight using the following formula:

$$\text{MAV (weight)} = (\text{avg. wt. of label measurements} \times \text{MAV [length]}) \div (\text{labeled measurements})$$

Convert the MAV to dimensionless units by dividing the MAV (weight) by the unit of measure and record.

Evaluation of Results

Follow the procedure in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

Convert back to dimensions when completing the report form using following the formula:

$$\text{Avg. Pkg. Error (dimension)} = (\text{Avg. Pkg. Error [dimensionless units]} \times (\text{Unit of Measure}) \times (\text{Labeled unit of measure}) \div (\text{Avg. Weight of Labeled dimension}))$$

4.9. Baler Twine – Test Procedure for Length

Equipment

- A scale that meets the requirements in Section 2.2. “Measurement Standards and Test Equipment,” except a scale with 0.1 g (0.000 2 lb) increments must be used for weighing twine samples. The recommended minimum load for weighing samples is 20 divisions.
- Steel tapes and rules – Determine measurements of length to the nearest division of the appropriate tape or rule.

➤ Metric Units:

For labeled dimensions 40 cm or less, Linear Measure: 30 cm in length, 1 mm divisions; or a 1 m rule with 0.1 mm divisions, overall length tolerance of 0.4 mm.

For labeled dimensions greater than 40 cm, 30 m tape with 1 mm divisions.

➤ Inch-pound Units:

For labeled dimensions 25 in or less, use a 36 in rule with $\frac{1}{64}$ in or $\frac{1}{100}$ in divisions and an overall length tolerance of $\frac{1}{64}$ in.

For dimensions greater than 25 in, use a 100 ft tape with $\frac{1}{16}$ in divisions and an overall length tolerance of 0.1 in.

- A hand-held straight-face spring scale of at least 4.53 kg (10 lb) capacity or a cordage-testing device that applies the specified tension to the twine being measured. When measuring twine samples or total roll length, apply 4.53 kg (10 lb) of tension to the twine.

Test Procedure

Follow Section 2.3. “Basic Test Procedure – Define the Inspection Lot.” Use a “Category A” sampling plan in the inspection; select a random sample; then use the following test procedure to determine lot compliance.

1. Select packages for tare samples. Determine gross weights of the initial tare sample and record. Open the tare samples. Use the procedures for tare determination in Section 2.3. “Basic Test Procedure – Tare Procedures” to compute the average tare weight and record this value.
2. Procedure for obtaining twine samples: randomly select four balls of twine from the packages that were opened for tare.

From each of the four balls of twine:

- Measure and discard the first 10.05 m (33 ft) of twine from each roll. Accurate measurement requires applying tension to the ends of the twine before measuring in order to straighten the product.
 - Take two 30.48 m (100 ft) lengths of twine from inside each roll.
 - Weigh and record the weight of each piece separately and record the values. Compare the weight values to determine the variability of the samples. If the individual weights of the eight twine samples vary by more than one division on the scale, use one of the following steps: If the lot is short, determine the actual length of the lightest-weight roll found in the lightest-weight package of the lot to confirm that the weight shortages reflect the shortages in the length of the rolls; or, determine the average weight-per-unit of measure by taking ten 30.48 m (100 ft) lengths from inside the lightest weight package. Use this value to recalculate its length and determine lot compliance.
3. Weigh all of the sample lengths together and record the total value. Determine the total length of the samples (243.8 m or 800 ft, unless more than eight sample-lengths were taken) and record the value. Compute the average weight-per-unit-of-length by dividing the total weight by the total length of the pieces.
 4. Determine the MAV for a package of twine (refer to Appendix A, Table 2-8. “Maximum Allowable Variations for Packages Labeled by Length, Width, or Area”).
 - Record the total declared package length.

- Multiply the MAV from Appendix A, Table 2-8. “Maximum Allowable Variations for Packages Labeled by Length, (Width), or Area,” times the total package length to obtain the MAV for length and record this value.
 - Multiply the weight per unit of length (from step 3) times the MAV for the total declared package length to obtain the MAV by weight and record this value.
 - Convert the MAV to dimensionless units and record.
5. Calculate the nominal gross weight and record.

Follow Section 2.3. “Basic Test Procedure – Determine Nominal Gross Weight and Package Errors for Sample Tare” to determine individual package errors. Determine errors using the following formula:

$$\text{Package error (weight)} = (\text{package gross weight}) - (\text{nominal gross weight})$$

- To convert the Package error in weight back to length, divide the weight by the average weight-per-unit-of-length.

Evaluation of Results

Follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot compliance.

4.10 Procedure for Checking the Area Measurement of Chamois

Chamois is natural leather made from skins of sheep and lambs that have been oil-tanned. Chamois are irregularly shaped, which makes area measurement difficult. Because of these characteristics, an accurate area determination can only be made using an internationally recognized method of conditioning (rehydrating) and measurement. Chamois is produced in a wet manufacturing process, so it has high moisture content at time of measurement. Chamois is hygroscopic; therefore, its dimensions and total area change as it loses or absorbs moisture. It is also subject to wrinkling. Because of the variation of the thickness and density, and therefore the weight per unit area of chamois, an estimated gross weight procedure cannot be used to verify the labeled area declaration.

Standard Test Conditions: As with all hygroscopic products, reasonable variations in measure must be allowed if caused by ordinary and customary exposure to atmospheric conditions that normally occur in good distribution practice. Both federal and international standards specify procedures to restore the moisture content of chamois so that tests to verify dimensions and area can be conducted.

Federal Test Method Standard 311, “Leather, Methods of Sampling and Testing,” (January 15, 1969) defines the standard atmospheric condition for chamois as 50 ± 4 % relative humidity and 23 ± 2 °C (73.4 ± 3.6 °F). The chamois is considered to be at equilibrium moisture when the difference in two successive weighings, made at 1 hr intervals, is no greater than 0.25 % (e.g., the maximum change in weight on a 100 g sample in two successive weighings is less than 0.25 g (250 mg).

Test Procedures

The area of chamois is verified using a two-stage test procedure. The first stage is a field audit using the template test procedure. This test is used for field audits because it is simpler to perform and does not require the chamois to be conditioned. The field audit is used to identify chamois that are potentially under measure. It is not as accurate as the gravimetric procedure because some error results from reading the area from the template. The gravimetric procedure should be used for compliance testing because it includes conditioning (rehydrating) the chamois.

Template Test Method (for field audits)

Select a random sample of chamois and use the Template Procedure (below) to determine the area of each sample. Chamois is labeled in uniform sizes in terms of square decimeters and square feet, and are sized in increments of $\frac{1}{4}$ ft² (e.g., 1 ft², $1\frac{1}{4}$ ft², and $1\frac{1}{2}$ ft²). Separate the chamois into different sizes and define the inspection lot by specific sizes.

Equipment

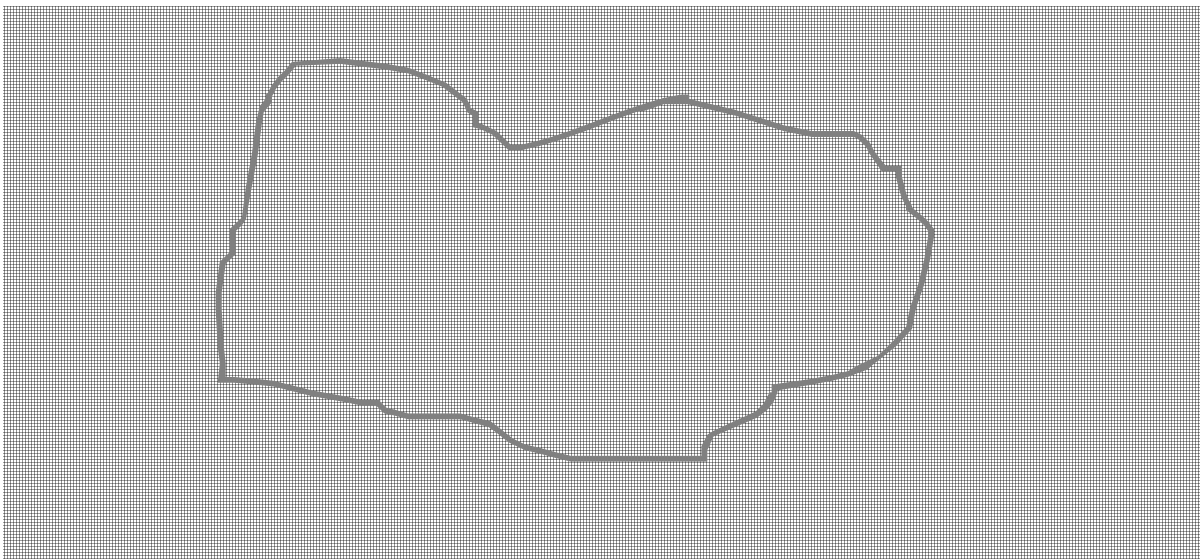
Use a transparent, flexible template that is graduated in square centimeters or square inches and that has been verified for accuracy. The template must be large enough to completely cover the chamois under test.

Template Procedures

1. Template Procedure

Place the template over the chamois specimen on a smooth surface. Determine the area by counting the number of squares that cover the surface of the chamois. Estimate parts of the template that do not completely cover the chamois by adding the number of partially covered blocks. (See Figure 1.) Compute the total area and go to Evaluation to determine if further action is necessary.

Figure 1.



First Stage – Decision Criteria

If the average minus error exceeds 3 % of the labeled area, the chamois may not be labeled accurately. To confirm the finding, the sample must be taken to a laboratory for conditioning and testing using the gravimetric test procedure.

2. Gravimetric Procedure for Area Measurement

This test cannot be performed in the field because the samples must be conditioned with water before testing. This method is intended for use in checking full or cut skins, or pattern shapes. Open and condition all of the packages in the sample before determining their area on the recommended paper. Conditioning and verifying chamois can be accomplished without destroying the product. When successful tests are completed, the chamois may be repackaged for sale, so do not destroy the packaging material.

Equipment

- Scale with a capacity of 1 kg that is accurate to at least ± 0.01 g and a load-receiving element of adequate size to properly hold the chamois
- Atomizer or trigger-type sprayer and sealable, airtight polyethylene bags
- Medium weight drawing paper (e.g., drawing paper, medium weight (100 lb), regular surface or comparable)
- Household iron with low temperature settings 30 °C to 40 °C (86 °F to 104 °F)
- Rule or tape that is graduated in centimeters or inches
- Instrument for cutting paper (razor blade, scissors, or cutting board)

Sample Conditioning

1. Remove each sample from its packages weigh and record each weight. Using an atomizer-type sprayer, spray water in the amount of 25 % of the weight of each skin uniformly over its area. Place wetted chamois in an airtight polyethylene bag; seal the bag, and leave it in this condition at room temperature for 24 hours.
2. Open the bag, remove the chamois, and reweigh the chamois to confirm that it retained maximum moisture. This is done by confirming that the difference in the two consecutive weighings conducted an hour apart does not exceed 0.25 %).
3. Place the chamois flat on a continuous piece of drawing paper. To remove wrinkles and make the chamois lie flat, use a normal domestic iron that is heated to a maximum of 30 °C to 40 °C (86 °F to 104 °F). Place the iron on the bottom of the skin, and iron the skin up the center to the top. Then, iron the skin from the center out to each side. Iron until the skin is fully extended and perfectly flat.

Measurement

1. Immediately after ironing, carefully draw around the outline of the skin on the paper. Remove the skin; carefully cut along the outline of the skin; weigh the cutout pattern, and record to the nearest 0.1 g as Sample Weight 1 (W1).
2. Lay out the pattern and cut an accurately measured rectangle of a size not less than one-half the area of the pattern. Weigh the cutout rectangle and record the weight to the nearest 0.1 g as Sample Weight 2 (W2). Calculate the area of the rectangle cut from the patterns by multiplying length by width and record as Area (A) in centimeters or square inches.

- For metric units – calculate the area of the original skin being checked as follows:

$$W1/W2 \times A = \text{Skin Area in cm}^2/100 = \text{Area in dm}^2$$

- For inch-pound units – calculate the area of the original skin being checked as follows:

$$W1/W2 \times A = \text{Skin Area in in}^2/144 = \text{Area ft}^2$$

Evaluation of Results

Compute the average error for the sample and follow the procedures in Section 2.3. “Basic Test Procedure – Evaluating Results” to determine lot conformance.

The MAV for area declarations on chamois is 3 % of the labeled area as specified in Appendix A, Table 2-8. “Maximum Allowable Variations for Packages Labeled by Length, (Width), or Area”.

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Appendix D

Letter Submitted from the International Ice Cream Association to the Food and Drug Administration

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International Dairy Foods Association
Milk Industry Foundation
National Cheese Institute
International Ice Cream Association

July 10, 2008

Ms. Geraldine A. June
Team Leader, Food Labeling and Standards
Office of Nutritional Products, Labeling and Dietary Supplements
FDA/Center for Food Safety & Applied Nutrition
CPK1/4D014
5100 Paint Branch Parkway
College Park, MD 20740
Sent Via E-mail to: geraldine.june@cfsan.fda.gov

RE: Request for Interpretation of FDA Food Labeling Regulations for Net Quantity of Contents and Serving Size of Pelletized Ice Cream and Frozen Desserts

Dear Ms. June:

The International Ice Cream Association (IICA) appreciated the opportunity to meet on June 27, 2008 with officials from FDA's Office of Food Labeling, along with staff from the National Institute of Standards and Technology (NIST) Weights and Measure's Division, and regional Weights & Measures officials to discuss the net contents declaration and method of measurement for pelletized ice cream.

We are writing this letter seeking FDA assistance on determining the net quantity of content statement and serving size declaration that should be used for pelletized ice cream and frozen desserts. For the reasons noted below, IICA believes the net quantity of content statement should be a volumetric declaration that excludes the external air. We also are asking for FDA guidance in identifying the serving size that should appear in the nutrition facts panel for these products.

Pelletized ice cream is a unique and novel ice cream product that entered the market in 1988 under the brand name Dippin' Dots,™ which was predominantly sold in food service venues to consumers for immediate consumption. Due to commercialization and development of processing technology, pelletized ice cream has been introduced into retail stores over the past several years by five companies. Today the product is sold in food service and retail stores both in multi-serving and individual serving packages.

Pelletized ice cream products meet the federal standard of identity (SOI) for ice cream as specified in 21 CFR §135.110. The product is made using pasteurized mix consisting of one or more of the prescribed dairy ingredients, sweeteners, stabilizers and flavorings. The ice cream

mix is stirred via pumping and spraying action as the droplets are frozen at very low temperatures using liquid nitrogen. The freezing process results in small round shaped beads or pellets of ice cream that meet the required 4.5 lbs per gallon weight requirements set forth in the SOI for ice cream. Different flavored ice cream pellets such as strawberry, banana, chocolate and vanilla may be mixed together to create novel flavors such as "banana split," or flavoring can be added to the pellets such as cookie pieces, cookie dough, brownies, and other inclusions. In addition to pelletized ice cream, this same freezing process is also used to produce similar products such as pelletized water ice and pelletized frozen desserts. IICA believes that determination of the method of sale and serving size in the nutrition fact panel should apply to all pelletized ice cream, and all pelletized frozen dessert products.

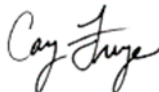
As we discussed during the June 27th meeting, ice cream and frozen desserts are sold by units of fluid measure. Therefore, the declared net quantity of contents for pelletized ice cream and frozen desserts will be expressed in fluid ounces. The ice cream industry's position is that the method of sale and net quantity of contents for pelletized ice cream and pelletized frozen desserts should be declared in fluid ounces without including any external air surrounding the pellets of ice cream or flavoring. We are seeking concurrence from FDA that it agrees with the industry position of using in the net quantity statement fluid ounces that exclude the external air.

We also are seeking FDA guidance on the serving size that should be stated in the nutrition facts panel (NFP) for pelletized ice creams and frozen desserts. During the June 27th meeting we discussed the issue and are asking FDA to identify the serving size that should be used on these products.

We would greatly appreciate your prompt reply in this matter, as it is critical to future work on determining the proper method for measuring the volume of the pelletized ice cream and frozen desserts. The IICA would like to propose a new method of measurement for this product to the 2009 National Conference of Weights and Measures. In order to meet that deadline we would need to develop and verify a test method to submit the proposal to the Southern Weights and Measures Association meeting on October 5, 2008.

If you have any questions or require additional information regarding this matter, please feel free to contact me at (202) 220-3543 or via e-mail at cfrye@idfa.org.

Sincerely,



Cary Frye
Vice President,
Regulatory Affairs

cc: K. Butcher, NIST
L. Warfield, NIST

Appendix E

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

Fuel Specifications Subcommittee (FSS) A Proposed Method of Sale and Quality Specification for Hydrogen Vehicle Fuel

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**U.S. National Work Group for the
Development of Commercial Hydrogen Measurement Standards
December 4, 2008**

**Fuel Specifications Subcommittee (FSS)
A Proposed Method of Sale and Quality Specification
for Hydrogen Vehicle Fuel**

Summary of Current Information

This document incorporates the decisions made by the FSS at its December 4, 2008, meeting in Boulder, CO.

The Chairman of the FSS is: Robert W. Boyd

Manager, Project Development
Hydrogen Solutions
Linde North American, Inc.
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- a. The proposed method of sale and quality specification for hydrogen vehicle fuel was presented to the Western Weights and Measures Association (WWMA) and Southern Weights and Measures Association (SWMA) 2008 Annual Meetings and was adopted with a recommendation that the draft proposal be presented on the National Conference of Weights and Measures (NCWM) agenda at its 2009 Interim Meeting which will be held January 11-14, 2009, in Daytona Beach, Florida.
- b. The recommendations of the FSS based on its December 2008 review of the proposed method of sale for hydrogen engine fuel are:
 - i. The FSS agreed to continue to develop the fuel quality standards for hydrogen using the current proposal as a foundation and will consider further refinement of the definition for hydrogen vehicle fuel.
 - ii. The FSS noted that FTC's Fuel Rating Rule (16 CFR Part 309) see the requirements in "Labeling of Alternative Fuels" (<http://www.ftc.gov/bcp/edu/pubs/business/autos/bus29.shtm>) requires dispensers to bear a declaration of minimum hydrogen content determined according to the test methods described in "Standard Test Method for Analysis of Natural Gas by Gas Chromatography (ASTM D1946-90).
 - iii. The FSS modified the proposed HB 130 language to recognize the language in 16 CFR Part 309.15 Posting of non-liquid alternative vehicle fuel rating.

Section I. Prologue

The discussion paper that follows "The Starting Point: A Discussion Paper Describing a Proposed Method of Sale and Quality Specification for Hydrogen Vehicle Fuel originally published in June 2008. The corresponding proposals are for the method of sale and fuel quality.

This paper describes proposals for a uniform method of sale and fuel quality specifications on hydrogen vehicle fuels that are under development by the USNWG Fuel Specifications Subcommittee (FSS). The purpose of this

document is to organize, focus, and record the work of the FSS. Participation in the work of the subcommittee is open to anyone intending to make a positive contribution to the process.

The States have always had a leadership role in establishing and enforcing the laws and regulations for legal metrology and fuel quality in the United States. The goal of this effort is to develop proposals for inclusion in NIST Handbook 130 “Uniform Laws and Regulations in the areas of Legal Metrology and Engine Fuel Quality”¹ which is a source for model laws that the States use in developing their legal requirements. Some states adopt the regulations in that handbook by reference or citation in law, and this approach has provided national uniformity in regulation of a number of significant issues including packaging and labeling, net quantity of contents, and fuel quality.

The FSS includes hydrogen producers, dispenser and component manufacturers, weights and measures, air resource, and fuel quality officials and other interested parties. This document is presented to invite comments from automotive and fuel cell manufacturers, marketers, weights and measures and other state officials and other experts who certainly will have questions, concerns, and suggestions as these proposals are developed in the National Conference of Weights and Measures – Laws and Regulations Committee.

The members of the FSS recognize that when small groups develop standards for emerging technologies it is impossible to be knowledgeable of all aspects about a subject which is, by its nature, changing even as a meeting takes place or a report of its progress is being composed. With this in mind please review this document and contribute your knowledge, understanding, and ideas to this effort.

Section II. Method of Sale and Fuel Quality Standard

Participants at the first FSS meeting in March 2008 considered a proposed for a Method of Sale for Hydrogen Fuel that was prepared by the National Institute of Standards and Technology (NIST). Recent FSS work to update the proposed Method of Sale requirements are presented in Section II below. Also discussed was the need for a quality standard. The basis for that discussion was the proposed Hydrogen Fuel Standard developed by the California Department of Food and Agriculture; Division of Measurement Standards (CDFA/DMS) contained in a March 3, 2008, regulatory notice.² The FSS recognizes and commends the State of California for sharing its knowledge and experience in providing a starting point for a national standard for hydrogen fuel. This document should be interpreted as neither an endorsement nor criticism of the CDFA/DMS proposal by either the FSS or NIST unless otherwise stated. For the most recent FSS updates on the fuel quality proposal refer to Section III.

Uniform Method of Sale for Hydrogen Vehicle Fuel

Defining a legal requirement for a uniform method of sale for commodities is the most practical and efficient way that weights and measures uses to ensure that consumers can make value comparisons between competing sellers of the same commodity. The purpose is to ensure that their purchasing decisions enable them to obtain the greatest value for their money. A uniform method of sale also ensures that sellers advertise and deliver a commodity using a single unit of measurement so comparisons can be quick and simple. Typically commodities (e.g., gasoline, diesel fuel, food, milk, wine, sand and gravel, and others) are sold by weight, measure (volume or dimensions, including area), or count.

Establishing a method of sale for any product is a critical first step in the development of a fair and competitive marketplace for any commodity especially one that is just emerging and for which there is not a traditional method of sale for the commodity on which to build. History has shown that when products are introduced into the marketplace without a legally defined standard, confusion and unfair competitive practices can quickly evolve and potentially harm the consumer’s perception of the product and business reputation of the seller.

¹ See the 2009 Edition of NIST HB 130 at <http://www.nist.gov/owm>

² Available at <http://www.cdfa.ca.gov/dms/hydrogenfuel/hydrogenfuel.html>.

The need for a method of sale was stated in the 2005 “Hydrogen Delivery Technology Roadmap”³ which called on retailers and appropriate government agencies to establish a legal unit of measurement for hydrogen (see endnote ⁱ for more discussion).

The FSS recommends that all retail sales of hydrogen vehicle fuel be by mass using the kilogram as the unit of measurement.

The industry’s pre-market practice has been to dispense hydrogen using the kilogram as the unit of measurement. The use of mass was strongly favored by the FSS participants who agreed that it should be the basis for retail commercial transactions. By requiring use of the kilogram as the unit of measurement for all retail dispensers consumers can make value comparisons between competing retailers. Dispensing hydrogen by mass using the kilogram is specified in Section 2.4.2. Indications of OIML R 139 “Compressed Gaseous Fuel Measuring Systems for Vehicles” (Edition 2007) and is the method of sale used in other countries so the U.S. method of sale will be consistent with that used in the global marketplace. As this fuel becomes fully commercialized, consumers considering the lease or purchase of a hydrogen vehicle will need to learn the fueling process for their hydrogen vehicle and be educated that their fuel purchases will be made on the basis of mass using the kilogram. The FSS considered but does not support a Gasoline Gallon Equivalent for use in retail commercial sales (see endnote ⁱⁱ).

This proposal presents the kilogram as the unit of measurement to be used in commercial sales and on street signs when a unit price is displayed (see Figure 1 on page 5 which provides an example of how the unit of measurement might appear on the dispenser). The unit can be shown using the term “kilogram” or by use of its accepted abbreviation “kg,” which is its prescribed symbol in NIST Special Publication 330 – “The International System of Units (SI).”⁴

Nothing in the proposal should be interpreted as prohibiting the use of a Hydrogen GGE for information purposes to facilitate general comparisons with other fuels in advertisements and other literature. Consumers who are considering the lease or purchase of a hydrogen vehicle should be informed that they will be purchasing fuel by the kilogram and that they can make reliable value comparisons using that method of sale.

The FSS recommends that in retail sales the capital letter “H” be used to represent Hydrogen vehicle fuel and that delivery pressures be presented using the Pascal (Pa), the SI unit for pressure measurement.

Product Identity

The FSS agreed to support the use of the capital letter “H” as the symbol for hydrogen instead of H₂ to of simplify product identification of Hydrogen Vehicle Fuel sold at the retail level.

Service Pressures shall be shown in the SI Unit Pascal (MPa)

Knowing the service pressure of the dispenser is a critical factor for consumers as the storage tanks on their vehicle is designed to be filled at one of those pressures. In addition to needing this information for safety and vehicle filling purposes participants at the March 2008 FSS meeting indicated that retailers may charge different prices depending on the delivery pressure at which the fuel is dispensed. Some dispensers currently are marked with service pressures in units of bar⁵ (e.g., 350 bar and 700 bar) or megapascals (MPa) which are the pressures available to service hydrogen vehicles. A few dispenser manufacturers use megapascal (MPa) in trade publications and in declaring dispenser delivery pressures. The FSS agreed that the service pressure at which the product is dispensed must be posted on the user’s interface of all dispensers.

³ Available at <http://www1.eere.energy.gov/vehiclesandfuels> on the Internet.

⁴ See NIST Special Publication 330 – 2008 “The International System of Units (SI).” Ambler Thompson, Editor.

⁵ A bar is an atmospheric pressure defined as 100 kilopascals. See NIST Special Publication 330 – 2008 “The International System of Units (SI).” Ambler Thompson, Editor.

While the bar is accepted for use with the International System of Units (SI), the metric system, the primary SI unit for pressure is the pascal (international symbol - Pa). The relative value of service pressures for pascals, bar and pounds are 35 MPa (350 bar) (5 000 psi) and 70 MPa (700 bar) (10 000 psi).

The FSS decided that in using the SI unit for pressure, the pascal would standardize industry practice and enable it to easily present the information in a consistent manner. It will also simplify the manner used to declare service pressures on dispensers, street signs and in advertisements.

Unit Pricing in Whole Cents

The FSS also agreed that the conditions for sale, such as operation pressure, should be stated with the unit price in whole cents per kilogram in street signage to inform drivers of hydrogen vehicles of the service pressures available at the retailer’s fueling facility. The proposal does not mandate street signs, but will require that when street signs are available they must display the unit price and service pressure of the dispensers. The requirement is only applicable when retailers voluntarily post or present the price of fuel in advertisements and on street signs.

The FSS agreed the traditional practice of using decimal fractions of a cent in unit pricing in advertisements, the unit price, or in the calculation of total price should not be extended to sales of hydrogen fuel. Under the proposed method of sale that practice is prohibited (e.g., “\$3.499 per kg” would not be permitted but “\$3.49” per kg would be permitted).

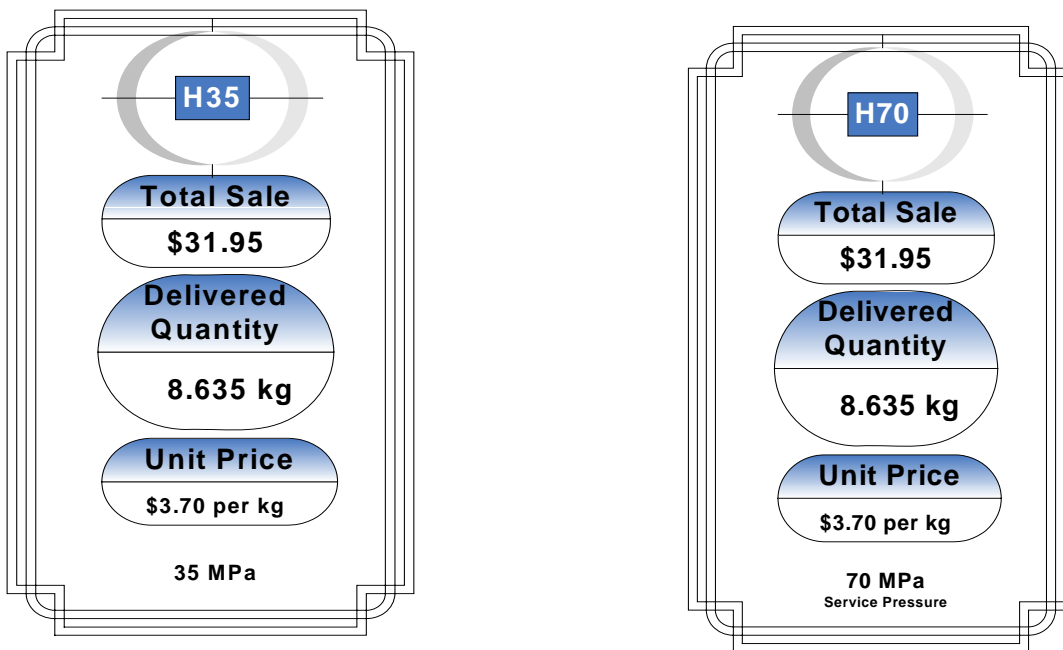


Figure 1. Examples of the Product Identity, Measurement Unit, Unit Price, and Service Pressure on the User’s Interface of a Hydrogen Fuel Dispenser

A Competitive Marketplace

Figure 2 depicts how a fueling station in the marketplace might display required information. Due to the current cost of these installations, the limited user base, the development of home based fueling systems, and limited availability of portable fueling units we are not likely to see competitors offering fuel across the street from one another for some time. However, the purpose of the graphics is to illustrate that a uniform method of sale in a single unit of measurement and other requirements for posting of service delivery information will facilitate value comparison in a competitive marketplace and provide users with critical information. The graphics of the signage shows how posting the unit of measurement and service pressure provides drivers with information to permit them to make product and service pressure value comparisons between retailers.

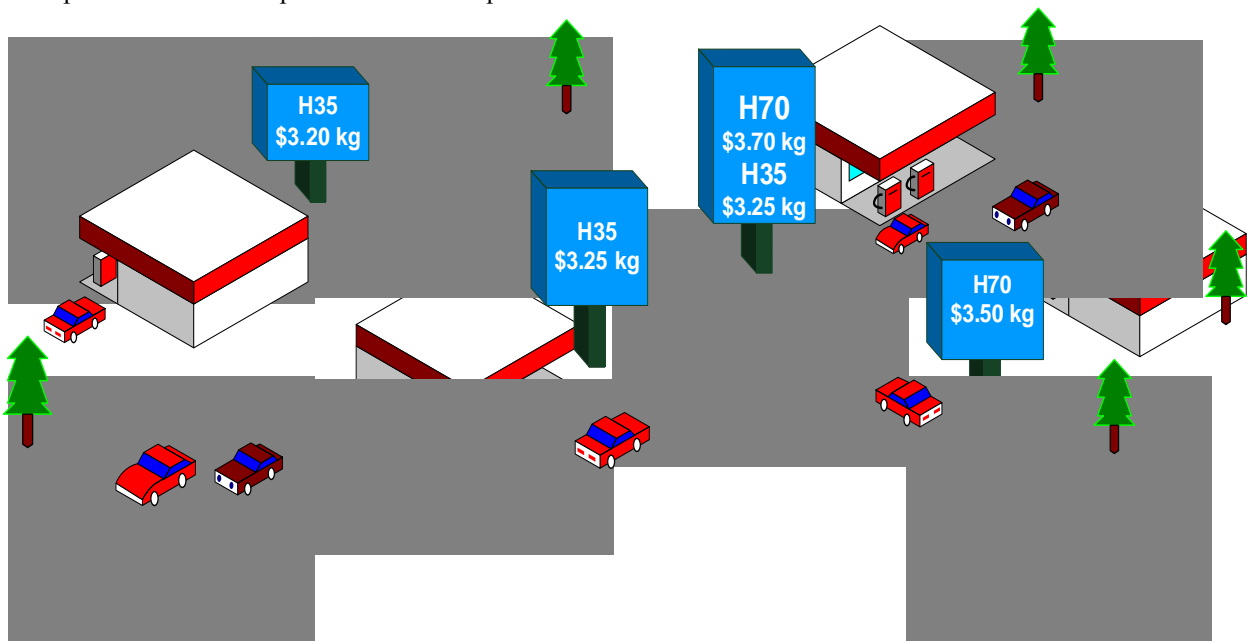


Figure 2. Showing the use of the Uniform Unit of Measurement and Posting of Product Identity, and Service Pressure to Enable Value Comparison

One alternative to the posting of service pressures (perhaps even unit prices) may be found in the growing prevalence of vehicle navigation systems and satellite information services. If drivers of hydrogen vehicles have access to real-time price and service pressure information through those systems and use them to make their purchasing decisions the current approach of using street sign pricing may not continue in this marketplace.

The FSS supports the following method of sale for petroleum:

Recommendation: The Fuel Specification Subcommittee presents the following December 2008 recommendation for consideration by the 2009 NCWM Laws and Regulations Committee.

Section 2. Non-food Products ^[Note 1, page 103]

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. National Fire Protection Association (NFPA) labeling requirements also apply.

2.XX.3.5. Hydrogen shall be labeled in accordance with 16 CFR 309 – FTC Labeling Alternative Fuels.

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_{MPa}).

Section III. Hydrogen Vehicle Fuel Quality Specification

The FSS will continue to develop a model regulation to specify the quality requirements for hydrogen vehicle fuel for addition to the Uniform Fuels and Lubricants Regulation (UFLR) in NIST Handbook 130. The UFLR cites ASTM International and SAE International standards for gasoline, diesel and other fuels. At least 11 states use that model regulation as a basis for their rules on fuel quality. As with other fuels the regulations in Handbook 130 will reference standards from appropriate standards organization and utilize the test methods authorized and referenced by those standards. The proposed regulation will likely include standards developed by ASTM International, SAE International, and the International Organization for Standardization (ISO) or other American National Standards Institute (ANSI) accredited organization.

The State of California is at the forefront in establishing a fuel quality standard for Hydrogen to meet a legislative mandate.⁶ At its first meeting in March 2008, the FSS participants reviewed the March 3, 2008 draft developed by the California Department of Food and Agriculture's/Division of Measurement Standards (CDFA/DMS) so that it could be used as a starting point in the development process for a national standard. This approach takes advantage of California's expertise and because it has been published for comment as part of that state's rulemaking process which means that it has received public review. The CDFA/DMS proposal provides an interim standard for hydrogen fuel.

Once ANSI has adopted fuel standard the CDFA/DMS is required by law to adopt that standard by reference. Since test procedures have not yet been finalized to measure the properties specified in the CDFA/DMS interim standard, that agency will adopt sampling and test procedures in regulation as they are developed. The agency will begin enforcement of its regulations and require compliance once sample and test procedures have been adopted by an accredited organization and its regulation are finalized. Several FSS participants reminded the group that the higher the quality of the fuel the higher its cost may be so the approach taken in the United States must be practical and cost effective if the commercialization of hydrogen vehicle fuel is to be successful.

Proposed Specification for Hydrogen Fuel

The FSS identified several quality criteria where there was tentative agreement with their associated values (see properties 6, 7, 8, 9, 12, 14, and 16 which are highlighted in green) in the proposed Table 1. Hydrogen Fuel Quality Specification. When a quality property and numerical value (defining a maximum or minimum limit) is added to the specification appropriate test methods must then be identified. As test methods are identified and adopted by the FSS they will be added to Column 6 in Table 1. The 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 properties 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.

FSS supports the proposed new definitions to address gaseous hydrogen refueling applications.

1. **Specification for Hydrogen Fuel for Internal Combustion Engines and Fuel Cells**
2. **Definitions**

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.

⁶ See <http://www.cdfa.ca.gov/dms/hydrogenfuel/hydrogenfuel.html> for more information on the California Division of Measurement Standards Hydrogen Fuel Program. (Viewed 4/11/08)

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:

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	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 FTC’s Fuel Rating Rule (16 CFR Part 309) see the requirements in “Labeling of Alternative Fuels” at <http://www.ftc.gov/bcp/edu/pubs/business/autos/bus29.shtm> requires dispensers to bear an declaration of minimum percent of hydrogen determined according to test methods described in “Standard Test Method for Analysis of Natural Gas by Gas Chromatography (ASTM D1946)

The FSS will monitor national and international standard activities, research, and other programs to avoid duplication of effort and ensure that its work provides a fuel specification for hydrogen vehicle fuel that serves the needs of the this emerging marketplace. Quality standards are currently under development in SAE International (e.g., SAE J2719 “Hydrogen Specification Guideline for Fuel Cell Vehicles”) and in ASTM International (e.g., see www.astm.org for a list of the work underway in its Committee D03.14 on Hydrogen and Fuel Cells and that organizations other committees).

Quality standards are under consideration around the world including the European Union, Japan and other countries. Also of interest are the efforts of Working Group 12 of ISO’s Technical Committee 197 on Hydrogen

which is very active in this area.⁷ ISO's website indicates that its fuel quality standard will be finalized within a few years.

Future work of the FSS may include the development of recommendations for field sampling equipment and handling procedures, along with suggestions about what type of test equipment is appropriate for establishing a hydrogen vehicle fuel quality laboratory.

For Further Information or to Comment Contact:

Please send comments and suggestions concerning the proposals presented in this document to Lisa Warfield or Ken Butcher, Technical Advisors to the USNWG Fuel Specifications Subcommittee at lisa.warfield@nist.gov or 301-975-3308 or kbutcher@nist.gov or at 301-975-4859. Faxes may be sent to 301-975-8091.

Fuel Specifications Subcommittee
U.S. National Work Group for the
Development of Commercial Hydrogen Measurement Standards
NIST Weights and Measures Division
Laws and Metric Group
100 Bureau Drive, MS 2600
Gaithersburg, Maryland 20899-2600

⁷

http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=54560. (Viewed 4/11/08)

End Notes

ⁱ **Additional Information on the Importance of a Method of Sale** - Establishing a uniform method of sale ensures marketplace integrity and increases consumer confidence while ensuring fair trade practice in a competitive marketplace. In past experience, the lack of a legal standard of sale has resulted in sellers establishing different methods of sale for the same product. This resulted in investments in weighing and measuring equipment and spending on packaging and marketing programs only to find that the units of measurement used were not appropriate for the commodity. Once a new standard was established existing measuring equipment, labeling, and sales literature had to be retrofitted or discarded. Establishing a method of sale early in the process informs the designers of weighing and measuring devices about how they are to design the device and the user interface. It also enables marketers to create sales and promotional programs for the product using a consistent unit of measurement throughout the system. Past experience with conflicting methods of sale has taught weights and measures and sellers many valuable lessons over the years. One of the most important lessons is that consumers are intelligent and willing to learn new methods of sale and readily accept products and services, if the information they receive from different sellers is informative, uniform, and accurate. Establishing a uniform method of sale will also inform automobile and fuel cell manufacturers about how they will need to educate consumers in sales literature and owners' manuals about the fuel and how it will be measured for dispensing into the vehicles and other refueling applications. Decisions are needed so that as marketing and promotional ideas are being considered and developed the uniqueness of the fuel and dispensers can be addressed using a single unit of measurement.

ⁱⁱ **Additional Information on the Gasoline Gallon Equivalent** - A question at the FSS March 2008 meeting was whether the marketing of hydrogen vehicles against those that use fuels sold on the basis of a gallon would benefit from the establishment of a Gasoline Gallon Equivalent (GGE). GGEs are based on energy content of fuels. GGE for hydrogen is mentioned in the media and government literature as 1 kg = 119,823 kilojoules (kJ) (113,571 BTU (LHV)). GGE is used to compare the fuel in terms of price per gallon and to introduce hydrogen as a commercial vehicle fuel. This approach facilitates those comparisons as long as it is also understood that the energy content in a gallon of fuel varies widely with the fuel. When the GGE for Compressed Natural Gas (CNG) was developed as a legally defined value in the 1990's, one reason for its adoption was to allow consumers to compare the cost of competing fuels on street signs and on dispensers in a unit of measurement that was comparable among fuels such as gasoline. Thus, consumers could determine the potential savings when choosing a vehicle capable of using one type of fuel over another. In 1994 the GGE was set at 2.567 kg for CNG by NCWM using the lower heating value of gasoline which was then given at 120,401.7 kJ (114,118.8 BTU). It should be noted that the adoption of the GGE for CNG was somewhat contentious. A proposal to add a Diesel Gallon Equivalent (DGE) for CNG is expected to be on the NCWM's agenda in 2009.

It is difficult to make accurate comparisons between fuels because energy content varies by fuel, by region, and season for gasoline. Currently the *Transportation Energy Data Book* lists the net energy of a gallon of gasoline at 121,753.4 kJ (115,400 BTU) and diesel as 135,785.7 kJ (128,700 BTU). Variations in energy content increase when gasoline is blended with Ethanol (E10 or E20) and E85 (15 % gasoline + 85 % ethanol) which contains only 89,679.76 kJ (85,000 BTUs) according to the National Ethanol Vehicle Coalition. Hydrogen fuel, which is expected to come into the marketplace as a commercial fuel within the next ten years, will be competing for customers who have far more fuel choices than are currently available. If a GGE is considered for hydrogen the question that should be asked is "Would a GGE based on today's net energy content for Hydrogen be a valid tool 10 years from now to compare it against gasoline, CNG, E85, diesel, and other fuels and the new electric cars expected from automobile manufacturers?"

Because of constant changes in energy policies and environmental concerns new fuels and blends will continue to emerge in the marketplace. This constant state of change impacts the validity of GGEs. One question that must be raised if a GGE for hydrogen is proposed is if these artificial comparison tools should be periodically reviewed to ensure they provide an equitable means of ensuring reasonable and reliable comparisons between fuels.

Appendix F


Briefing by Better Seafood Bureau

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Industry Challenge: Economic Integrity of Seafood

Lisa Weddig
Better Seafood Bureau
January 12, 2009



Outline

- Who is NFI?
- Challenges
- History of Economic Integrity at NFI
- Next Steps



Who is NFI?

- The National Fisheries Institute (NFI) is the nation's leading advocacy organization for the seafood industry.
- NFI's members represent every element of the industry from the fishing vessels at sea to the national seafood restaurant chains.
- NFI and its members support and promote sound public policy based on hard science.




Seafood Consumption

- Overall seafood consumption in America was 16.3 pounds per person in 2007.



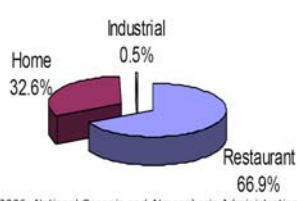
Data compiled by NOAA Fisheries



The food service seafood market size continues to grow


Seafood consumed at food service operations - \$46.6 billion

Seafood consumed at home - \$22.7 billion



Category	Percentage
Restaurant	66.9%
Home	32.6%
Industrial	0.5%

Source: Fisheries of the United States, 2006; National Oceanic and Atmospheric Administration



GAO Report - 1988


- SEAFOOD SAFETY: Seriousness of Problems and Efforts to Protect Consumers
- Seafood misrepresentation
 - Short-weighting
 - Lower value species for a higher value species
 - Improper labeling


CRS Report for Congress


**Seafood Marketing:
Combating Fraud and Deception**

RL34124, August 8, 2007

 <http://nationalaglawcenter.org/assets/crs/RL34124.pdf>


Fraud and Deception

- Mislabeling or Substituting Species
- Low Weights or Undercounting
- Trans-shipments to Avoid Duties


Substitution violations
Published June 1, 2007 in St. Petersburg Times


██████████ Clearwater, 5/17/06, substituted ponga for grouper.
██████████, St. Petersburg, 6/27/06, substituted basa, pangasius fish for grouper.
██████████ Pinellas Park, 7/12/06, substituted cod for grouper.
██████████ Pinellas Park, 7/18/06, substituted pollock and basa for grouper.
██████████ Oldsmar, 7/27/06, substituted pangasius fish for grouper.
██████████ Pinellas Park, 9/20/06, substituted ponga for grouper and trout.
██████████, Crystal River, 10/17/06, substituted swai for grouper.
Source: Florida Department of Business and Professional Regulation


Common Offers

Black Tiger HLSO
6x4 lbs, Block Frozen


100% NW/NC
90% NW/NC
80% NW/NC





Low Weights or Undercounting

Fair Packaging and Labeling Act

Labels must contain accurate information to identify the product, manufacturer, packer or distributor and the **net quantity of contents, in terms of weight or mass, measure, or numerical count.**




SEC 403. Misbranded Food

A food shall be deemed to be **misbranded**—

- (a) ... If (1) its labeling is false or misleading in any particular, ...
- (b) ... If it is offered for sale under the name of another food.
- (d) ... If its container is so made, formed, or filled as to be misleading.
- (e) ... If in package form unless it bears a label containing (1) the name and place of business of the manufacturer, packer, or distributor; and (2) **an accurate statement of the quantity of the contents in terms of weight, measure, or numerical count**, except that ... reasonable variations shall be permitted, ...
- (w) Major food allergen labeling requirements. (states specific species of fish or crustacean shellfish).

FFDCA SEC. 402 Adulterated Food

A food shall be deemed to be **adulterated**—

(b) Absence, substitution, or addition of constituents.

(1) If any valuable constituent has been in whole or in part omitted or abstracted therefrom; or

(2) if any substance has been substituted wholly or in part therefor; or

(4) if any substance has been added thereto or mixed or packed therewith so as to increase its bulk or weight, ... or make it appear better or of greater value than it is.

SEC. 801. Imports and exports

(a) Imports...


If it appears from the examination of such samples or otherwise that ... such article is **adulterated, misbranded,** ... then such article shall be refused admission

Handbook 130

- **6.3. Net Quantity.** – A declaration of net quantity of the commodity in the package, exclusive of wrappers and any other material packed with such commodity ..., shall appear on the principal display panel of a consumer package ...
- **7.2. Location.** – A non-consumer package shall bear on the outside a declaration of the net quantity of contents.

Ensuring Economic Integrity

- Industry and government both have a role in ensuring consumers are confident in seafood purchases.
 - The government provides and **enforces** guidelines to ensure economic integrity
 - Industry follows the guidelines.



GET YOUR CHEATER PACKS HERE!

- Frozen Tilapia Fillet, Skinless, Boneless, 10kg/carton, bulk, IQF, **Size after Glaze**, No Chemical, CO treated or not,
- 5-7oz, **10% Glaze**, CNF Miami or LA USA, USD 1.87/LB
- 5-7oz, **100% NW**, CNF Miami or LA USA, USD 2.15/LB

- Frozen Tilapia Fillet
- 90% NW ,skinless, boneless, **size after glaze** ,IVP packing ,
- 10kg/carton ,bulk
- 3-5oz CNF LA USD 1.70/LB
- 5-7oz CNF LA USD 1.80/LB

TO: SEAFOOD BUYER

FROM: Alphen Yuan
 TEL: 86-532-80099580
 FAX: 86-532-80099580
 EMAIL: joineafoods@better.com
 Website: www.joineafoods.com

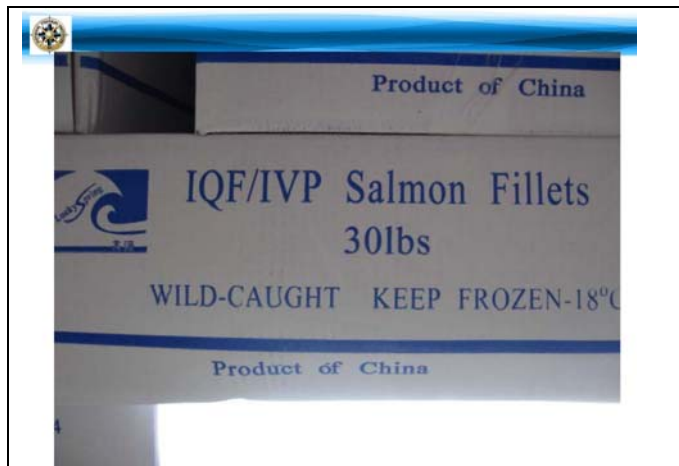
LOS ANGELES OFFICE:
 TEL: 1-626-336-3218
 FAX: 1-626-336-3230

PRODUCT OF CHINA

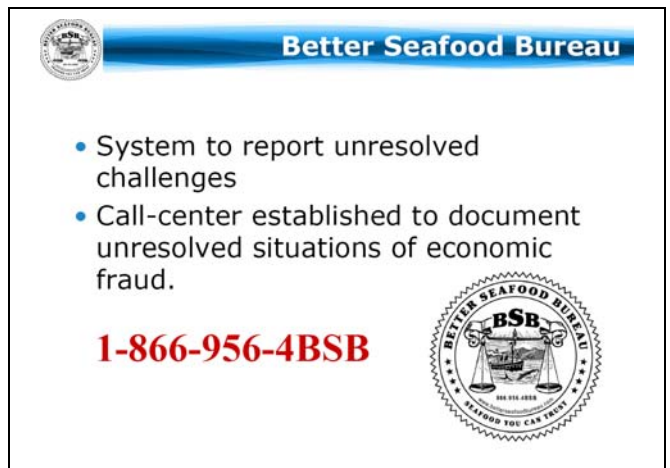
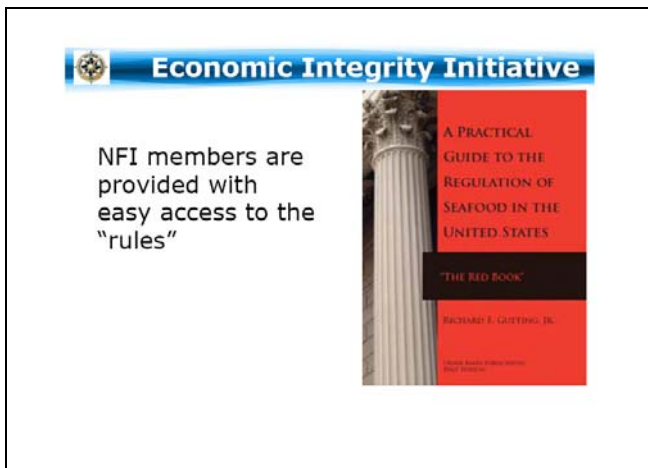
2008-09-30

CHANNEL CATFISH: JUST RELEASED BY FDA
 CHANNEL CATFISH IQF, 16LBS CARTON
 BRAND: XIHE
 80%NW 5-7/7-9OZ, FOB PFS CHICAGO \$1.80/LB
 95%NW 5-7/7-9OZ, FOB PFS HOUSTON: \$1.90/LB
 100%NW 3-5/5-7OZ, FOB PFS NEWARK: \$2.00/LB
 100%NW 3-5/5-7OZ, FOB PFS NORFOLK: \$2.00/LB

Product Fillet	Size	Quality	Unit	Price
	2/4, 4/6, 6/8, 4x10 IQF	70%	FOB Dalian	\$0.82
	skinless, boneless, chem-in	75%	FOB Dalian	\$0.87
		80%	FOB Dalian	\$0.90
		85%	FOB Dalian	\$0.93
		90%	FOB Dalian	\$0.97
		95%	FOB Dalian	\$1.02
		100%	FOB Dalian	\$1.06



- ### Economic Integrity Initiative
- In 2006, NFI Board approved an Economic Integrity Initiative.
 - Goal to increase consumer confidence in seafood products
 - Economic disadvantage to “follow the rules”
 - Develop a process for accountability





Member Response

- It is illegal to offer product and to sell product in the United States that is less than 100% net weight. We are a member of NFI and have signed a seafood integrity contract. This contracts us to notify NFI every time we are offered illegal labeled or weight from any country.
- Please do NOT offer us any product less than 100% net weight and properly labeled.



Member Response

- You people have to stop offering short weight product into the United States-- --We have already contacted the authorities as well as the National Fisheries Institute and have given your companies name with copies of your e-mails.
- We are putting you as well as the American authorities on alert as we have been warned you about in the past of your continuous unacceptable short weight offerings.



- XXX does not own, import or purchased this product, this was an offer we received from an importer/supplier for us to buy, the only thing I did was to pasted it and email it to our clients. **I was not aware of the violations involved in this offer.**



- can not understand what are you talking about? **We just do what customer need.**
- the direction of combating "short weight" **should focus on end sellers in USA**, it has nothing to do with producers, **we merely process goods according to buyers' orders.**



- Have your government write a law making this illegal.



Thank You!

Lisa Weddig
lweddig@nfi.org
703.752.8886

Specifications and Tolerances Committee Interim Report

Todd Lucas, Chairman
Ohio Department of Agriculture
Weights and Measures

Reference
Key Number

300 INTRODUCTION

The Specifications and Tolerances (S&T) Committee (hereinafter referred to as “Committee”) submits its Interim Report for consideration by the National Conference on Weights and Measures (NCWM). This report contains the items discussed and actions proposed by the Committee during its Interim Meeting in Daytona Beach, Florida, January 11 - 14, 2009.

Table A identifies the agenda items in the Report by reference key number, item title, and page number. The item numbers are those assigned in the Interim Meeting agenda. A Voting item is indicated with a “V” after the item number. An item marked with an “I” after the reference key number is an Informational item. An item marked with a “D” after the reference key number is a Developing item. The Developing designation indicates an item has merit; however, the item was returned to the submitter for further development before any action can be taken at the national level. An item marked with a “W” was Withdrawn by the Committee and generally will be referred to the regional weights and measures associations because it either needs additional development, analysis, and input or does not have sufficient Committee support to bring it before the NCWM.

This Report contains many recommendations to revise or amend National Institute of Standards and Technology (NIST) Handbook 44 (HB 44), 2009 Edition, “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices.” Proposed revisions to the handbook(s) are shown in **bold face print** by ~~striking out~~ information to be deleted and underlining information to be added. Requirements that are proposed to be nonretroactive are printed in **bold-faced italics**.

Note: The policy of NIST is to use metric units of measurement in all of its publications; however, recommendations received by the NCWM technical committees have been printed in this publication as submitted. Therefore, the report may contain references to inch-pound units.

**Table A
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300	INTRODUCTION	1
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310-2	I Appendix D – Definition of Electronic Devices, Software-Based and Built-For-Purpose Device ...	8
310-3	I G-S.1. Identification. – (Software).....	10
310-4	V G-N.3. Verification of Testing Standards	15
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320	SCALES.....	19
320-1A	V S.2.1.6. Combined Zero-Tare (“0/T”) Key, Appendix D – Definitions for Tare Mechanism, and Tare Balancing Mechanism.....	19

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320-1C	I	S.2.3.4. through S.2.3.7. Value of Tare Indication and Recorded Representations, and Appendix D. Definitions for Gross Weight Value, Net Weight Value, Net Weight, Tare, and Tare Weight Value.....	24
320-1D	I	S.2.4. Preset Tare Mechanism and Appendix D – Definitions for Preset Tare.....	26
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320-3	I	S.2.1.7. Automatic Zero-Setting Mechanism.....	29
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Table C
Glossary of Acronyms

AWS	Automatic Weighing Systems	NEWMA	Northeastern Weights and Measures Association
AWWA	American Water Works Association	NIST	National Institute of Standards and Technology
BCS	Belt-Conveyor Scales	NTEP	National Type Evaluation Program
CC	Certificate of Conformance	NTETC	National Type Evaluation Technical Committee
CWMA	Central Weights and Measures Association	NW&SA	National Weighing and Sampling Association
EPO	Examination Procedure Outline	OEM	Original Equipment Manufacturer
GS	NTETC Grain Analyzer Sector	Pub 14	NCWM Publication 14
GMM	Grain Moisture Meters	RMFD	Retail Motor-Fuel Dispenser
GPMA	Gasoline Pump Manufacturers Association	SI	International System of Units
HB 44	NIST Handbook 44	SMA	Scale Manufacturers Association
HB 130	NIST Handbook 130	SWMA	Southern Weights and Measures Association
LMD	Liquid-Measuring Device	WG	Work Group
LPG	Liquefied Petroleum Gas	WMD	NIST Weights and Measures Division
MDMD	Multiple Dimension Measuring Devices	WS	NTETC Weighing Sector
MFM	Mass Flow Meter	WWMA	Western Weights and Measures Association
MMA	Meter Manufacturers Association	USNWG	NIST/OIML U.S. National Working Group
MS	NTETC Measuring Sector	VTM	Vehicle-tank Meters
NCWM	National Conference on Weights and Measures, Inc.		
<p>“Handbook 44” (HB 44) means the 2009 Edition of NIST Handbook 44 “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices”</p> <p>“Handbook 130” (HB 130) means the 2009 Edition of NIST Handbook 130 “Uniform Laws and Regulations in the Areas of Legal Metrology and Fuel Quality”</p> <p>Note: NIST does not imply that these acronyms are used solely to identify these organizations or technical topics.</p>			

Details of All Items
(In Order by Reference Key Number)

310 GENERAL CODE

310-1 I G-S.8. Provision for Sealing Electronic Adjustable Components, G-S.8.1. Access to Calibration and Configuration Adjustments, and G-S.8.2. Automatic or Semi-automatic Calibration Mechanism

Source: 2008 Carryover Item 310-1. This item originated from the SWMA Committee and first appeared on the Committee's 2008 agenda.

Recommendation: Amend General Code paragraph G-S.8. to clarify what is considered an effective method of sealing, and requirements for indicating and recording appropriate information when a device is in a metrological adjustment mode.

Background/Discussion: At its 2007 Annual Meeting, the SWMA received a proposal to add requirements to G-S.8. to assure that a device could not be sealed in the configuration mode and continue to operate normally. Such a condition could facilitate fraud. The proposal as submitted required that a device continuously indicate when access to the set-up mode was not disabled.

At the 2008 Interim Meeting, the Committee reviewed the comments received during the open hearing and discussed the alternate proposals provided by WMD and SMA. The Committee agreed that if a device designed for commercial applications is capable of being "sealed" with external or remote access to the calibration or configuration mode, it is clearly in violation of the current G-S.8. Provision for Sealing Electronic Adjustable Components and G-S.2. Facilitation of Fraud and, therefore, no change to the existing language is needed. However, because of the ongoing disagreement on the interpretation of G-S.8. among the NTEP laboratories, the Committee agreed to make changes to the proposal based on the concerns raised during the open hearing. The changes to the original proposal made a distinction between configuring a device to either enable or disable external or remote access to the calibration and configuration modes and taking the device out of a normal mode of operation and putting it into a special mode of operation where adjustments are made to calibration and configuration parameters. In other words, if the internal position of a switch or jumper enables external access to the calibration and configuration modes, the device will operate normally until an operator takes action such as entering a pass code, depressing and holding down a specific key, or uses other means to enter a special operating mode to make adjustments to calibration and configuration parameters. The Committee also believes that an indication for the adjustment mode of operation is only necessary for devices with approved category 1, 2, or 3 audit trails and that it not be operable in normal weighing or measuring operation.

The revised proposal states that:

- In the case of a device with a physical security seal, the application of the seal means that the external or remote access that enables the calibration and configuration modes is automatically disabled.
- In the case where a device has an approved audit trail, the device would be required to clearly and continuously indicate on the display (and printed if equipped with a printer) that it is in a calibration mode and not the normal operating mode.

At the 2008 Annual Meeting, the Committee heard comments from WMD which noted that the alternate language submitted by SMA would require that *all* devices provide the operator with indications in the calibration mode. This would encompass mechanical and electronic devices, and devices that use category 1 physical seals. Additionally, WMD believes that a device does not need indications in a calibration or configuration mode if it is incapable of providing indications that can be interpreted, printed, or transmitted to a memory device as a correct measurement value. WMD suggested that the Committee amend the recommendation to address some of the concerns noted by the CWMA, NTEP participating laboratories, and WMD since the 2008 Interim Meeting.

The Committee agreed with the comments from the CWMA, and WMD and amended paragraph G-S.8.1. to:

- delete the references to the sealing categories of device,

- clarify printing requirements, and
- include an option that the device not operate or provide metrological indications that can be interpreted, or transmitted into memory or to recording elements while in this mode.

Just prior to the voting session, it was noted that the revised language in G-S.8.1.(a) was inadvertently changed to where it could be literally read that the physical seal itself disabled access to the adjustment mechanisms instead of preventing access to the mechanism. Consequently, the Committee changed the status of the item from Voting to Informational. The Committee believed that the intent of the recommendation is to ensure that the access to the calibration and configuration modes is disabled.

The Committee redrafted the language in paragraph G-S.8.1. and submitted the following revised language for G-S.8.1. to the regional weights and measures associations for further review and consideration.

G-S.8.1. Access To Calibration and Configuration Adjustments - Electronic Devices. – An electronic device shall be so designed that access to calibration and configuration modes, including external and remote access, are only permitted when:

- (a) **the application of the physical security seal shall ensure that the access to the calibration and configuration modes is disabled, or**
- (b) **the calibration and configuration adjustments are protected by an approved ~~category 1, 2, or 3~~ audit trail, and the device shall clearly and continuously indicate and print, if equipped with a printer, that the calibration and configuration adjustment modes are enabled.**

During the calibration and configuration adjustment mode, electronic devices shall either;

- **not provide metrological indications that can be interpreted, or transmitted into memory, or printed while it is in the calibration and/or configuration adjustment mode as a correct measurement value, or**
- **clearly and continuously indicate that it is in the calibration and/or configuration adjustment mode and record such message if capable of printing in this mode.**

(Nonretroactive as of January 1, 201X)

At its 2008 Annual Technical Conference, the WWMA supported the above alternate language for paragraph G-S.8.1. and recommended that this move forward as an Informational item to allow further review, comments and recommendations by the NTETC weighing and measuring sectors, the other regional associations, and other interested parties.

At its 2008 fall meeting, the NTETC Weighing Sector did not have sufficient time to review and provide comments on this item.

During its 2008 Interim Meeting, the CWMA and NEWMA supported the Committee's recommendation as shown in the 2008 Annual Report of the NCWM and 2009 Interim agenda.

At its 2008 Annual Meeting, the SWMA heard no specific recommendations for change to the proposal during its open hearings. The SWMA Committee heard that the SMA plans to further review the item and may have additional recommendations to propose for consideration. The Committee supports the changes proposed by the NCWM S&T Committee at the July 2008 Annual Meeting, noting that there were some comments regarding portions of the language that may need to be addressed. If an agreement cannot be reached on proposed changes to these paragraphs, the SWMA recommended that additional work is needed before the item is ready for a vote and that the NCWM S&T Committee may wish to consider at least incorporating interpretations and guidelines for the existing language in its reports. Consequently, the Committee recommended maintaining this as an Informational item on its agenda.

At its 2008 fall meeting, the SMA supported the intent of the item and recommends the following language:

G-S.8.1. Access to Calibration and Configuration Adjustments. – A device shall be so designed that:

- (a) The application of the physical security seal shall ensure that the calibration and configuration modes are disabled, or**
- (b) The calibration and configuration adjustments are protected by an approved category 1, 2, or 3 method of sealing, and the device shall clearly and continuously indicate and print, if equipped with a printer, that the calibration and configuration adjustment modes are enabled.**

During the calibration and configuration adjustment mode, electronic devices shall either:

- **The device shall not provide metrological indications that can be interpreted, or transmitted into memory, or printed while it is in the calibration and/or configuration adjustment mode as a correct measurement value, or**
- **The device shall clearly and continuously indicate that it is in the calibration and/or configuration adjustment mode and record such message if capable of printing in this mode.**

Nonretroactive as of January 1, 201X)

(Added 201X)

During the open hearings at the 2009 Interim Meeting, WMD stated that it had received comments questioning how the application of a physical seal (as recommended by the manufacturer and listed on the CC) ensures that the calibration and configuration modes are disabled. What does that presence of the physical seal (pressure sensitive or lock and wire) do to the device that disables the calibration and configuration modes?

In considering these comments, WMD suggested that the Committee consider the following changes:

- Modify G-S.8. to clarify the differences in requirements between physical seals and electronic seals (audit trails),
- Add new specifications for externally and remotely configurable devices,
- Amend G-UR.4.5. to require the user to verify that the device is correctly configured to disable external configuration,
- Add definitions from the white paper on the “Metrological Requirements for Audit Trails” adopted by NCWM in July 1993, and
- Add a new definition for externally configurable devices.

Stephen Patoray, Consultants on Certification, LLC, related discussions from the NTETC Weighing Sector where it was reported that service agents were leaving scales configured with external calibration capability and then applying a security seal which did not follow the manufacturer’s instructions. He also expressed concerns that the proposed language would require a manufacturer to design a device where the application of the physical seal (e.g., lock and wire, pressure sensitive, etc.) would disable external access to the configuration mode. Currently, all that a physical seal does is provide an indication that the seal has been broken and thus leave a device subject to adjustment. He believes that the language in the proposal would force the manufacturer to redesign access covers to devices so that the cover disables the external adjustment capability. Consequently, the application of the security seal secures the cover in place and then if broken, provides an indication that the device may have been adjusted.

The Committee also received a comment from Will Wotthlie, Maryland, stating that he was concerned with the language that requires that the physical seal “shall ensure” that external access to the configuration mode is disabled. He provided examples of a mechanical ATC element where a specially designed sealing pin had to be installed before the physical seal could be applied and where electronic motor-fuel devices have a specially designed cover plate where the closing of the cover plate disables the electronic configuration. The manufacturer has the option

under this proposal to either specially design the physical seal method or sealing or design the device with an electronic method of sealing.

Several manufacturers stated that this proposal was not ready and that designs for the method of providing security to the metrological adjustments should be left to the manufacturers. Darrell Flocken, Mettler-Toledo, added that the intent of the proposal is that the manufacturer can either design a device so that a security seal cannot be applied without placing the device into the proper mode *or*, design the device so that it has an approved audit trail.

The Committee agreed with the comments that the proposal *is not ready* to become a Voting item and suggested that further development to the proposal addresses the following concerns:

1. Avoid language that allows the indication of usable metrological values while in the adjustment mode for devices that do not have an event logger.
2. Recognize that more than one method of sealing is acceptable on a single device, such as using a lock and wire seal for the mechanical adjustments and an audit trail for electronic adjustments.
3. Recognize that other codes in HB 44 do not have language for device categories and corresponding methods of sealing.
4. Require an obvious indication when a device is being adjusted if it is provided with a physical security seal.
5. Clarify that the application of a physical security seal to a specially designed and sealable plate or cover that disables external access to the configuration and adjustment mode is not the only method to seal adjustable components.

Consequently, the Committee recommends that this item remain Informational. See the 2008 NCWM Annual Report for additional background information.

After the Interim Meeting, the NIST technical advisor developed the following language that can be further developed by the regional weights and measures associations, NTETC sectors, and other interested parties with the intent that a revised proposal can be forwarded to the Committee for consideration at the 2010 NCWM Interim Meeting.

G-S.8. Provision for Sealing Electronic Adjustable Components. – *A device shall be designed with provision(s) for: ~~applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.~~*

(a) applying a physical security seal that must be broken, or

(b) using other approved means of providing security (e.g., data change audit trail available at the time of inspection)

before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.

[Nonretroactive as of January 1, 1990]

(Amended 201X)

A device may be fitted with an automatic or a semi-automatic calibration mechanism. This mechanism shall be incorporated inside the device. After sealing, neither the mechanism nor the calibration process shall facilitate fraud.

(Added 1985) (Amended 1989 and 1993)

G-S.8.1. Multiple Weighing or Measuring Elements that Share a Common Provision for Sealing. - (Unchanged)

G-S.8.2. Multiple Sealing Methods. – Weighing and measuring devices may be approved for use with multiple methods for sealing adjustable components such as physical seals for calibration adjustment (e.g., load cells, meters, etc.) and event counters or event logger for the configuration parameters (e.g., capacity, interval size, octane blend settings, etc.).

[Nonretroactive as of January 1, 1990]

(Added 201X)

G-S.8.3. Adjustment Mode Indications. – During the calibration and configuration adjustment mode, the device shall:

- (a) Not provide metrological indications that can be interpreted, or transmitted into memory, or printed while it is in the calibration and/or configuration adjustment mode as a correct measurement value, or***
- (b) Clearly and continuously indicate that it is in the calibration and/or configuration adjustment mode, and record such message if capable of printing in this mode.***

Nonretroactive as of January 1, 201X)

(Added 201X)

310-2 I Appendix D – Definition of Electronic Devices, Software-Based and Built-For-Purpose Device

Source: 2008 Carryover Item. This item originated from the NTETC Software Sector and first appeared on the Committee’s 2007 agenda as Developing Item Part 1, Item 2.

Recommendation: Delete the current definition of built-for-purpose device as follows:

~~**built for purpose device. Any main device or element which was manufactured with the intent that it be used as, or part of, a weighing or measuring device or system. [1.10]**~~

~~**(Added 2003)**~~

Add a new definition and a cross-reference to Appendix D in HB 44 for “Electronic devices, software-based” as follows to replace the current definition of “built-for-purpose device:”

Electronic devices, software-based. – Weighing and measuring devices or systems that use metrological software to facilitate compliance with Handbook 44. This includes:

- (a) Embedded software devices (Type P), aka built-for-purpose. – A device or element with software used in a fixed hardware and software environment that cannot be modified or uploaded via any interface without breaking a security seal or other approved means for providing security, and will be called a “P,” or**
- (b) Programmable or loadable metrological software devices (Type U), aka not-built-for-purpose. – A personal computer or other device and/or element with PC components with programmable or loadable metrological software, and will be called “U.” A “U” is assumed if the conditions for embedded software devices are not met.**

Software-based devices – See Electronic devices, software-based.

Background/Discussion: In 2005 the Board of Directors established an NTETC Software Sector. One of the tasks of the Sector is to develop a clear understanding of the use of software in today's weighing and measuring instruments.

At the Sector's October 2007 meeting, it was initially suggested that the term "not-built-for-purpose" be removed from the wording in NIST HB 44 paragraph G-S.1.1. since there is no definition for a not-built-for-purpose device in HB 44. After a lengthy discussion related to the terms "built-for-purpose" and "not-built-for-purpose," the Sector agreed these terms were not clear and should be replaced with the terminology proposed above. The proposed definitions are based on the revision of OIML R 76 Non-automatic weighing instruments Subsections 5.5.1. (Type P) and 5.5.2. (Type U).

At the 2008 Interim Meeting, the SMA supported the intent of the item, but stated that it is premature to place these definitions in HB 44. The SMA recommended that the status of the item be changed to Developing on the S&T Committee agenda. The Committee agreed to move Item 310-2 of the 2008 S&T Committee Interim agenda and assign Developing status as 360-2 Part 1, Item 2.

At the 2008 Annual Meeting, the Committee heard comments from the former NTETC Software Sector Chairman indicating that the Sector had completed its review of this item and could not develop it any further. The Chairman requested that the Committee consider moving the item from the Developing section of the agenda and at least make it an Informational item to facilitate discussion and comment on the proposed language. Consequently, the Committee agreed to change the status of the item from Developing to Informational in its agenda.

At its 2008 Annual Technical Conference, the WWMA agreed to propose this item remain Informational, based on comments heard supporting the item, until other interested parties had the opportunity to provide comments.

At its 2008 Interim Meeting, the CWMA heard comments during their open hearings in favor of the item and no comments were made in opposition. The CWMA recommends this item go forward as a Voting item.

At its 2008 Interim Meeting, NEWMA discussed how this item would affect field examination and verification of software. NEWMA recommends this item move forward as Informational.

At its 2008 Annual Meeting, the SWMA heard comments indicating that the Software Sector is seeking additional input on the proposed definitions and views the proposed changes as a first step in developing wider changes to the General Code and Definitions to better accommodate software-based devices. The SWMA agrees that additional review and study is needed before the proposal can be forwarded as a Voting item and, therefore, is maintaining this item as an Informational item on its agenda. The SWMA encourages people to review this proposal and the proposal in Item 310-3 and provide input to the NCWM S&T Committee and the Software Sector. The SWMA is interested in comments from other organizations, including SMA. In the meantime, the Committee also offers the following comments for consideration:

- The term "software-based electronic devices" is not currently included in NIST Handbook 44. The Committee acknowledges that this proposal is a step toward a broader proposal; however, it believes it is inappropriate to include a definition for a term that isn't currently used in the handbook.
- There needs to be a definition and/or cross-reference for the terms "Type P" and "Type U." A better approach might be to add a reference for "not-built-for-purpose;" include cross-references for terms "Type P" and "Type U" to the terms "built-for-purpose" and "not-built-for purpose;" and develop proposed changes to the General Code to incorporate the new terms "Type P" and "Type U." This would ensure references to terminology that is being used in Handbook 44.

At the 2009 NCWM Interim Meeting, the Committee received comments from the SMA stating that it now opposes this item since there is no technological justification for making a distinction in software-based device types. Darrell Flocken added that the SMA can only provide limited responses; SMA continues to support the efforts of the Software Sector and the SMA response is based on the concern that the proposed definitions in this recommendation and the marking requirements proposed in agenda Item 310-3 will make a weighing device more complex than what is currently produced. The MMA indicated that it supports the item as written in the recommendation.

Will Wotthlie, Maryland, does not agree with the SMA position that there are no technological differences between the types of software-based devices. He added that Type P devices and separable elements have limited flexibility in changing software and indications and frequently include the sensing elements necessary for the measurement (e.g., load cells, meters, etc.), whereas Type U devices and separable elements are typically devices that do not contain measuring elements; can be replaced with compatible equipment and display devices purchased from any number of sources; and only process metrological information received from measuring and other sensing elements.

Stephen Patoray, Consultants in Certification, LLC, agrees with the SMA that there are few differences between Type P and U software-based devices. However, there are significant differences between Type P and U devices in that a Type P device is defined as an instrument that requires a security means since the instrument has fixed hardware (including sensing components), where the metrological software is *embedded* into the instrument. Type U devices do not include fixed components and metrological software cannot be sealed using physical security seals or the minimum form of an audit trail (i.e., two event counters).

Software Sector Co-chair Jim Pettinato (FMC Technologies) added that international recommendations recognize the differences between embedded software and programmable/loadable software. Additionally, the Software Sector recommends that this item remain Informational to allow conference members to further study the proposed definitions.

The Committee agreed with the comments received during the open hearing and the request from the Co-chairman of the Software Sector and agreed that this item should remain an Informational item for further review.

Additional background information on this item can be reviewed in the 2008 Final Report of the Committee.

310-3 I G-S.1. Identification. – (Software)

Source: 2008 Carryover Item. This item originated from the NTETC Software Sector and first appeared on the Committee’s 2007 agenda as Developing Item Part 1, Item 1.

Recommendation: Amend G-S.1. and G-S.1.1. as follows:

G-S.1. Identification. – For the purposes of identification, all equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect and manufactured on or after January 1, 201X, shall be clearly marked as specified in Table G-S.1. Identification and explained in the accompanying notes in Table G-S.1. Notes:

All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect **and manufactured prior to January 1, 201X**, shall be clearly and permanently marked for the purposes of identification with the following information:

- (a) the name, initials, or trademark of the manufacturer or distributor;
- (b) a model identifier that positively identifies the pattern or design of the device;

(1) The model identifier shall be prefaced by the word “Model,” “Type,” or “Pattern.” These terms may be followed by the word “Number” or an abbreviation of that word. The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.). The abbreviation for the word “Model” shall be “Mod” or “Mod.” Prefix lettering may be initial capitals, all capitals, or all lowercase.

[Nonretroactive as of January 1, 2003]

(Added 2000) (Amended 2001)

- (c) a nonrepetitive serial number, except for equipment with no moving or electronic component parts and **Type U (not-built-for-purpose) software-based** devices;
[Nonretroactive as of January 1, 1968]
(Amended 2003 **and 201X**)
- (1) The serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number.
[Nonretroactive as of January 1, 1986]
- (2) Abbreviations for the word “Serial” shall, as a minimum, begin with the letter “S,” and abbreviations for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., S/N, SN, Ser. No., and S. No.).
[Nonretroactive as of January 1, 2001]
- (d) the current software version or revision identifier for **Type U (not-built-for-purpose) software-based** devices;
[Nonretroactive as of January 1, 2004]
(Added 2003) (**Amended 201X**)
- (1) The version or revision identifier shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required version or revision.
[Nonretroactive as of January 1, 2007]
(Added 2006)
- (2) Abbreviations for the word “Version” shall, as a minimum, begin with the letter “V” and may be followed by the word “Number.” Abbreviations for the word “Revision” shall, as a minimum, begin with the letter “R” and may be followed by the word “Number.” The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.).
[Nonretroactive as of January 1, 2007]
(Added 2006)
- (e) an NTEP Certificate of Conformance (CC) number or a corresponding CC Addendum Number for devices that have a CC. The CC Number or a corresponding CC Addendum Number shall be prefaced by the terms “NTEP CC,” “CC,” or “Approval.” These terms may be followed by the word “Number” or an abbreviation of that word. The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.)
[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.

(Amended 1985, 1991, 1999, 2000, 2001, 2003, ~~and~~, 2006, **and 201X**)

G-S.1.1. Location of Marking Information for Type U (Not-Built-For-Purpose), Software-Based Devices. – For ~~Type U-not-built-for-purpose, software-based~~ devices **manufactured prior to January 1, 201X, either:**

- (a) The required information in G-S.1. Identification. (a), (b), (d), and (e) shall be permanently marked or continuously displayed on the device; or
- (b) The Certificate of Conformance (CC) Number shall be:
- (1) permanently marked on the device;
- (2) continuously displayed; or

- (3) *accessible through an easily recognized menu and, if necessary, a submenu. Examples of menu and submenu identification include, but are not limited to, “Help,” “System Identification,” “G-S.1. Identification,” or “Weights and Measures Identification.”*

Note: For (b), clear instructions for accessing the information required in G-S.1.(a), (b), and (d) shall be listed on the CC, including information necessary to identify that the software in the device is the same type that was evaluated.

[Nonretroactive as of January 1, 2004]

(Added 2003) (Amended 2006 **and 201X**)

Table G-S.1. Identification for Devices Manufactured on or after January 1, 201X (For applicable notes, see Table G-S.1. Notes on Identification)			
<u>Required Marking</u>	<u>Full Mechanical Devices and Separable Mechanical Elements</u>	<u>Type P Electronic Devices and Separable Elements</u>	<u>Type U Electronic Devices and Separable Elements</u>
<u>Name, initials, or trademark of the manufacturer or CC holder</u>	<u>Hard-Marked</u>	<u>Hard-Marked or Continuously Displayed</u>	<u>Hard-Marked, Continuously Displayed, or Via Menu (display) or Print Option (8)</u>
<u>Model identification information that positively identifies the pattern or design of the device (1)</u>	<u>Hard-Marked</u>	<u>Hard-Marked or Continuously Displayed</u>	<u>Hard-Marked, Continuously Displayed, or Via Menu (display) or Print Option (8)</u>
<u>Non-repetitive serial number (2)</u>	<u>Hard-Marked</u>	<u>Hard-Marked or Continuously Displayed</u>	<u>Not Acceptable</u>
<u>Software version or revision (3)</u>	<u>Not Applicable</u>	<u>Hard Marked (5), Continuously Displayed, or by Command (operator action) (6)</u>	<u>Continuously Displayed or Via Menu (display) or Print Option (8)</u>
<u>Certificate of Conformance number or corresponding CC Addendum (4)</u>	<u>Hard-Marked</u>	<u>Hard-Marked or Continuously Displayed</u>	<u>Hard-Marked (7) or Continuously Displayed</u>
<u>The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.</u>			

(Added 201X)

Table G-S.1. Notes on Identification
For Devices Manufactured on or after January 1, 201X

- 1) **The model identifier shall be prefaced by the word “Model,” “Type,” or “Pattern.” These terms may be followed by the word “Number” or an abbreviation of that word.**
 - **The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.).**
 - **The abbreviation for the word “Model” shall be “Mod” or “Mod.” Prefix lettering may be initial capitals, all capitals, or all lowercase.**
- 2) **Except for equipment with no moving or electronic parts, the serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number.**
 - **Abbreviations for the word “Serial” shall, as a minimum, begin with the letter “S,” and abbreviations for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., S/N, SN, Ser. No., and S. No.).**
- 3) **Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be dedicated to the metrologically significant portion.**
 - **The version or revision identifier shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required version or revision.**
 - **Abbreviations for the word “Version” shall, as a minimum, begin with the letter “V” and may be followed by the word “Number.”**
 - **Abbreviations for the word “Revision” shall, as a minimum, begin with the letter “R” and may be followed by the word “Number.”**
 - **The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.).**
- 4) **An NTEP Certificate of Conformance (CC) number or a corresponding CC Addendum Number for devices that have a CC. The CC Number or a corresponding CC Addendum Number shall be prefaced by the terms “NTEP CC,” “CC,” or “Approval.”**
 - **These terms may be followed by the word “Number” or an abbreviation of that word.**
 - **The abbreviation for the word “Number” shall, as a minimum, begin with the letter “N” (e.g., No or No.).**
- 5) **If the manufacturer declares that the primary sensing element “software” is integral, has no end user interface and no print capability, the version/revision shall be hard-marked on the device. Example: Primary sensing element may be Positive Displacement (P.D.) meter with integral correction, digital load cell (only for reference, not limiting).**
- 6) **Information on how to obtain the Version/Revision shall be included on the NTEP CC.**
- 7) **Hard-marking of the CC Number is permitted if no means of displaying this information is available.**
- 8) **Information on how to obtain the name, initials, or trademark of the manufacturer or CC holder, model designation, and software version/revision information shall be included on the NTEP CC.**

(Added 201X)

Background/Discussion: In 2005 the Board of Directors established an NTETC Software Sector. One of the tasks of the Sector is to develop a clear understanding of the use of software in today’s weighing and measuring instruments.

During their October 2007 meeting, the Sector discussed the value and merits of required markings for software. This included the possible differences in some types of devices and marking requirements. After hearing several proposals, the Sector agreed to the following technical requirements applicable to the marking of software.

1. The NTEP CC Number must be continuously displayed or hard-marked;
2. The version must be software-generated and shall not be hard-marked;
3. The version is required for embedded (Type P) software;
4. Printing the required identification information can be an option;
5. Command or operator action can be considered as an option in lieu of a continuous display of the required information; and
6. Devices with Type P (embedded) software must display or hard-mark make, model, S.N. to comply with G-S.1. Identification.

At the 2008 NCWM Annual Meeting, the Committee heard comments from the former NTETC Software Sector Chairman indicating that the Sector had completed its review of this item and could not develop it any further during its May 2008 Sector meeting. He requested that the Committee consider moving the item from the Developing section of the agenda and make it an Informational item on the Committee’s agenda to facilitate discussion and comment on the proposed language. Consequently, the Committee agreed to forward the item to the regional weights and measures associations for consideration and will include this item on its 2009 interim agenda.

After the 2008 Annual Meeting, WMD reviewed the following Software Sector Proposal to amend G-S.1. and/or G-S.1.1. in the Committee’s 2008 Interim Report:

Method	NTEP CC No.	Make/Model/Serial No.	Software Version/Revision
TYPE P electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X	X	Not Acceptable ¹
Continuously Displayed	X	X	X
By command or operator action	Not Acceptable	Not Acceptable	X ²
¹ If the manufacturer declares that the primary sensing element “software” is integral, has no end user interface and no print capability, the version/revision shall be hard marked on the device. Example: Primary sensing element may be Positive Displacement (P.D.) meter with integral correction, digital load cell (only for reference, not limiting). ² Information on how to obtain the Version/Revision shall be included on the NTEP CC. Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.			

Method	NTEP CC No.	Make/Model	Software Version/Revision
TYPE U electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X ³	X	Not Acceptable
Continuously Displayed	X	X	X
Via Menu (display) or Print Option	Not Acceptable	X ⁴	X ⁴
³ Only if no means of displaying this information is available. ⁴ Information on how to obtain Make/Model, Version/Revision shall be included on the NTEP CC. Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.			

WMD agreed that the proposed language has merit. However, the Software Sector did not include a recommendation on how to incorporate the proposal into existing G-S.1. and G-S.1.1. language. WMD studied the current and proposed language and was not sure how to address the various existing requirements and multiple non-retroactive dates. Consequently, WMD suggested changes to the General Code language on Identification be considered in the further review of this item by the Committee. In brief, the WMD proposed language divides the identification and marking location requirements for all devices and separable elements manufactured prior to and

after a date adopted by the Conference. WMD developed two versions of proposed Table G-S.1. (with the only difference being that the rows and columns are reversed) for consideration by the Conference and forwarded these to the regional weights and measures associations.

At their September 2008 meetings, the WWMA and CWMA reviewed the WMD suggested changes for G-S.1. and Tables G-S.1.a. and G-S.1.b. and supported the proposal to amend G-S.1. and to include the marking requirements in a table format similar to other specific device codes. The WWMA also expressed a preference for the alternate Table G-S.1.a. and recommends that this item remain Informational for further review and discussion.

At their October 2008 Interim Meeting, NEWMA also recommended this item move forward as Informational.

At its 2008 Annual Meeting, the SWMA heard comments during its open hearings from Gordon Johnson, Gilbarco, proposing that the words “not acceptable” in the third column for the entry “By command or operator action” be replaced with an “X” and a reference to footnote 2. Will Wotthlie, Maryland, stated that he would support the change to an “X,” but that a new footnote should be created; Will noted that, if the information is not going to be physically marked on a plate, the inspector would need a means to find the information without having to go to a CC to find out how to call it up. The SWMA acknowledged that this variation is already permitted for computer-based systems, but acknowledged that additional review is needed before proposing such a change. The SWMA believes that additional input is needed on this issue before it is ready to move forward as a Voting item. The SWMA S&T Committee is interested in comments from other organizations, including SMA on this issue. Consequently, the SWMA made this an Informational item on its agenda.

At the 2009 Interim Meeting, SMA commented that it has consistently opposed having different requirements between embedded and downloadable/programmable software-based devices and added that it continues to support the intent of the proposal and will continue to participate in the Software Sector discussions to develop alternate proposals for the marking of software-based devices. Several weights and measures officials expressed concerns that the proposed language does not specify how the identification information is to be retrieved if it is not continuously displayed noting this could result in several ways to access the information (e.g., passwords, display checks, dropdown menus, etc.). They added that the identification location information on the NTEP CC will become outdated anytime a manufacturer changes the way the information can be retrieved. They suggested that a limited number of methods to access the identification information be developed and specified as the only acceptable methods to retrieve identification information. This would make it easier for the inspector to verify the required identification information.

WMD noted that in 1992, the NCWM adopted S&T Committee agenda Item 320-6, S.6.3. Marking Requirements; Capacity by Division and recommended that Tables S.6.3.a. and S.6.3.b. (note 3) be interpreted to permit the required capacity and scale division markings to be presented as part of the scale display (e.g., displayed on a video terminal or in a liquid crystal display), rather than be physically marked on the device. WMD agrees with the interpretation and suggests that this interpretation could be expanded to other marking requirements (e.g., flow rates capacity, interval, etc.) and codes on a case-by-case basis, and that specific language (based on the above interpretation) be added to the applicable sections in HB 44.

Software Sector Co-chair Jim Pettinato (FMC Technologies) noted that there were some typographical errors in the proposed tables which have been corrected in the above recommendations. He also stated that the Software Sector recommends that this item remain Informational to allow conference members to further study the proposal in order to develop a consensus on the format for Table G-S.1. Identification.

The Committee agreed with the format of the first version of Table G-S.1. Identification since the format matches the style of similar tables in HB 44. Consequently, the Committee agreed that this item should remain an Informational item for further review. Additional background information on this item can be reviewed in the Committee’s 2008 Final Report.

310-4 V G-N.3. Verification of Testing Standards

Source: 2008 Carryover S&T Item 310-4. This item arose as a result of a proposal submitted by the CWMA. See also the note in the Background/Discussion regarding the origin of this item.

Recommendation: Add the following paragraph G-N.3. to the General Code:

G-N.3. Verification (Testing) Standards. – Field standards will meet the specifications of the National Institute of Standards and Technology Handbook 105-Series standards (or other suitable and designated standards). This section shall not preclude the use of additional field standards and/or equipment, as approved by the Director, for uniform evaluation of device performance. In all cases where the standard is used without correction, its combined error and uncertainty must be less than one-third of the applicable device tolerance.

(Added 2009)

Delete corresponding paragraphs in the Scales Code, Automatic Bulk Weighing Systems Code, and the Automatic Weighing Systems Code as follows:

Scales Code:

~~**N.2. Verification (Testing) Standards. Field standard weights used in verifying weighing devices shall comply with requirements of NIST Handbook 105 Series standards (or other suitable and designated standards) or the tolerances expressed in Fundamental Considerations, paragraph 3.2. (i.e., one third of the smallest tolerance applied).**~~

~~**(Amended 1986)**~~

Automatic Bulk Weighing Systems Code:

~~**N.2. Verification (Testing) Standards. Standard weights and masses used in verifying weighing devices shall comply with requirements of NIST Handbook 105-1 (Class F) or the tolerances expressed in Appendix A, Fundamental Considerations, paragraph 3.2. (i.e., one third of the smallest tolerance applied).**~~

Automatic Weighing Systems Code:

~~**N.1.3. Verification (Testing) Standards. Field standard weights shall comply with requirements of NIST Handbook 105-1 (Class F) or the tolerances expressed in Fundamental Considerations, paragraph 3.2. (i.e., one third of the smallest tolerance applied).**~~

Background/Discussion: This item was originally addressed under Item 330-2 in the Committee’s 2008 Interim agenda. As a result of deliberations (see “Background/Discussion” below) at the 2008 Interim Meeting, the Committee decided to delete Item 330-2 and to address the issue in this new Item 310-4, which proposes adding a paragraph to the General Code to designate general requirements for all field standards. At the 2008 NCWM Annual Meeting, the Committee decided (as a result of comments received following the Interim Meeting) to reinstate Item 330-2 (which proposes an addition to the Liquid-Measuring Devices Code to specify pour and drain times for measuring device test standards) as an Informational item; the Committee’s rationale for this decision is outlined in Item 330-2. Note that the Committee retained Item 310-4 and presented that item as a Voting item at the Annual Meeting; however, the item did not receive sufficient votes to pass or fail and, therefore, was returned to the Committee. See the Committee’s 2008 Final Report for additional background information.

The CWMA noted that HB 44 does not address pour or drain times for 5-gallon test measures used to test retail motor-fuel devices. However, the pour and drain time requirements are in HB 112 Examination Procedure Outline Numbers 21 and 22 for Retail Motor-fuel Dispensers in Test Notes paragraph 2. They are also referenced in NIST HB 105-3 Specifications and Tolerances for Graduated Neck-Type Volumetric Field Standards Section 7. Test Methods and References.

Metrology labs are not routinely requiring that hand-held test measures be labeled with this information when the information is missing. Additionally, many hand-held test measures used by service agents and agencies do not specify drain times. As a result, service agents, are using incorrect pour and drain times.

At the 2008 Interim Meeting, the Committee agreed that rather than putting a requirement in HB 44 stipulating pour and drain times for provers and test measures, it is preferable to reference the requirements in NIST Handbook 105-3.

The Committee received comments from WMD indicating that, since pour and drain times are published in the EPOs and taught in WMD training, a reference to the 105 series in the General Code is more appropriate; particularly since NIST Handbook 105-3 Section 4.5.10.1. requires the marking of drain and delivery times on handheld test measures. With regard to concerns raised by some about update intervals for a particular 105 series handbook, WMD pointed out that the 105 series are already referenced in the Fundamental Considerations and have been for some time, and periods during which a handbook is being updated have apparently not posed any significant problems in the past. WMD also raised a concern over whether a trend for inclusion of references such as this in many individual codes might ultimately discourage the inspector and service company from referencing the Fundamental Considerations where other important information about necessary equipment and practices are found.

At the 2008 NCWM Annual Meeting, the Committee agreed that the proposed change to the General Code should remain as a Voting item since the language will provide guidance for device codes that do not specify the suitability and use of standards in the specific codes.

The Committee heard comments during the open hearing that specific hand-held test measure use requirements are still needed in the LMD Code for weights and measures officials and service agents. Therefore, the Committee recommends that language originally submitted by the CWMA be reinstated in the Committee's report as an Informational item on the agenda. The Committee also heard comments that the language in parentheses referring to "suitable and designated standards" is not clear with regard to what criteria are used to determine suitability and what entity "designates" the standards.

At its 2008 Annual Technical Conference, the WWMA heard a comment from one weights and measures jurisdiction during the open hearing that the addition of paragraph G-N.3. will not ensure that service agents will follow proper test procedures. The SMA supports this item, and recommends removal from the Scales Code, AWS Code and ABWS Code to the General Code. The WWMA recommends this be a Voting item, and also supports the specific requirements proposed in Item 330-2.

At its 2008 Interim Meeting, the CWMA stated it believes other suitable and designated standards as stated in the original item came from Fundamental Considerations, Section 3. Testing Apparatus as referenced below. Therefore the CWMA recommends that the item move forward for a Vote and that the words "*or other suitable and designated standards*" be removed from the proposal.

At its 2008 Annual Meeting, the SWMA heard no comments on this item during its open hearings. The Committee considered the proposed changes from the CWMA which would strike the words "other suitable standards;" however, the SWMA believes this language is necessary since there are not 105 Handbooks for every type of test standard. The SWMA also noted that there is similar language in other handbook requirements and that it is generally understood that this refers to the approval authority of the weights and measures jurisdiction. The SWMA supports the item as written in the 2008 NCWM Annual Report.

At its 2008 Interim Meeting, NEWMA reviewed and discussed the proposal which included comments that this requirement already exists in the Fundamental Considerations of HB 44 and as such may not be necessary. NEWMA does not support this item.

At the 2009 NCWM Interim Meeting, the Committee heard comments from Ross Andersen, New York, stating that the proposed addition of the words "or other suitable standards" raises the question of how the suitability of the standards are determined. Steve Malone, Nebraska, supported the addition of the language "the most current" when referring to the 105 Series documents; he stated that older versions of these standards may no longer be sufficient and, therefore, conflict with the Fundamental Consideration Section 3 Testing Apparatus. The SMA supported the original language proposed by the Committee stating that it had concerns about the impact of the words "the most current" in the proposal in the 2008 Annual Report.

Ross Andersen submitted the following alternate proposal to the Committee that he believes addresses the CWMA's and SWMA's concerns:

G-N.3. Verification (Testing) Standards. – Where practical, field standards conforming to the specifications and tolerances in the NIST 105 Series, recommendations of the OIML or other designated standards shall be used for official tests. The requirements of Fundamental Considerations paragraph 3.2 (i.e., one-third of the smallest tolerance applied) shall apply to all standards used in official tests.

The Committee reviewed the requirements in Fundamental Considerations Section 3. The Committee reworded the proposal as shown in the Committee's recommendation above so that the words are consistent with the language in footnote 2 of that section, and addresses the suitability concerns expressed by the comments received during the open hearing. The Committee agreed to present the revised proposal for a Vote at the 2009 Annual Meeting.

310-5 W G-T.1. Acceptance Tolerances

Source: Central Weights and Measures Association

Recommendation: Amend General Code paragraph G-T.1. Acceptance Tolerances as follows:

G-T.1. Acceptance Tolerances. – Acceptance tolerances shall apply to:

- (a) equipment to be put into commercial use for the first time;
- (b) equipment that has been placed in commercial service within the preceding 30 days and is being officially tested for the first time;
- (c) equipment that has been returned to commercial service following official rejection for failure to conform to performance requirements and is being officially tested for the first time within 30 days after corrective service;
- (d) equipment that is being officially tested for the first time within 30 days after **metrological adjustment or major reconditioning or overhaul**; and
(Amended 201X)
- (e) equipment undergoing type evaluation.
(Amended 1989)

Background/Discussion: At its 2008 Interim Meeting, the CWMA received comments that there are differences in how jurisdictions interpret G-T.1. Acceptance Tolerances. Several jurisdictions feel that when a seal on commercial equipment is broken by other than a regulatory official, this action constitutes taking the device out of service. Furthermore, if metrological adjustments are made and the equipment was resealed, this would constitute placing the equipment back into service. It is believed that the 30-day window for applying acceptance tolerance would apply to this scenario.

The CWMA also noted that equipment that “is adjusted” would require the application of acceptance tolerance according to HB 44 Appendix A – Fundamental Considerations in the second paragraph of Section 2.1. Tolerances for Commercial Equipment – Acceptance and Maintenance Tolerances.

During the open hearing at the 2009 NCWM Interim Meeting, the Committee received several comments opposing this item. Some comments indicated that the proposed language may deter routine maintenance to bring a device that was already in maintenance tolerance into acceptance tolerance. For example, device owners may have service contracts for verifying the accuracy of their equipment between official inspections and as part of the routine service, break the security seal to adjust the equipment as close to zero as possible. As a result of the adjustment and subsequent “placed in service report,” an official inspection may be conducted resulting in the potential that the

equipment may be rejected even if it repeats with maintenance tolerances. The device would not have been rejected if the owner did not attempt to maintain their equipment. Other comments indicated that devices may no longer be capable of being adjusted to acceptance tolerances but still maintain maintenance tolerances. SMA stated that a “metrological adjustment” does not have the same significance as a “major reconditioning or overhaul” in G-T.1., and that the implication of failing a test using acceptance tolerances may create an unnecessary economic burden on the device owner. The MMA commented that normal deterioration in repeatability may cause rejection even though the device is capable of performing within applicable maintenance and repeatability tolerances. The CWMA noted that Appendix A – Fundamental Considerations Section 2.1. Acceptance and Maintenance Tolerances states that acceptance tolerances are applied to new, newly reconditioned, or adjusted equipment.

The Committee reviewed past conference reports that indicated that a similar proposal was considered by the NCWM in the Committee’s 1990 agenda Item 310-5. The proposal would have required acceptance tolerances to apply whenever the security seal has been changed. The proposal was ultimately Withdrawn since the possible ramifications of this proposal had not been sufficiently developed to evaluate the proposal.

The Committee agreed to withdraw this item because of the lack of support from industry and weights and measures officials and because it believes that equipment which performs within maintenance tolerances poses “no serious injury” to either the buyer or seller of commodities (See 2009 NIST Handbook 44 Appendix A – Fundamental Considerations Section 2.2. Theory of Tolerances).

320 SCALES

320-1A V S.2.1.6. Combined Zero-Tare (“0/T”) Key, Appendix D – Definitions for Tare Mechanism, and Tare Balancing Mechanism

Source: Carryover Item 320-6. (This item originated from the NTETC WS and first appeared on the Committee’s 2007 agenda.) This item will be considered jointly along with the similar Item 324-2A. It should also be noted that the proposed tare definitions can be found in Item 320-1A.

Recommendation: The recommendations in Items 320-1A through 320-1D are intended to clarify the requirements for metrological tare (e.g., tare objects weighed or balanced off at the time of the transaction), tare accuracy, operating range, visibility, and preset tares (e.g., manually entered or stored tares for multiple transactions) as outlined in the recommendation below by modifying the definition for “tare mechanism” and adding new definitions for “gross weight value,” “net weight,” “net weight value,” “tare,” and “tare weight value” to Appendix D, and amending paragraphs S.2.3. and S.2.3.1. and adding new paragraphs S.2.3.2. through S.2.3.8. and S.2.4. through S.2.4.3. to provide new requirements for tare accuracy, operating range, and visibility.

Amend paragraph S.2.1.6. as follows:

S.2.1.6. Combined Zero-setting and Tare-balancing Mechanisms (“0/T”) Key. – Scales not intended to be used in direct sales ~~to the public applications~~ may be equipped with a combined zero-setting and tare-balancing function key, provided that the device is clearly marked as to how the key functions. ~~The device must also be clearly marked on or adjacent to the weight display with the statement “Not for Direct Sales.”~~**The following apply to the zero-setting mechanism and the tare-balancing mechanism at any load:**

- (a) After zero/tare setting, the accuracy of the zero/tare setting shall be not more than $\pm 0.25 d$.
[Nonretroactive as of January 1, 2010]
- (b) A “center-of-zero” condition shall either automatically be maintained to $\pm 0.25 d$ or less or have an auxiliary or supplemental “center-of-zero” indicator that defines a zero-balance condition to $\pm 0.25 d$ or less.
[Nonretroactive as of January 1, 2010]

(c) **A zero-tracking mechanism, if equipped, shall operate only when:**

- (1) **the indication is at zero, or at a negative net value equivalent to gross zero, and**
- (2) **the weight indication is stable.**

(d) **The scale must also be clearly marked on or adjacent to the weight display with the statement “Not for Direct Sales.”**

(Added 1998)

(Amended 2009)

Amend the following definition for “tare mechanism:”

tare mechanism. A **tare-weighing or tare-balancing** mechanism (including a tare bar) designed for determining **the value of,** or balancing out the weight of packaging material, containers, vehicles, or other materials that are not intended to be included in net weight determinations **and for setting the net indication to zero when the tare object is on the load-receiving element (See also “preset tare,” “tare-weighing mechanism” and “tare-balancing mechanism”).**

Notes:

1. **Reducing the weighing range for net loads is known as subtractive tare (e.g., Net Weight + Tare Weight \leq Gross Weight Capacity).**
2. **Increasing the weighing range for gross loads without altering the weighing range for net loads on mechanical scales is known as additive tare (e.g., a tare bar on a mechanical scale with a beam indicator where Net Weight + Tare Weight \geq Gross Weight Capacity).**

The tare mechanism may function as:

1. **a non-automatic mechanism (load balanced or weighed by an operator),**
2. **a semi-automatic mechanism (load balanced or weighed automatically following a single manual command), or**
3. **an automatic mechanism where the load is balanced or weighed automatically without the intervention of an operator. An automatic tare mechanism is only suitable for indirect sales to the customer (e.g., prepackaging scales).**

[2.20, 2.24]

(Amended 2009)

Add a new definition for tare-balancing mechanism in Appendix D.

tare-balancing mechanism. A **tare mechanism with an indication that tare has been taken either semiautomatically or automatically and without an indication of the tare value (weight) when the instrument is loaded. A negative net weight is assumed to be the tare value when the weighing instrument is unloaded. [2.20, 2.24]**

(Added 2009)

Background/Discussion: The WS proposal is one of several proposed modifications to HB 44 requirements intended to clarify the acceptable tare features already recognized for use in commercial applications. Scales Code requirements do not include sufficiently detailed language to identify all types of tare, define how tare features must operate, or specify the net and tare values a scale must indicate and record. Current HB 44 requirements that address tare include paragraphs S.2.1.6. Combined Zero-Tare (“0/T”) Key; S.2.3. Tare; S.2.3.1. Monorail Scales Equipped with Digital Indications; and T.N.2.1. General (Tolerances).

The WS developed criteria used to type evaluate tare features based on General Code paragraph G-S.2. Facilitation of Fraud and other requirements that apply to indicating and recording elements and recorded representations. NTEP laboratories find it has become increasingly difficult to base compliance decisions solely on paragraph G-S.2. because the general nature of the language results in multiple interpretations. Type evaluation criteria are published

in NCWM Publication 14; however, this document is not in wide distribution in the weights and measures community. Additionally, only a limited number of weights and measures officials, device manufacturers, and device owners and operators are regular participants in WS meetings where tare evaluation criteria are developed and discussed. It is difficult for parties responsible for the design, use, and test of the tare feature to interpret and apply technical requirements published in Publication 14. This results in differing interpretations of HB 44 requirements.

In 2006 the NTETC WS formed a Tare WG to review existing tare requirements and make recommendations as to how tare should operate on a single range scale, a multiple range scale, and a multi-interval scale. The WG was asked to develop, where necessary, recommendations for changes to Publication 14, HB 44, and HB 130 and to provide guidance to the WS on type evaluation requirements.

The WG developed proposals to amend HB 44 requirements to:

- a. ensure a tare feature operates in a manner that increases the accuracy of net weight determinations,
- b. state clearly what information and values are permitted and required for indicated and recorded representations of net weight and tare weight, and
- c. identify the types (e.g., semiautomatic and stored) of tare weight values determined at the time objects are weighed or tare weight values are determined prior to the time objects are weighed.

At its 2007 Annual Meeting, the WS reviewed the final recommendation of the Tare WG and recommended that the NIST technical advisor submit a number of these recommendations to the weights and measures regional association and the NCWM S&T Committees.

Comments from all the 2007 regional weights and measures associations indicated general support for the recommendations and clarification of the tare definitions and that this item be broken up into several parts in order to provide additional clarification.

During the 2008 NCWM Interim Meeting Committee discussions on this item, the following clarifications for “consecutive tare operations” and “transactions using different tare mechanisms” were provided by Mettler-Toledo.

“Consecutive tare operations” in proposed paragraph S.2.3.5. are described as a single transaction with one gross, one net, and multiple tare values. Examples include but are not limited to:

- (1) The sales of wrapped candy sold in bulk where a metrological tare (weighed) for a bag and a preset (percentage) tare for the candy wrappers are used to determine the net weight of the candy.
- (2) The loading of a vehicle with bins of products (where the preset tare weight for the bins was predetermined). If indicated and/or printed, the representation of tare would include the value of the metrological tare (T) and the summed values of the preset tare (PT).

“Net weight values and tare values determined by different tare mechanisms” in proposed paragraph 2.3.6.(e) include single transactions with multiple gross, tare, and net determinations. For example, an unloaded vehicle would first be weighed to determine tare, loaded with a commodity, and reweighed to determine the gross weight and the net weight for that commodity. The vehicle would then be loaded with a different commodity and reweighed to determine a new gross weight. The second gross weight would be used to calculate the net weight of the second commodity by taking the difference between the second “tare” weight (gross weight of the first commodity) and the second gross weight (total weight of unloaded vehicle and both commodities).

At its 2008 Annual Technical Conference, the WWMA considered a request from the SMA asking the WWMA to keep this an Informational item until it has an opportunity to discuss it and make comments after its fall meeting. The NIST technical advisor gave a presentation at the WWMA that provided clarification. The Committee recommends this presentation be made available at the other regional meetings. The Committee recommends this item remain Informational.

At its 2008 Interim Meeting, the CWMA heard comments during discussion that:

- The tare information language should be put in Handbook 44 format for viewing.
- New language is needed for type evaluation and the tare information from Publication 14 might be referenced in Handbook 44.
- More training with detailed examples should be placed in Handbook 44 format.

At its 2008 Annual Meeting, the SWMA heard no opposition to this item during its open hearings; however, the Committee believes that, because of the complexity of the issue and the number of new terms involved, the item should remain an Informational item. The Committee heard that Steve Cook, NIST WMD, developed and presented an excellent presentation on this issue at the Western Weights and Measures Association meeting in September 2008. Tina Butcher, NIST WMD, reported that Steve plans to post this presentation on the NIST WMD website in the near future. Steve also prepared two related articles intended to assist the community in its review of these issues. The Committee supported a recommendation to ask that Steve give this presentation at the NCWM Interim and Annual Meetings to help provide additional background to the community on these proposals.

During its 2008 Interim Meeting, NEWMA recommended this item remain Informational.

At the 2009 NCWM Interim Meeting, the SMA suggested that the proposal be Withdrawn since the item began with a Weighing Sector item dealing with the proper rounding of a tare value, on multiple range devices, when changing ranges. This discussion led to the development of the “mathematically correct” item (See Item 320-2 in the 2008 S&T agenda which was subsequently adopted) and the creation of the Tare Work Group. They believe that this proposal goes beyond the original scope of the WG since its focus was to determine if any similar situation exists in HB 44 that would not be addressed with the “mathematically correct” agenda item. The work group expanded its efforts to include harmonization to OIML R 76 requirements related to tare. It is SMA’s feeling that these changes do not address any problem and can only lead to confusion in the current regulatory and product development fields.

NIST technical advisor Steven Cook gave a presentation on this item describing the background and answered questions regarding the specific language in the proposal in response to the suggestions from the CWMA. The Committee decided to break the item into multiple parts to make it easier for people to address and analyze as follows:

320-1A is the proposal to amend (and renumber depending if other items are adopted) paragraph S.2.1.6. regarding scales with a combination “zero/tare” key.

320-1B is the proposal to amend paragraph S.2.3. by:

- reorganizing the separate subjects in the existing paragraph,
- specifying that tare cannot operate above the tare capacity of the device,
- adding tare division and capacity requirements for multi-interval and multiple range scales, and
- adding new language for tare accuracy.

320-1C is the proposal to add new language for visibility of tare and net indications, printing of weighing results for net and tare, motion detection for tare, and requirements for consecutive tare operations.

320-1D is the proposal to add new language for preset tares, which are also known as stored tare, predetermined tare, programmable tare, etc.

The proposal to amend the definition of tare mechanism and add new terms and definitions for the terms used in the above proposals have been incorporated in the individual items where the terms first appear.

For additional background information, refer to the Committee’s 2008 Annual Report.

Background/Discussion: The first item, 320-1A addresses the proposed amendment to paragraph S.2.1.6. for scales that have a combined zero/tare key. The Committee agreed to move this item and the applicable definitions for tare-balancing mechanism and tare-weighing mechanism forward as a Voting item. Note that the Committee

recommends that subparagraphs c and d be given retroactive status since these requirements have been verified by NTEP since the 0/T feature was included into HB 44.

320-1B V S.2.3. Design of Balance, Tare, Level, Damping, Arresting Mechanisms, and Appendix D – Tare-weighing Mechanism.

Source: Carryover Item 320-6. (This item originated from the NTETC WS and first appeared on the Committee’s 2007 agenda.)

Recommendations: Amend paragraphs S.2.3. and S.2.3.1. as follows (**Note:** Language indicated with double underlined font represents the “strikeout language” moved from S.2.3. to S.2.3.1.):

S.2. Design of Balance, Tare, Level, Damping, and Arresting Mechanisms.

S.2.3. Tare. – ~~*On any scale (except a monorail scale equipped with digital indications, and multi-interval scales and multiple range scales when the value of tare is determined in a lower weighing segment or weighing range), the value of the tare division shall be equal to the value of the scale division.**~~–The tare-weighing and tare-balancing mechanism shall operate only in a backward direction (that is, in a direction of underregistration) with respect to the zero-load balance condition of the scale. A device designed to automatically clear any tare value shall also be designed to prevent the automatic clearing of tare until a complete transaction has been indicated.*

(Amended 1985 and 2009)

*[Note: On a computing scale, this requires the input of a unit price, the display of the unit price, and a computed positive total price at a readable equilibrium. Other devices require a complete weighing operation, including tare, net, and gross weight determination.]**

*[*Nonretroactive as of January 1, 1983]*

S.2.3.1. Scale Interval (Division) and Capacity. – *On any scale (except a monorail scale equipped with digital indications, multi-interval scales and multiple range scales when the value of tare is determined in a lower weighing segment or weighing range), the value of the tare-weighing division shall be equal to the value of the scale division for any given load and shall not be operable above its maximum capacity.*

[Nonretroactive as of January 1, 1983]

(Added 2009)

S.2.3.1.1. Monorail Scales Equipped with Digital Indications. – On a static monorail weighing system equipped with digital indications, means shall be provided for setting any tare value of less than 5 % of the scale capacity to within 0.02 % of scale capacity. On a dynamic monorail weighing system, means shall be provided to automatically maintain this condition.

(Amended 1999)

Add new paragraphs S.2.3.1.2., S.2.3.1.3., S.2.3.2. and S.2.3.3. as follows:

S.2.3.1.2. Multi-interval Scales. – *On multi-interval scales, the tare capacity is limited to the capacity of the first weighing segment and the value of the tare division shall be equal to the value of the scale division from the first weighing segment.*

(Added 2009)

S.2.3.1.3. Multiple Range Scales. – *On multiple range scales, the tare capacity may be operable in the greater weighing ranges if it is possible to switch to a greater weighing range with a load on the scale. The value of the tare division shall be equal to the value of the scale division from the weighing range where the tare was determined.*

(Added 2009)

S.2.3.2. Accuracy. – A tare-weighing or -balancing mechanism shall permit setting the net indication to zero with an accuracy equal to or better than:

- (a) $\pm 0.25 d$ for electronic weighing devices and any weighing device with an analog indication, and**
- (b) $\pm 0.5 d$ for mechanical weighing devices with a digital indication (e.g., weighbeams with only notched poises and no sliding poises).**

On a multi-interval scale, d shall be replaced by d_1 (division value of the first weighing segment).

(Added 2009)

[Nonretroactive as of January 1, 2010]

S.2.3.3. Damping - Semi-automatic or Automatic* Tare-Balancing or Tare-Weighing Mechanisms. – These mechanisms shall be operable or accessible only by a tool outside of and separate from this mechanism or they shall be enclosed in a cabinet, or they shall be operable only when the indication is stable within:

- (a) ± 3 scale divisions for scales of more than 2000 kg (5000 lb) capacity in service prior to January 1, 1981, and for all axle-load, railway track, and vehicle scales; or**
- (b) ± 1 scale division for all other scales.**

*** Automatic tare mechanisms are not permitted for direct sales to the public.**

(Added 2009)

Add a new definition for tare-weighing mechanism in Appendix D:

tare-weighing mechanism. A tare mechanism that stores a tare value that has been taken either semi-automatically or automatically and is capable of displaying (continuously or upon command) or printing the value whether or not the instrument is loaded. [2.20, 2.24]

(Added 201X)

Background/Discussion: Background information on this item can be found in 320-1A.

After the NIST presentation on Tare during the 2009 Interim Meeting and considering that very few questions were raised during the discussion of the paragraphs in the recommendation, the Committee agreed to move this item and applicable definition for a tare-weighing mechanism forward as a Voting item. Note that the Committee recommends that language in paragraphs S.2.3.1.2., and S.2.3.1.3., be given retroactive status since these requirements have been verified by NTEP and since these types of weighing devices were included into HB 44 Appendix D.

320-1C I S.2.3.4. through S.2.3.7. Value of Tare Indication and Recorded Representations, and Appendix D. Definitions for Gross Weight Value, Net Weight Value, Net Weight, Tare, and Tare Weight Value

Source: Carryover Item 320-6. (This item originated from the NTETC WS and first appeared on the Committee's 2007 agenda.)

Recommendation: Add new paragraphs S.2.3.2. through S.2.3.6. as follows:

S.2.3.4. Visibility of Operation. – Operation of the tare mechanism shall be visibly indicated on the instrument. In the case of instruments with digital indications, this shall be done by marking the indicated net value with the word “NET” or the symbol “N.” “NET” may be displayed as “NET,” “Net,” or “net.” If a scale is equipped with an indicator that allows the gross value to be displayed

temporarily while a tare mechanism is in operation, the “NET” symbol shall disappear while the gross value is displayed.

(Added 201X)

S.2.3.5. Subtractive Tare Mechanism. – After any tare operation and while tare is in effect, an indicating or recording element shall not display nor record any values when the gross load (not counting the initial dead load that has been canceled by an initial zero-setting mechanism) is in excess of 105 % of scale capacity after tare has been taken.

(Added 201X)

S.2.3.6. Consecutive Tare Operations. – Repeated operation of a tare mechanism (including preset tare) is permitted for single transactions with one gross, one net, and multiple tare values. If more than one tare mechanism is operative at the same time, tare weight values shall be clearly designated (identified) with either “T” for tare or “PT” for preset tare, as appropriate, when indicated or printed.

(Added 201X)

S.2.3.7. Indication and Printing of Weighing Results.

- (c) Gross weight values may be printed without any designation or by using a complete word or symbol. For a designation by a symbol, only uppercase “G” is permitted.
- (d) If only net weight values are printed without corresponding gross or tare values, they may be printed without any designation or by using a complete word or symbol. The complete word “Net” or symbol “N” shall be used to designate a net weight as shown in S.2.3.3. Visibility of Operation. This applies also where semi-automatic zero-setting and semi-automatic tare balancing are initiated by the same key.
- (e) Gross, net, or tare values determined by a multiple range instrument or by a multi-interval instrument need not be marked by a special designation referring to the (partial) weighing range.
- (f) If net weight values are printed together with the corresponding gross and/or tare values, the net and tare values shall be identified at least by the corresponding symbols “N” and “T” or by complete words using all upper-case letters, all lower-case letters, or a combination of upper- and lower-case letters.
- (g) If net weight values and tare values determined by different tare mechanisms are printed separately for single transactions with multiple gross, tare, and net values, they shall be suitably identified (e.g., vehicle sequentially loaded with mixed commodities).

(Added 201X)

Add the following new definitions to Appendix D:

gross weight value. Indication or recorded representation of the weight of a load on a weighing device, with no tare mechanism in operation. [2.20, 2.24]

(Added 201X)

net weight (net mass). The weight of a commodity excluding any materials, substances, or items not considered to be part of the commodity. Materials, substances, or items not considered to be part of the commodity include, but are not limited to, containers, conveyances, bags, wrappers, packaging materials, labels, individual piece coverings, decorative accompaniments, and coupons, except that, depending on the type of service rendered, packaging materials may be considered to be part of the service. For example, the service of shipping includes the weight of packing materials. [2.20, 2.24]

(Added 201X)

net weight value. Indication or recorded representation of the weight of a load placed on a weighing device after the operation of a tare mechanism. [2.20, 2.24]

(Added 201X)

tare. The weight of packaging material, containers, vehicles, or other materials that are not intended to be part of the commodity included in net weight determinations. [2.20, 2.24]

(Added 201X)

tare weight value. The weight value of a load determined by a tare mechanism. [2.20, 2.24]

(Added 201X)

Background/Discussion: Background information on this item can be found in the Background/Discussion paragraphs on agenda Item 320-1A.

During the NIST presentation on Tare during the 2009 Interim Meeting, the Committee heard several questions that indicated the need for additional clarification on:

- the value of specifying acceptable words and abbreviations for Gross, Tare, Preset Tare, and Net;
- what is meant by consecutive tare operations;
- whether itemized indications and recorded representations are required for each tare; and
- whether different indications and recorded representations are required for each tare value when tare and preset tare are used in the same transaction.

Consequently, the Committee recommends that this proposal remain an Informational item and suggests that the WS further clarify the proposed language and consider providing examples of; 1) indications and recorded representations of tare and preset tare in consecutive tare transactions, and 2) indications and recorded representations when multiple tares and preset tares are used to determine net weights.

320-1D I S.2.4. Preset Tare Mechanism and Appendix D – Definitions for Preset Tare

Source: Carryover Item 320-6. (This item originated from the NTETC WS and first appeared on the Committee's 2007 agenda.)

Recommendations: Add new paragraphs S.2.4. Fto address preset tare as follows:

S.2.4. Preset Tare Mechanism, Operation. – In addition to the provisions of paragraphs S.2.3. Tare and S.2.3.1. Scale Interval, a preset tare mechanism may be operated together with one or more tare devices provided:

- (a) **the preset tare mechanism complies with paragraph S.2.3.6. Consecutive Tare Operations,**
- (b) **the preset tare operation cannot be modified or cancelled as long as any tare mechanism operated after the preset tare operation is still in use,**
- (c) **the preset tare associated with a price look-up (PLU) shall be automatically cancelled at the same time a PLU is cancelled, and**

- (d) the preset tare values are designated by the symbol “PT”; however, it is permitted to replace the symbol “PT” with complete words.

A preset tare may operate automatically only if the preset tare value is clearly identified with the load to be measured (e.g., part of the product look-up information).

(Added 201X)

S.2.4.1. Indication of Operation. – It shall be possible to temporarily indicate the preset tare value (e.g., pressing a tare display button or by indicating a negative net weight with no load on the load-receiving element). In addition to the provisions of paragraph S.2.3.7. Indication and Printing of Weighing Results, the net value and at least the preset tare value is printed, with the exception of:

- (a) a Class II or a Class III instrument and point-of-sale systems with a maximum capacity not greater than 100 kg (200 lb) used in direct sales to the public,
- (b) price computing scales, and
- (c) nonautomatic weigh/price labeling scales.

(Added 201X)

Add new preset tare definitions to Appendix D as follows:

preset tare. A numerical value, representing a weight that is entered into a weighing device (e.g., via keyboard entry, recalling from stored data, or entered through an interface) and is intended to be applied to weighings without determining individual tares.

(Added 201X)

preset tare mechanism. A part of a weighing system for subtracting a preset tare value from a gross or net weight value and indicating the result of the calculation as a net weight. The weighing range for net loads is reduced accordingly.

Types of preset tare mechanisms include:

- keyboard tare. The operation of keys on a keyboard. For example: On a scale where $d = 0.01$ with a typical 10-key keyboard with values 0 through 9, pushing numbered key 5, or pressing the 0 then 5 keys results in a 0.05 tare value.
- digital tare. By the repeated operation of a particular key, tare values are entered in amounts equal to the value of a scale division. For example, on a 25 lb x 0.01 lb scale, each time a specifically marked key is depressed, a tare is entered equal to 0.01 lb. If that key were depressed five times, the tare value would be equal to 0.05 lb.
- programmable tare. Preset (predetermined) tare values that are stored in memory for multiple transactions. They may be part of the product information on PLU (product look-up), preset product, or tare keys.
- stored tare. Preset (predetermined) tare values that are stored in memory for multiple transactions and are used predominately in vehicle scale applications.
- percentage tare. A preset tare value, expressed as a percentage (i.e., 5.6 %), that represents the percentage of tare material compared to the gross or net weight of the commodity. A percentage tare is one form of proportional tare.
- proportional tare. A preset tare value, automatically calculated by the scale, proportional to the gross weight indicated by the scale. A proportional tare can be a percentage tare or a fixed tare

value relative to a range of gross weights (i.e., a 10 g tare for gross weights between 0 and 2 kg, a 20 g tare for gross weights from 2 and 4 kg, etc.). A proportional tare is, therefore, not limited to being a percentage tare.

[2.20, 2.24]

(Added 201X)

Background/Discussion: Background information on this item can be found in the Background/Discussion paragraphs on agenda Item 320-1A.

During the NIST presentation on Tare during the 2009 Interim Meeting, the Committee heard several questions that indicated the need for additional clarification on the value of specifying acceptable words and abbreviations for Gross, Tare, Preset Tare, and Net.

Consequently, the Committee recommends that this proposal remain an Informational item.

320-2 V T.N.4.6. Time Dependence (Creep) for Load Cells During Type Evaluation

Source: 2008 S&T Committee

Recommendation: Amend T.N.4.7. as follows:

T.N.4.7. Creep Recovery for Load Cells During Type Evaluation. – The difference between the initial reading of the minimum load of the measuring range (D_{\min}) and the reading after returning to minimum load subsequent to the maximum load (D_{\max}) having been applied for 30 minutes shall not exceed:

- (a) ~~0.83~~ ~~0.5~~ times the value of the load cell verification interval (~~0.830.5~~ v) for Class I, II, III, and IIII load cells, or
- (b) 1.5 times the value of the load cell verification interval (1.5 v) for Class III L load cells.

(Added 2006) **(Amended 2009)**

Background/Discussion: The current tolerance of 0.5 times the load cell verification interval comes from OIML R 60 and was adopted in an attempt at harmonization. Because of the difference between the U.S. and European marketplace, a Class III scale with 5000 divisions is more common in the UNITED STATES whereas a 3000 division Class III scale is more common in the international marketplace. The U.S. load cell manufacturers have stated that the OIML tolerance should be multiplied by $\sqrt[3]{}$ to maintain consistency in the level of performance between the U.S. and international marketplace equivalent devices. For example, a HB 44 5000 lb device with a load cell where $v = 1$ lb would have a maintenance tolerance of ± 5 lb with a creep recovery tolerance of 0.5 lb. An equivalent capacity OIML 3000 kg scale with an equivalent load cell where $v = 1$ kg would have a maintenance tolerance at a capacity of 2 kg (approximately 4.4 lb) and a creep recovery of 0.5 kg (1.1 lb). The proposal would increase the HB 44 creep recovery tolerance by $\sqrt[3]{}$ to 0.83 lb.

A few weeks prior to the 2008 Annual Meeting, the Committee received a “priority” request to add a proposal as a Voting item to the Committee’s agenda and was prompted by a significant increase in the failure rate for load cells submitted to NTEP since creep recovery tolerances were adopted into HB 44. The request to add the item as a Voting item was not approved according to criteria in HB 44 Introduction Section H(c) Exceptions to Policy for Submission of Items to a Committee Agenda; Submission of Priority Items. However, the Committee agreed to discuss this item during the Annual Meeting. As a result of these discussions, the Committee added this item to its list of carryover items as an Informational item and recommended that the NIST technical advisor work with the submitter of the item to develop a proposal to amend Table T.N.4.6. and add a table for designating loading and unloading times for consideration by the regional weights and measures associations to the 2009 NCWM Interim Meeting.

During their 2008 fall meetings, WWMA, CWMA, SWMA, and NEWMA heard from representatives of the SMA stating that additional load cell manufacturers will discuss this issue at the November 2008 SMA meeting and expect

to have a proposal that the NCWM S&T Committee can consider at the 2009 Interim Meeting. Until such time that an alternate proposal is developed for consideration, the regional weights and measures associations recommend maintaining this item as an Informational item on its agenda. The regional associations encourage the load cell manufacturers and SMA in their efforts to develop a proposal that can be considered for voting at the 2009 NCWM Annual Meeting.

During the 2008 NCWM Interim Meeting, the Committee received comments during the open hearing on whether this proposed language should be reviewed by the Weighing Sector (WS). The WS chairman (Darrell Flocken) replied that this was not reviewed by the Sector since it is a tolerance issue for HB 44 and not the test procedures in Publication 14. Darrell stated that the 2008 WS did provide recommendations to amend Publication 14 based on some of the issues identified during the discussions of the priority item submitted to the Committee at the 2008 Annual Meeting.

At the 2009 Interim Meeting, WMD stated that the proposed tolerance deviates from the recommendations in OIML R 60. WMD believes that, in most cases, this proposed tolerance does not present a technical barrier to trade since an equivalent OIML Class C load cell with 3000 v will likely pass HB 44 Class III S 5000 v requirement because of the extra tolerance step in Table 6 and proposed increase in the creep recovery tolerance. Stephen Patoray, Consultants on Certification, LLC, cautioned the Committee that there is a similar creep recovery tolerance for scales and separable weighing/load-receiving elements, and he suggested that the Committee consider the potential impact the increase in tolerance for load cells will have on these devices. Darrel Flocken suggested that the Committee consider developing a similar proposal for scales. However, the Committee would like to determine if there are similar creep recovery problems before recommending increasing the tolerances in paragraph T.N.4.5.1.(c) Time Dependence.

The Committee agreed to move this item forward as a Voting item and requests that the NTEP weighing labs be queried to see if there is a similar increase in device failures due to the new requirements for creep recovery on scales.

After the 2009 Interim Meeting, the NIST Force Group provided a set of compliance data for load cells submitted to NTEP since November 2007 where the creep recovery compliance results were recalculated using the proposed tolerance. The compliance rate increased to 58 % passing, which is up from 29 % passing.

320-3 I S.2.1.7. Automatic Zero-Setting Mechanism

Source: 2008 NTETC Weighing Sector and S&T Committee

Recommendation: Add a new paragraph S.2.1.7. and definition for Automatic Zero-Setting Mechanism as follows:

S.2.1.7. Automatic Zero-Setting Mechanism. – If equipped, an automatic zero-setting mechanism shall operate only when the indication has remained;

- (a) stable according to S.2.5. Damping Means, and**
- (b) below zero for at least 5 seconds.**

The maximum effect of automatic zero-setting mechanism is limited to 4 % of the nominal capacity of the scale and is a sealable parameter.

(Added 201X)

Amend paragraph S.2.1.3.3. as follows:

S.2.1.3.3. Means to Disable Automatic Zero-Tracking and Automatic Zero-Setting Mechanisms on Class III L Devices. – Class III L devices equipped with ~~an~~ automatic zero-tracking and automatic zero-setting mechanisms shall be designed with a sealable means that would allow automatic zero-tracking and automatic zero-setting to be disabled during the inspection and test of the device.

[Nonretroactive as of January 1, 2001]

(Amended 201X)

Amend HB 44 Appendix D by adding a new definition for automatic zero-setting mechanism, move the current definition for initial zero-setting mechanism under the broad heading of type of zero-setting mechanism, and move the definition for automatic zero-tracking mechanism to a stand-alone definition as follows:

automatic zero-tracking mechanism. Automatic means provided to maintain the zero balance indication, within certain limits, without the intervention of an operator. See “automatic zero-tracking mechanism” under “zero-setting mechanism.” [2.20, 2.22, 2.24]

(Amended 2010)

zero-setting mechanism. Means provided to attain a zero balance indication with no load on the load-receiving element. ~~Four~~ **Three** types of these mechanisms are: [2.20]

automatic zero-setting mechanism. Automatic means provided to maintain the zero balance indication without the intervention of an operator. [2.20, 2.22, 2.24]

(Added 201X)

~~**automatic zero-tracking mechanism.** Automatic means provided to maintain the zero balance indication, within certain limits, without the intervention of an operator.~~ [2.20, 2.22, 2.24]

initial zero-setting mechanism. Automatic means provided to set the indication to zero at the time the instrument is switched on and before it is ready for use. [2.20]

(Added 1990)

manual zero-setting mechanism. Nonautomatic means provided to attain a zero balance indication by the direct operation of a control. [2.20]

semiautomatic zero-setting mechanism. Automatic means provided to attain a direct zero balance indication requiring a single initiation by an operator. [2.20]

(Amended 2010)

Background/Discussion: At its 2008 Annual Meeting, the NTETC Weighing Sector discussed an issue on an increasing number of scales submitted for NTEP evaluations that include an “automatic zero-setting” feature not addressed in NIST HB 44. It has been noted that many devices are built for a global marketplace and that the operation of this “automatic zero-setting” device may be functional on the device when installed in the United States. Currently, HB 44 does not define this function. NCWM Pub 14 has no test to determine if the device submitted for evaluation has such a function, or if it is sealable. Additionally, a scale was recently submitted for evaluation and certified by NTEP where the automatic zero-setting feature worked in both the positive and negative directions and could be activated or deactivated without breaking a security seal or changing the audit trail information. The operation of the feature in the positive direction does not even comply with R 76. Competitors have also commented to NTEP that they had to disable this feature because it was not allowed by other NTEP weighing labs.

In the past, several of the NTEP labs, when asked about this “feature,” have indicated that since it does not meet the definition of “automatic zero-tracking” mechanism, it is not allowed. Additionally, the Sector agreed that HB 44 does not clearly state that this function is not allowed. This led to incorrect interpretations of Section 2.20. Scales

paragraphs S.1.1.(c) (Zero Indication – “. . . return to a continuous zero indication”) and S.1.1.1.(b) (Digital Indicating Elements – “*a device shall either automatically maintain a “center-of-zero” condition. . .*”) and could also be interpreted to allow the automatic zero-setting device as described in R 76. This interpretation was not the intent of the HB 44 requirements referenced above.

The Sector concluded the following:

1. There is a problem that needs to be solved, based on the current information or lack of information in HB 44.
2. There are no technical reasons why the feature automatic zero-setting as described in OIML R 76 should not be included in NIST Handbook 44.
3. The feature may not be suitable for all applications if it is allowed to function with both positive and negative weight indications.
4. Language will need to be developed for NCWM Publication 14 to either test for the correct function of “automatic zero-setting” or test to determine that the device does not have “automatic zero-setting” and it is a sealable parameter.

The Sector established a small WG to develop language to be submitted to the NCWM S&T Committee and to make a recommendation addressing the suitability of scales with the capability to automatically set a positive weight indication to zero. This group, which included Scott Davidson (Mettler-Toledo), Scott Henry (NCR), Steve Cook (NIST technical advisor), and Stephen Patoray (Consultants on Certification, LLC), volunteered to develop a proposal for the S&T Committee. (Todd Lucas, Ohio NTEP laboratory, and Jim Truex, NTEP Administrator, also contributed to the discussions and subsequent proposal.) Additionally, the Sector agreed to review the language developed by the WG to confirm its support of the proposed language.

In the process of developing the proposal, the WG recommends the following:

1. Make the proposal to add automatic zero-setting “retroactive” since the group is aware that the feature has been included on several scales for nearly 20 years and may not have been activated. The group considered alternate retroactive dates, but felt that the proposed requirements for the feature should be applicable to all scales incorporating this feature. Additionally, NCWM Publication 14 NTEP technical policies state that only the standard features and options that have been evaluated will be included on the CC. As a result, an NTEP applicant will have to submit an application to NTEP in order to have the automatic zero-setting feature listed on an existing CC.
2. The automatic zero-setting mechanism shall be limited to operating only when the scale indication is below zero. The group discussed allowing the feature to operate in both directions. Although there may be valid reasons for allowing it in the positive direction, the group felt that legitimate objects on a scale could be inadvertently (or intentionally) zeroed without an obvious indication to the customer or operator when the scale was indicating zero at the start of a transaction.
3. The automatic zero-setting mechanism should be considered as a “sealable parameter” since there are applications where it is required to be disabled, or scale parameters such as the time before initiating automatic zero-setting, motion detection, and capacity limitations can be adjusted beyond the requirements in the proposal.
4. Publication 14 evaluation and field examination procedures should be amended to verify that the automatic zero-setting mechanism cannot set the scale to a zero indication in less than five seconds; it can only operate if it complies with motion detection requirements, and its effect on the nominal scale capacity is no larger than 4 %.
5. The automatic zero-setting mechanism should be capable of being disabled for testing purposes for the same reasons that zero-tracking is capable of being disabled for Scales Code Class III L devices.

6. The group noted the current definition for initial zero-setting mechanism as a type of zero mechanism and should be included with the definition on zero-setting mechanism as shown in the recommendation.
7. The Committee is asked to consider recommending changing “automatic zero-tracking” to “zero-tracking” throughout the weighing codes in order to reduce the confusion with the term and definition for “automatic zero-setting.” Additionally, the word “automatic” is redundant for zero-tracking since it is used in its definition.

The WG did not have sufficient time to both develop the proposal and ballot the Sector prior to the cutoff date for submitting items to the Committee. The responses to the ballot indicated that eight Sector members responded to the ballot of which six voted in favor of the proposed language. It should be noted that two of the affirmative votes stated that their vote was provisional on the basis that the reference to the 4 % of scale capacity limitation be removed from the proposal. Two members opposed that item stating that the language should not be rushed through the S&T Committee and that the feature should operate with either negative or positive weight indications.

At the 2009 NCWM Interim Meeting, the Committee heard comments from the SMA stating that it was in favor of the proposal provided the reference to the 4 % of scale capacity limitation is removed from the proposal. Paul Lewis, Rice Lake Weighing, recommended that the proposal be discussed by the regional weights and measures associations before it is ready to be voted on. Ted Kingsbury, Measurement Canada, stated that the language in the proposal is identical to Canadian requirements and that it is consistent with the recommendations in R 76. Any changes to the proposal involving the 4 % capacity limitation and the ability to operate in the positive direction would require that MC perform additional testing for devices submitted under the U.S./Canada Mutual Recognition Agreement. Darrell Flocken, Mettler-Toledo, also pointed out the inclusion of the term and definition for “automatic zero-tracking mechanism” should stand-alone and not be included as a type of zero-setting mechanism in order to be consistent with OIML R 76. Steve Cook, NIST technical advisor, added that he had received an earlier comment that the word “automatic” should be deleted from the term since the word is used in the definition and that it is not used in the corresponding term in R 76 and suggested that the Committee consider developing a proposal to delete the word “automatic” in the term “automatic zero-tracking” throughout HB 44.

The Committee reviewed the Sector ballot results and comments it received during the open hearing. The Committee agreed that there was no clear consensus among the Sector members and recommends that this proposal remain an Informational item. The Committee agreed with Darrell Flocken to move the definition of “automatic zero-tracking.” The Committee also asked that the NTEP labs and the WS further discuss this item, develop a consensus position, and forward its recommendations to the Committee and that they also consider the suggestion from Steve Cook to amend the term “automatic-zero tracking.”

321 BELT-CONVEYOR SCALE SYSTEMS

321-1 V UR.3.2.(c) Maintenance; Zero-Load Tests

Source: 2008 Western Weights and Measures Association (WWMA) (This item previously appeared on the 2008 Committee’s Developing agenda as Item 360-2 Part 3 Item 1.)

Recommendation: Modify UR.3.2.(c) as follows:

UR.3.2. Maintenance. – Belt-conveyor scales and idlers shall be maintained and serviced in accordance with manufacturer’s instructions and the following requirements:

- (c) **Zero-load and load (simulated or material) tests** ~~Simulated load tests, or material tests, and zero-load tests~~ shall be conducted at periodic intervals between official tests **and after a repair or mechanical adjustment to the conveyor system** in order to provide reasonable assurance that the device is performing correctly. **The minimum interval for periodic zero-load tests and simulated load tests shall be established by the official with statutory authority or according to manufacturer recommendations.**

The action to be taken as a result of the zero-load tests is as follows:

- **if the change in zero is less than ± 0.25 %, adjust the belt-conveyor scale system to zero and proceed to a simulated load test or return the conveyor to operation;**
- **if the change in zero is ~~± 0.1 %~~ to ± 0.25 % to ± 0.5 %, inspect the conveyor and weighing area for compliance with UR.2. Installation Requirements and repeat the zero-load test; and**
- **if the change in zero is greater than ± 0.5 %, inspect the conveyor and weighing area for compliance with UR.2. Installation Requirements, repeat the zero-load test, and reduce the interval between zero-load tests.**

The action to be taken as a result of the **simulated load or** material tests ~~or simulated load tests~~ is as follows:

(Amended 2002 **and 2009**)

- if the error is less than 0.25 %, no adjustment is to be made;
- if the error is at least 0.25 % but not more than 0.6 %, **inspect the conveyor and weighing area for compliance with UR.2. Installation Requirements and repeat the test**~~adjustment may be made if the official with statutory authority is notified;~~
(Amended 1991 **and 2009**)
- **if the result of tests, after compliance with UR.2. Installation Requirements is verified, remain greater than ± 0.25 %, a span correction shall be made and the official with statutory authority notified;**
- if the error is greater than 0.6 % but does not exceed 0.75 %, **inspect the conveyor and weighing area for compliance with UR.2. Installation Requirements, and repeat the test;**
(Amended 1991 **and 2009**)
- **if the result of tests, after UR.2. Installation Requirements compliance is verified, remains greater than ± 0.25 %, a span correction shall be made, the official with statutory authority shall be notified, and an official test shall be conducted;**
- if the error is greater than 0.75 %, an official test is required.
(Amended 1987 **and 2009**)

Discussion: HB 44 gives limited guidance on what to do with zero-load test results. Belt loss is not the only factor that may require the scale operator to make physical adjustments to the belt-conveyor system to correct for deficiencies. For example, a dirty scale structure or a worn belt scraper will increase the zero-reference number and the test results may exceed tolerances.

The scale user/owner has to protect his interest between weighing transactions. At present, some belt-conveyor systems may have errors greater than 0.5 % in zero reference over a 24-hour period. The belt is part of tare (net load) on any empty running system and the system must be maintained to within tolerance at all times.

During its 2006 meeting, the WWMA recommended the alternate industry proposal shown above. The WWMA also recommended the alternate proposal be considered at a future meeting of the USNWG on Belt-Conveyor Scale Systems. The WWMA recommended the alternate proposal remain a Developing item to allow sufficient time for a review by the WG. The CWMA and the SWMA concurred with the WWMA's recommendation.

This WG agrees that there is a need to establish some zero-load test interval for the normal use of a belt-conveyor scale system and that there is also a need to vary the interval (longer interval if the scale is stable; shorter interval if

the zero-load tests require frequent adjustment). The WG has reviewed and discussed this Developing item and submitted a revised proposal to the NIST technical advisor to the S&T Committee.

At its 2007 Annual Meeting, the WWMA believed this item was not sufficiently developed and did not have a consensus from the Belt-Conveyor Scales (BCS) and, therefore, recommended this remain a Developing item on the NCWM S&T Committee agenda.

At its 2007 Interim Meeting, the CWMA recommended this item be Withdrawn.

During the 2008 NCWM Interim Meeting, the Committee was informed that the USNWG on Belt-Conveyor Scales was planning to further develop the proposal during their next meeting on February 27 - 28, 2008, in St. Louis, Missouri. During that meeting, the WG further amended the proposal as shown in the above recommendation and believes that this item is sufficiently developed to be added to the NCWM S&T Committee Agenda as a Voting item.

At its 2008 Annual Technical Conference, the WWMA heard comments from the BCS USNWG that the item is sufficiently developed. The WWMA agreed with the comments and proposed change to add “and after a repair or mechanical adjustment to the conveyor system” in (c) as shown in the above proposal and recommends that this proposal move forward as a Voting item.

At the 2009 NCWM Interim Meeting, the Committee heard comments from Bill Ripka, Thermo Ramsey, who recommends that this item move forward as a Voting item since recent changes to the Belt-Conveyor Scale Systems Code have increased attention to the accuracy of the zero reference on belt-conveyor scales and raised questions on how frequently the zero reference and simulated tests should be conducted between official testing. The language in this proposal would require users to perform tests to monitor the scale’s performance at a frequency that would be established either by the official or by recommendations from the manufacturer. Jack Kane, Montana, was concerned that the proposed language appears to rely only on the official’s experience and expertise and suggested the scale manufacturer be able to provide input to the frequency of testing. Julie Quinn, Minnesota, stated that this language by itself would imply recordkeeping requirements. The NIST technical advisor stated that the requirements for recordkeeping are supported in paragraph UR.3.3. Retention of Maintenance, Test, and Analog or Digital Recorder Information. The NIST technical advisor stated all the belt-conveyor scale proposals will be reviewed by the BCS WG during their February 2009 meeting.

The Committee agreed with the comments from Jack Kane and amended the proposal as shown in the Committee’s recommendation to include the manufacturer’s recommendations in determining the frequency of zero and simulated tests between official tests and recommended this item move forward as a Voting item. The Committee also requests input from the BCS WG and other interested parties on the table format for the “actions to be taken as a result” of the zero or simulated tests.

(See also the Committee’s 2008 Annual Report for additional background information.)

After the Interim Meeting, the NIST technical advisor developed the following tables, which were based on a suggestion during the open hearing. The following tables represent the above bulleted language in UR.3.3.(c) presented in a table format. The USNWG on Belt Scales will review the alternate format and provide the Committee with its recommendations and additional comments.

Change in Zero Reference Point ($\Delta 0$)	Action to be Taken
If the change in zero is less than $\pm 0.25\%$ ($\Delta 0 < 0.25\%$)	Perform zero adjustment and proceed to simulated load test
If the change in zero is $\pm 0.25\%$ to $\pm 0.5\%$ ($0.25\% \leq \Delta 0 \leq 0.5\%$)	Inspect the conveyor and weighing area for compliance with UR.2. Installation Requirements and repeat the zero-load test
If the change in zero is greater than $\pm 0.5\%$ ($\Delta 0 > 0.5\%$)	Inspect the conveyor and weighing area for compliance with UR.2. Installation Requirements, repeat the zero-load test, and reduce the interval between zero-load tests.

Change in Reference Point established in N.3.3.(b)	Action to be Taken
If the error is less than 0.25% ($\Delta N.3.3.(b) < 0.25\%$)	No Action
If the error is at least 0.25% but not more than 0.6% ($0.25\% \leq \Delta N.3.3.(b) \leq 0.6\%$)	Inspect the conveyor and weighing area for compliance with UR.2. Installation Requirements and repeat the test. If the result of tests, after compliance with UR.2. Installation Requirements is verified, remain greater than $\pm 0.25\%$, a span correction shall be made and the official with statutory authority notified.
If the error is greater than 0.6% but does not exceed 0.75% ($0.6\% < \Delta N.3.3.(b) \leq 0.75\%$)	Inspect the conveyor and weighing area for compliance with UR.2. Installation Requirements, and repeat the test. If the result of tests, after UR.2. Installation Requirements compliance is verified, remains greater than $\pm 0.25\%$, a span correction shall be made, the official with statutory authority shall be notified, and an official test shall be conducted.
If the error is greater than 0.75% ($\Delta N.3.3.(b) > 0.75\%$)	An official test is required.

321-2 V N.3.1.4. Check for Consistency of the Conveyor Belt Along Its Entire Length

Source: 2008 Western Weights and Measures Association (WWMA) (This item last appeared on the 2008 Committee's Developing agenda as Item 360-2 Part 3 Item 2)

Recommendation: Amend NIST Handbook 44, Section 2.21. Belt Conveyor Scales (BCS) Systems Code, paragraph N.3.1.4. as follows:

N.3.1.4. Check for Consistency of the Conveyor Belt Along Its Entire Length. – During a zero-load test, the total change indicated in the totalizer during one revolution of the belt shall not exceed 0.18 % of the load that would be totalized at scale capacity for the duration of the test. The end value of the zero-load test must meet the $\pm 0.06\%$ requirement of paragraphs N.3.1.2. Initial Stable Zero and N.3.1.3. Test for Zero Stability. ~~After a zero-load test with flow rate filtering disabled, the totalizer shall not change more than plus or minus (± 3 d) 3.0 scale divisions from its initial indication during one complete belt revolution.~~

(Added 2002) (Amended 2004 and 201X)

Discussion: The BCS WG agrees that the existing language in N.3.1.4. results in an excessive allowance for the variation in a belt. However, for belt-conveyor scales that can benefit from a smaller minimum division, the 3-division requirement can impose an excessively narrow restriction. It should be noted that variations in belt weight tend to be sinusoidal. In other words, the error caused by belt variations would be canceled if the material test were conducted using complete revolutions. The maximum belt variation would occur at 0.5, 1.5., 2.5, etc., revolutions. However, material tests are rarely conducted using complete revolutions of the belt.

The current tolerance of plus or minus 3 divisions can allow belt weight variation to contribute too large a portion to the 0.25 % belt-conveyor scale tolerance. The actual quantity represented by 3 divisions can vary with the belt-conveyor scale application. Paragraph N.2.3. Minimum Totalized Load (b) allows a material test load to be the amount of material to be weighed during one revolution of the belt. If the tolerance for the material test is 0.25 %, then on a root-sum-square basis, the variation in zero resulting from changes in the weight of the belt itself should not exceed 0.18 % (0.25 % times $\{\sqrt{2}\} / 2$).

Some rationale other than root-sum-square could result in a different allowable variation due to belt weight.

The following example illustrates the difference between divisions and percent for this purpose:

Belt length	= 800 ft,
Division size	= 0.1 ton,
Maximum capacity	= 800 tons/hr, and
Belt speed	= 400 ft/min

These minimum totalized load (MTL) values in paragraph N.2.3. are in a feasible range for an actual application.

N.2.3.(a)	800 divisions	= 80.0 tons
N.2.3.(b)	one revolution	= 26.67 tons, which is (66.67 lb/ft * 800 ft)
N.2.3.(c)	ten minutes	= 133.3 tons

The materials test tolerance (T.1.) based on the MTL in N.2.3.(b) = 0.07 tons.

The allowable variation due to belt weight is ± 3 divisions or ± 0.3 tons. Using ± 0.3 ton error in zero allows a total delivery error that can exceed maintenance tolerance in paragraph T.1. Tolerance values because of acceptable belt weight variation of 0.6 tons currently in HB 44 paragraph N.3.1.4. This tolerance exceeds the 0.25 % tolerance of the weighing system without weighing any material. Even for a 10 min MTL (N.3.1.4.(c)), the allowable error is 0.45 % of 133.3 tons.

The proposed language changes the tolerances in N.3.1.4. from ± 3 divisions to 0.18 %. In the above example, the allowable change in the totalizer readings could be no greater than 0.048 tons [0.18 % x 26.67 tons (MTL)].

NIST HB 44 paragraph N.2. Conditions of Test was amended, and the minimum totalized load (MTL) requirements were amended and renumbered to paragraph N.2.3. Since 10 min of operation in N.3.2.(c) typically results in a test load larger than (a) or (b), the 10 min MTL is used for most BCS installations. Additionally, the words “or a normal weighment” were removed from MTL requirements because, at that time, it was thought the words were no longer needed since language was developed to allow a smaller material test load provided the scale demonstrated compliance with BCS tolerances with the MTL and the smaller test load.

As a result of removing the words “or a normal weighment,” it has been reported that the revised MTL requirements were not suitable for BCS installations that issue individual weights for vehicles and railcars. This is due to limitations of the installation and uncertainties in determining the net weights of several vehicles or railcars to compare material test results of the 10 min MTL with the alternate test load of “2 % of the load totalized in 1 hour.”

The current NIST HB 44 paragraph N.2.3. permits “a smaller minimum totalized load down to 2 % of the load totalized in 1 hour....” In the above example the minimum load would be 16 tons for this criterion so the belt variation is even a larger percentage of the weighed load.

The change to 0.18 % is a better criterion in several ways.

1. It defines the allowable excursion of the totalized value during the zero procedure. Plus or minus requires some reference value and it is not known at the start of a zero test whether that portion of the belt is heavy or light.
2. It is independent of division size. (But the division size must be small enough to resolve the variation.)
3. It is in harmony with OIML R 50.

In the above example 0.18 % of 26.67 tons is 0.048 tons. This is quite different from 3 divisions or ± 3 divisions.

At its 2007 Annual Meeting, the WWMA heard comments from a device manufacturer who would like to leave the item as either Developing or Withdrawn.

During the 2008 NCWM Interim Meeting, the Committee was informed that the USNWG on Belt-Conveyor Scales was planning to further develop the proposal during their next meeting on February 27 - 28, 2008, in St. Louis, Missouri. During that meeting, the WG discussed this item and concluded that the language needs further development before a consensus can be reached and recommended this item remain as a Developing item.

At its 2008 Annual Technical Conference, the WWMA heard comments that the item is sufficiently developed and is an improvement over the existing language in HB 44. The Committee agrees and recommends that this proposal move forward as a Voting item.

During the 2009 NCWM Interim Meeting, the Committee heard a comment from Bill Ripka, Thermo Ramsey, supporting the proposal as written in the Committee's recommendation and added that the current language in HB 44 stating the current 3 scale interval deviation from an initial indication can lead to significant errors in scale accuracy.

The Committee agreed with the comments from Bill Ripka and recommended this item move forward as a Voting item.

(See also the Committee's 2008 Annual Report for additional background information.)

321-3 V S.1.3.1. For Scales Installed After January 1, 1986 (Value of the Scale Division)

Source: 2008 Western Weights and Measures Association (WWMA)

Recommendation: Amend HB 44 Section 2.21. paragraph S.1.3.1.

S.1.3.1. For Scales Installed After January 1, 1986. – The value of the scale division shall not be greater than 0.125 % ($1/800$) ~~0.1 % ($1/1000$)~~ of the minimum totalized load.

~~[Nonretroactive as of January 1, 1986]~~ **(Added 1985) (Amended 2010)**

The USNWG on BCS recommended that the above change be made to reconcile the value of the minimum scale division (0.1 % of the minimum totalized load) with the value of the minimum test load (800 divisions) listed in paragraph N.2.3.(a).

At its 2008 Annual Technical Conference, the WWMA heard support for this item as written in its agenda and recommends that the proposal move forward as a Voting item.

During the 2009 NCWM Interim Meeting, the Committee heard support for this item from Bill Ripka, Thermo Ramsey, and recommended that this item move forward as a Voting item.

321-4 V S.1.6.1 Zero-load Indicator

Source: 2008 Western Weights and Measures Association (WWMA)

Recommendation: Add new paragraph S.1.6.1. to HB 44 Section 2.21. as shown:

S.1.6.1. Zero-load indicator. – The integrator shall display an indication that defines a zero-balance condition when the unloaded condition of the belt over a unit revolution or revolutions is within ± 0.12 % of the rated scale capacity.
(Nonretroactive as of January 1, 2011)
(Added 201X)

Background/Discussion: It is apparent to owners, manufacturers, and service agents associated with belt-conveyor scale systems that on systems (particularly those equipped with automatic zero-mechanisms) running at a “no-load” level of operation, that a zero shift may occur and not be readily observed. At its February 2008 meeting, the USNWG on BCS recommended language that would require an indication be present which indicates a zero condition during these low-flow periods when no material is being totalized by an integrator. The recommended addition of the paragraph S.1.6.1. as shown above would require an indication that would notify an operator of an out-of-zero condition and also define the limit of the width of zero for that device.

At its 2008 Annual Technical Conference, the Committee heard support for this item as written in the agenda along with a request to allow additional time for manufacturers to make necessary changes to hardware or software. The Committee agreed with the comments and request and recommends the proposal be amended and moved forward as a Voting item with a 2011 nonretroactive date as shown in the recommendation (effective 18 months after adoption).

During the 2009 NCWM Interim Meeting, the Committee received written comments from Alabama Weights and Measures Division stating that an indicator should serve as a means to alert the operator that a zero condition during low-flow periods has occurred. However, if this indicator is activated, the operator and/or service person should make every effort to locate the possible zero change source before making a zero change/adjustment. The indicator could be indicating an electronic problem, a belt loss condition or another source of zero error. In many cases, problems of a mechanical or material handling nature occur that does affect the zero balance condition. In these cases, zero changes or adjustments must not be made until repairs, adjustments, or cleaning has been accomplished. It should also be understood that all conveyor belt scale operators be required to maintain a constant and thorough inspection process during operation of the scale conveyor system. This would help to reduce unwarranted electronic adjustments to the scale system.

The Committee agrees with the comments from Alabama Weights and Measures Division that any indications such as a change in the zero reference condition of the scale should be acted upon by the user. The Committee suggests that the Belt-Conveyor Scale WG or Alabama Weights and Measures Division develop a proposal for a separate user requirement similar to Scales Code paragraph UR.4.1. Balance Condition. The proposal should require the user to maintain the zero-balance condition when the belt is unloaded, and to include the inspections recommended in the Alabama comments.

The Committee also heard support for this item from Bill Ripka, Thermo Ramsey, supporting the proposal as written in the Committee’s recommendation. The Committee agreed to recommend that this item move forward as a Voting item.

321-5 V N.2. Conditions of Tests, N.2.1. Initial Verification and N.3.2. Material Tests

Source: 2008 Western Weights and Measures Association (WWMA)

Recommendation: Amend NIST HB 44 Section 2.21. paragraph N.2. and N.2.1. as follows:

N.2. Conditions of Tests. – A belt-conveyor scale shall be tested after it is installed on the conveyor system with which it is to be used and under such environmental conditions as may normally be expected. Each test shall be conducted with test loads no less than the minimum test load. **Before each test run, check the zero**

setting, and if necessary perform a zero-load test. Zero adjustment between test runs shall not exceed the tolerance of T.1.1.

(Amended 1986 and 2004 **and 201X**)

N.2.1. Initial Verification. – A belt-conveyor scale system shall be ~~tested~~ **verified with a minimum of two test runs at each of the following flow rates:**

1. normal use flow rate,
2. 35 % of the maximum rated capacity, and
3. an intermediate flow rate between these two points.

~~Test runs may also be conducted. The system may also be tested~~ at any other rate of flow that may be used at the installation. ~~If the~~ **The official with statutory authority may determine that a minimum of four test runs may be conducted at only one flow rate if evidence is provided that the systems is used to operate at a single flow rate that does not vary by more than ± 5 % of the maximum rated capacity (excluding the time that the flow rate is ramping up or down).**

(Added 2004) (**Amended 201X**)

N.3.2. Material Tests. – Material tests should be conducted using actual belt loading conditions. These belt loading conditions shall include, but are not limited to conducting materials tests using different belt loading points, all types and sizes of products weighed on the scale, at least one other belt speed, and in both directions of weighing.

~~On initial verification, at least three individual material tests shall be conducted.~~—On subsequent verifications, at least two individual tests shall be conducted. The results of all these tests shall be within the tolerance limits.

Either pass a quantity of pre-weighed material . . .

(Amended 1986, 1989, 1998, 2000, 2002, **and 2010**)

Background/Discussion: WMD has received inquiries and comments pertaining to whether or not rezeroing of the belt-conveyor scale under evaluation can be done between tests. There is inconsistency between jurisdictions in the way that tests are performed regarding these questions. Due to the requirement (HB 44 Section 2.21. paragraph N.2.1.) during an initial verification, which states that tests (runs) are to be performed at three flow rates and that they must be of 10 minute durations, many hours may be required to complete the testing. This presents a problem with determining if the BCS needs to be rezeroed after each test run regardless of the change in zero or if the BCS only needs to be rezeroed if the change exceeds the requirements in paragraph T.1.1. Tolerance Values – Zero Stability.

Paul Chase (member of the USNWG on Belt-Conveyor Scales) has collected some historical data on two belt-conveyor scale systems where temperature and zero information are available that show a clear trend with temperature. These data indicate that testing over a period of many hours can be affected by a zero shift that occurs during the testing. This could be a result of day-to-night temperature variation. A belt-conveyor scale that exhibits this property should be re-zeroed during normal operation as required to maintain the belt-conveyor scale within tolerance.

The expectation that a device will maintain a consistent zero under these conditions is considered by manufacturers and the USNWG to be an unfair performance standard. At its February 2008 meeting, USNWG recommended that HB 44 be amended as shown in the recommendation above.

Additionally, WMD received requests for clarification on the number of tests to be performed during initial verification. Paragraph N.2.1. Initial Verification, added in 2004, states that the scale be tested at three flow rates. Additionally, the second paragraph in N.3.2. Material Tests states that at least three individual material tests be conducted during initial verification, which was added prior to 1986. Officials and service agents were asking if the minimum number of tests were a total of three (one at each flow rate), or nine (three tests at each flow rate) during

initial verification. The WG confirmed that the language that was added in 2004 intended that at least two material tests at each flow rate were to be performed during an initial verification in order for the test to more closely align with international recommendations. Consequently, the WG recommended language to clarify the number of tests in N.2.1. and to delete the statement regarding the number of tests during initial verification N.3.2. since the language is already addressed in N.2.1.

At its 2008 Annual Technical Conference, the WWMA heard comments supporting this item along with a recommendation from Bill Ripka, Thermo Ramsey, to clarify when testing only at a single flow rate is permitted. The WWMA noted that the proposed change to the language is consistent with testing at different flow rates in paragraph N.2.2. Subsequent Verification. The WWMA agreed with the comments and recommends that this proposal move forward as a Voting item.

During the 2009 NCWM Interim Meeting, the Committee received written comments from Alabama Weights and Measures Division expressing their opposition to this proposal as recommended in the Interim agenda and stated that all conveyor-belt scales being tested for initial verification within the State of Alabama will be tested as follows:

- Three (3) individual tests will be performed at each of the following:
- at normal use flow rate,
 - 35 % of the maximum rated capacity, and
 - at an intermediate flow rate between these points.

The total number of test runs for this initial verification will be nine (9). Alabama believes that in order to establish a pattern of repeatability upon initial verification that three (3) individual tests at each flow rate need to be performed. Alabama notes that the conduct of these tests are only a “snapshot in time,” indicating that the scale and scale system as a whole operated or failed to operate as required at that point. Therefore, Alabama believes that the requirement for strong repeatability testing must remain.

Bill Ripka, Thermo Ramsey, supported the item as written as it clarifies the number of tests at each flow rate. He added that language should be included to address the ramping up and down of flow rates on installations that run predominately at a single flow rate, and he suggested that the proposed last sentence in the paragraph could be amended similarly to current paragraph N.2.2. Subsequent Testing, which provides additional guidance on when testing at multiple flow rates may be waived.

The Committee considered the comments from Alabama Weights and Measures Division and agreed that the proposed language is considered a minimum test and that additional testing may be required. Consequently, the Committee amended the proposal as shown in the Committee’s recommendation to clarify that the pairs of tests at each flow rate are a minimum test and to provide additional guidance on proposed language in determining when testing at three flow rates may be waived. The Committee amended the proposal to delete the third sentence in paragraph N.3.2. Material Tests. since the sentence conflicts with the language in the current and proposed language in paragraph N.2.1. shown in the recommendation above.

The NIST technical advisor added that this amended proposal will be reviewed by Alabama and by the belt-conveyor scale WG during their February 2009 meeting. The Committee recommends that the item move forward as a Voting item unless it receives information from the WG suggesting that the item is not ready for a vote.

321-6 V T.1.1. Tolerance Values – Test of Zero Stability

Source: 2008 Western Weights and Measures Association (WWMA)

Recommendation: Amend HB 44 Section 2.21. (Belt Conveyor Scale Systems Code) paragraph T.1.1. to coincide with amendment recommended to paragraphs N.2. and N.2.1. in agenda Item 321-5 as follows:

T.1.1. Tolerance Values - Test of Zero Stability. – Immediately after material has been weighed over the belt-conveyor scale during the conduct of ~~the any~~ materials test run, the zero-load test shall be repeated. The change in the accumulated or subtracted weight on the Master Weight Totalizer during the zero test shall not exceed 0.12 % of the totalized load at full scale capacity for the duration of the test. **If the total range of zero**

adjustment during a complete (official) verification test exceeds 0.18 %, the official with statutory authority may establish an interval for zero-load testing during normal operation.

(Added 2004 and 2009)

Background/Discussion: The recommendation to amend the paragraphs N.2. and N.2.1. would necessitate the amendments shown above to reflect the consideration of a tolerance associated with a zero shift in the scale. The U.S. National Work Group on BCS recognized the need and recommends the above wording changes.

At its 2008 Annual Technical Conference, the WWMA heard a comment from a jurisdiction that the proposal places an additional burden on the field inspector having to verify compliance with the frequency of zero and accuracy tests between official tests in order to monitor zero references and calibration stability. WMD noted that paragraph UR.4. Compliance already requires the user to retain records of these tests and that the proposal is only intended to give the inspector some guidance on establishing the frequency of these intermediate tests.

The WWMA considered the comments and recommends that this proposal move forward as a Voting item since it provides the regulatory official with guidance in determining the frequency for conducting zero-load tests between official tests.

During the 2009 NCWM Interim Meeting, the Committee received written comments from Alabama Weights and Measures Division stating that the proposed change from “the materials test run” to “a material test run” seems to indicate that only one material test run be required prior to performing a zero-load test. The State of Alabama requires that when performing initial and follow-up verification tests that three (3) separate material test runs be performed and recommends that the current wording should remain “as is” in order to be able to establish a pattern of repeatability and to insure that the scale is weighing with as much accuracy as possible.

The NIST technical advisor reviewed the summary of the May 2001 Belt-Conveyor Scale Seminar where the original language was developed. The discussions indicated that the participants believed that the zero-load reference be verified after any material test run and developed the language to coincide with language for UR.3.2. Maintenance subparagraph (c) Zero-Load Reference Information that the zero-load test be conducted immediately before and after a delivery when the zero-load information is recorded as part of a delivery.

Bill Ripka, Thermo Ramsey, supports the item as written in the Interim agenda and does not have a problem with the restrictions, but stated that he believes the zero reference should be allowed to drift provided the material test accuracy repeats within tolerances.

The Committee considered the comments and agreed to amend the proposal to clarify that the zero-load test is to be conducted after any material test run and recommended that this item move forward as a Voting item.

321-7 V N.3.1.2. Initial Stable Zero, N.3.1.3. Test of Zero Stability and S.3.1.1. Automatic Zero-Setting Mechanism

Source: 2008 Western Weights and Measures Association (WWMA)

Recommendation: Combine paragraphs N.3.1.2. and N.3.1.3. in HB 44 Section 2.21. resulting in one paragraph N.3.1.2. Test of Zero Stability.

Delete N.3.1.2. and amend N.3.1.3. as follows:

~~**N.3.1.2. Initial Stable Zero.**— The conveyor system shall be run to warm up the belt and the belt scale shall be zero adjusted as required. A series of zero load tests shall be carried out until three consecutive zero load tests each indicate an error which does not exceed $\pm 0.06\%$ of the totalized load at full scale capacity for the duration of the test. No adjustments can be made during the three consecutive zero load test readings.~~

~~(Added 2002) (Amended 2004)~~

N.3.1.23. Test of Zero Stability. – The conveyor system shall be run to warm up the belt and the belt scale shall be zero adjusted as required. A series of zero-load tests shall be carried out **before weighing material immediately before the simulated or materials test** until three consecutive zero-load tests each indicate an error which does not exceed $\pm 0.06\%$ of the totalized load at full scale capacity for the duration of the test. No adjustments can be made during the three consecutive zero-load test readings. **As specified in S.3.1.1., if operable, the automatic zero-setting mechanism shall not obscure any change in zero for integrators manufactured on or after January 1, 2010.**

(Added 2002) (Amended 2004 **and 2010**)

N.3.1.34. Check For Consistency of the Conveyor Belt Along Its Entire Length. – After a zero-load test with flow rate filtering disabled, the totalizer shall not change more than plus or minus 3.0 scale divisions ($\pm 3 d$) from its initial indication during one complete belt revolution.

(Added 2002) (Amended 2004) (**Renumbered 2010**)

Add new paragraph S.3.1.1. as shown below:

S.3.1.1. Automatic Zero-Setting Mechanism. – The automatic zero-setting mechanism shall not obscure any change in zero.

(Added 201X)

Background/Discussion: At its 2008 Annual Technical Conference, the WWMA reviewed a proposal from the USNWG on Belt Conveyor Scale Systems recommending that paragraphs N.3.1.2. and N.3.1.3. be combined since they are nearly identical in language and to reduce redundant language and to clarify that any change in zero is to be indicated to verify that the total range of zero adjustment during an official test complied with paragraph T.1.1. This combination would result in one paragraph identified as “N.3.1.2. Test of Zero Stability.” The group also recommends that paragraph S.3.1.1. be added so that specification requirements within the code coincide with the amendments to paragraph N.3.1.2. The WWMA heard support for the item and recommends that the proposal moves forward as a Voting item.

During the 2009 NCWM Interim Meeting, the Committee heard from Bill Ripka, Thermo Ramsey, in support of the item as written in the Committee’s recommendation since it eliminates redundant language in HB 44. The Committee agreed to recommend that this item move forward as a Voting item.

322 AUTOMATIC BULK-WEIGHING SYSTEMS

322-1 I S.2.1. Zero-Load Adjustment

Source: NTETC Weighing Sector

Recommendation: Amend HB 44 Section 2.22. Automatic Bulk-Weighing Systems by amending paragraph S.2.1.3.3. as follows:

S.2.1. Zero-Load Adjustment. – The weighing system shall be equipped with manual or semiautomatic means by which the zero-load balance or no-load reference value indication may be adjusted. ~~An automatic zero-tracking~~ **and automatic zero-setting** mechanisms ~~is~~ **are** prohibited.

(Amended 201X)

Background/Discussion: At its 2008 Annual Meeting, the NTETC Weighing Sector held a discussion about the increasing number of scales submitted for NTEP evaluations that include an “automatic zero-setting” feature, which is not addressed in NIST HB 44. It has been noted that many devices are built for a global marketplace and that the operation of this “automatic zero-setting” device may be functional on the device when installed in the United States. Currently, HB 44 does not define this function. NCWM Pub 14 has no test to determine if the device submitted for evaluation has such a function, or if it is scalable. The automatic zero-setting mechanism on a scanned/scale submitted to NTEP could be enabled and disabled by means of a bar code read by the scanner.

The Sector established a small WG to develop language to be submitted to the NCWM S&T Committee and make recommendations addressing the suitability of scales with the capability to automatically set a positive weight indication to zero. The group, which included Scott Davidson (Mettler-Toledo), Scott Henry (NCR), Steve Cook (NIST technical advisor), and Stephen Patoray (Consultant on Certification, LLC), volunteered to develop a proposal for the S&T Committee. (Todd Lucas, Ohio NTEP laboratory and Jim Truex, NTEP Administrator, also contributed to the discussions and subsequent proposal.) Additionally, the Sector agreed to review the language developed by the WG to confirm its support of the proposed language.

In the process of developing the proposal, the WG recommended that the automatic zero-setting mechanism be prohibited for devices covered by Section 2.22. Automatic Bulk-Weighing Systems for the same reasons that zero-tracking is prohibited (incorrect net weight determinations may occur when unintentional and unobserved zeroing or tracking off of material retained in a hopper).

See agenda Item 320-3 for additional background information on the development of this proposal.

The Committee agreed that this item should remain as an Informational item pending the development of the proposal to add the term “automatic zero-setting mechanism” in agenda Item 320-2.

324 AUTOMATIC WEIGHING SYSTEMS

324-1 I S.2.1.3. Automatic Zero-Setting Mechanism

Source: 2008 NTETC Weighing Sector

Recommendation: Amend HB 44 Section 2.24. Automatic Weighing Systems by adding new paragraph S.2.1.3. as follows:

S.2.1.3. Automatic Zero-Setting Mechanism – If equipped, an automatic zero-setting mechanism shall operate only when the indication has remained:

- (a) stable according to paragraph S.4.2. Damping, and**
- (b) below zero for at least 5 seconds.**

The maximum effect of automatic zero-setting mechanism is limited to 4 % of the nominal capacity of the scale and is a sealable parameter.

(Added 201X)

Background/Discussion: At its 2008 Annual Meeting, the NTETC Weighing Sector discussed an issue about the increasing number of scales submitted for NTEP evaluations that include an “automatic zero-setting” feature not addressed in NIST HB 44. It has been noted that many devices are built for a global marketplace and that the operation of this “automatic zero-setting” device may be functional on the device when installed in the United States. Currently, HB 44 does not define this function. NCWM Pub 14 has no test to determine if the device submitted for evaluation has such a function, or if it is sealable. The automatic zero-setting mechanism on a scanner/scale submitted to NTEP could be enabled and disabled by means of a barcode read by the scanner.

The Sector established a small WG to develop language to be submitted to the NCWM S&T Committee and make recommendations addressing the suitability of scales with the capability to automatically set a positive weight indication to zero. The group (Scott Davidson, Mettler-Toledo; Scott Henry, NCR; Steve Cook, NIST technical advisor; and Stephen Patoray, Consultants on Certification, LLC) volunteered to develop a proposal for the S&T Committee. (Todd Lucas, Ohio NTEP laboratory, and Jim Truex, NTEP Administrator, also contributed to the discussions and subsequent proposal.) Additionally, the Sector agreed to review the language developed by the WG to confirm its support of the proposed language.

In the process of developing the proposal, the WG recommended that the automatic zero-setting mechanism should be permitted for devices covered by Section 2.24. Automatic Weighing Systems since equivalent requirements can be found in OIML R 51 Recommendation for Automatic Catchweighing Instruments.

See agenda Item 320-3 for additional background information on this proposal.

The Committee agreed that this item should remain as an Informational item pending the development of the proposal to add the term automatic zero-setting mechanism in agenda Item 320-3.

324-2A V S.2.2. Tare, S.2.2.1. Scale Interval and Capacity, S.2.2.2. Accuracy, and S.2.2.3. Damping

Source: 2008 Carryover Item 324-2. (This item originated from the S&T Committee and first appeared on the Committee's 2007 agenda.)

Recommendation: (NOTE: This item will be considered jointly with Item 320-1B.) This recommendation clarifies the requirements for tare by modifying paragraph S.2.2. and adding new paragraphs S.2.2.1. through S.2.2.3. that provide new requirements for metrological tare (e.g., tare objects weighed or balanced off at the time of the transaction), and tare accuracy into HB 44 that supports the type evaluation procedures in NCWM Publication 14 and are consistent with OIML R 51 for automatic Catch-weighing Instruments.

Amend paragraph S.2.2. as follows:

S.2.2. Tare. – The tare-**weighing and tare-balancing** mechanism shall operate only in a backward direction (that is, in a direction of underregistration) with respect to the zero-load balance condition of the scale. A device designed to automatically clear any tare value shall also be designed to prevent the automatic clearing of tare until a complete transaction has been indicated.

[**Note:** On a computing scale, this requires the input of a unit price, the display of the unit price, and a computed positive total price at a readable equilibrium. Other devices require a complete weighing operation, including tare, net, and gross weight determination.]

(Amended 2004 **and 2008**)

Add new paragraphs S.2.2.1. through S.2.2.3. as follows:

S.2.2.1. Scale Interval (Division) and Capacity. – **On any scale (except multi-interval scales when the value of tare is determined in the first weighing segment), the value of the tare division shall be equal to the value of the scale division for any given load and shall not operate above its maximum capacity.**

S.2.2.1.1. Multi-interval Scales. – **On multi-interval scales, the tare capacity is limited to the capacity of the first weighing segment and the value of the tare division shall be equal to the value of the scale division from the first weighing segment.**

S.2.2.1.2. Multiple Range Scales. – **On multiple range scales, the value of the tare division shall be equal to the value of the scale division from the weighing range where the tare was determined.**

(Added 201X)

S.2.2.2. Accuracy. – **A tare-weighing or tare-balancing mechanism shall permit setting the net indication to zero with an accuracy equal to or better than:**

- (a) **$\pm 0.25 d$ for electronic weighing devices and any weighing device with an analog indication, and**

- (b) ± 0.5 d for mechanical weighing devices with a digital indication (e.g., weighbeams with only notched poises and no sliding poises).

On a multi-interval scale, d shall be replaced by d_1 (division value of the first weighing segment).
(Added 201X)

S.2.2.3. Damping for Semi-automatic or Automatic Tare* Balancing or Weighing Mechanisms. – These mechanisms shall be operable or accessible only by a tool outside of and separate from this mechanism or it shall be enclosed in a cabinet, or it shall be operable only when the indication is stable within ± 1 scale division.

*Automatic tare mechanisms are not permitted for direct sales to the public.

(Added 201X)

Background/Discussion: At the 2007 Interim Meeting, the Committee agreed that for procedural reasons a separate corresponding proposal should have appeared on its 2007 S&T agenda in Section 324 for Automatic Weighing Systems. Therefore, the Committee developed a separate proposal for automatic weighing systems that now appears in this agenda item. The Committee recommended that new S&T Item 324-2, along with a corresponding proposal to apply these definitions to devices that fall under the Scales Code S&T Item 320-1, be discussed and considered jointly during all deliberations and voting procedures. In the interest of brevity, the Committee placed all recommendations, discussion, and background information for this proposal in S&T Item 320-1 because the proposed definitions apply to both applications; this ensures both proposals are addressed collectively.

At their fall 2007 meetings, the CWMA, NTETC WS, and the WWMA supported this item. See additional comments and recommendations from agenda Item 320-1A through Item 3201D.

The Committee did not receive any comments opposing this item and made this a Voting item.

At the 2008 NCWM Annual Meeting, the Committee agreed with the comments that this item needs additional time for review and analysis and that the item be given Informational status. The NIST technical advisor will develop a 1- to 2-hour technical presentation on the proposed tare requirements that will be available to the regional weights and measures associations, the NTETC Weighing Sector, and posted on the WMD website.

324-2B V S.2.2.4. Combined Zero-setting and Tare-balancing Mechanisms (0/T Key)

Source: 2008 Carryover Item 324-2. (This item originated from the S&T Committee and first appeared on the Committee's 2007 agenda.)

Recommendation: (NOTE: This item will be considered jointly with Item 320-1A.) This recommendation clarifies the requirements for tare by adding a new paragraph S.2.2.4. that provides identical requirements for accuracy, center-of-zero, and zero tracking on Automatic Weighing Systems (AWS) that use a combined zero/tare key as recommended in the Committee's agenda Item 320-1A.

Add paragraph S.2.2.3. as follows:

S.2.2.4. Combined Zero-setting and Tare-balancing Mechanisms (0/T Key). – Automatic weighing systems may be equipped with a combined zero and tare function key. If the semi-automatic zero-setting mechanism and the semi-automatic tare-balancing mechanism are operated by the same key, the following apply at any load:

- (a) After zero/tare-setting, the effect of accuracy of the zero-setting shall be not more than ± 0.25 d.

(b) A “center-of-zero” condition shall either automatically be maintained to ± 0.25 scale division or less, or have an auxiliary or supplemental “center-of-zero” indicator that defines a zero-balance condition to ± 0.25 scale division or less.
[Nonretroactive as of January 1, 2010]

(c) A zero-tracking mechanism, if equipped, shall operate only when:

(1) the indication is at zero, or at a negative net value equivalent to gross zero, and

(2) the weight indication is stable.

[Nonretroactive as of January 1, 2010]

(d) The scale must also be clearly marked on or adjacent to the weight display with the statement “Not for Direct Sales.”

(Added 201X)

Background/Discussion: Background information on this item can be found in the Background/Discussion paragraphs on agenda Item 324-2A.

After the NIST presentation on Tare during the 2009 Interim Meeting and considering that very few questions were raised during the discussion on the proposal for scales that have a combined zero/tare key, the Committee agreed to forward the item as a Voting item. Note that the Committee recommends that subparagraphs (a) and (d) be given retroactive status since these requirements have been verified by NTEP since the 0/T feature was included into HB 44 Scales Code.

324-2C I S.2.2.4. Visibility of Operation and S.2.2.5. Subtractive Tare Mechanism

Source: 2008 Carryover Item 324-2. (This item originated from the S&T Committee and first appeared on the Committee’s 2007 agenda.)

Recommendation: This recommendation clarifies the requirements for tare by adding new paragraphs S.2.2.4. and S.2.2.5. that provide new requirements for visibility and subtractive tare (i.e., balancing off tare objects does not increase the nominal scale capacity).

S.2.2.4. Visibility of Operation. – Operation of the tare mechanism shall be visibly indicated on the instrument. In the case of instruments with digital indications, this shall be done by marking the indicated net value with the word “NET” or the symbol “N”. “NET” may be displayed as “NET”, “Net” or “net”. If a scale is equipped with an indicator that allows the gross value to be displayed temporarily while a tare mechanism is in operation, the “NET” symbol shall disappear while the gross value is displayed.

(Added 201X)

S.2.2.5. Subtractive Tare Mechanism. – After any tare operation and while subtractive tare is in effect, an indicating or recording element shall not display nor record any values when the gross load (not counting the initial dead load that has been canceled by an initial zero-setting mechanism) is in excess of 105 % of scale capacity after tare has been taken.

(Added 201X)

Background/Discussion: Additional background information on this item can be found in the Background/Discussion paragraphs on agenda Item 320-1.

After the NIST presentation on Tare during the 2009 Interim Meeting, several questions were asked that indicated the need for additional clarification on the indications. Consequently, the Committee recommended that this proposal remain an Informational item and suggested that the Weighing Sector (WS) clarify the proposed language

and consider providing examples of indications and recorded representations when multiple tares are used to determine net weights.

324-2D I S.2.2.6. Consecutive Tare Operations and S.2.2.7. Indication and Printing of Weighing Results

Source: 2008 Carryover Item 324-2. (This item originated from the S&T Committee and first appeared on the Committee's 2007 agenda.)

Recommendation: (NOTE: This item will be considered jointly with Item 320-1C.) This recommendation clarifies the requirements for tare by adding new paragraphs S.2.2.6. and S.2.2.7. that clarify the requirements for transactions that use multiple tare, tare mechanisms, and the indications and recording of weighing results.

S.2.2.6. Consecutive Tare Operations. – Repeated operation of a tare mechanism (including preset tare) is permitted for single transactions with one gross, one net, and multiple tare values. If more than one tare mechanism is operative at the same time, tare weight values shall be clearly designated (identified) with either “T” for tare or “PT” for preset tare, as appropriate, when indicated or printed.

(Added 201X)

S.2.2.7. Indication and Printing of Weighing Results.

- (a) **Gross weight values may be printed without any designation or by using a complete word or symbol. For a designation by a symbol, only uppercase “G” is permitted.**
- (b) **If only net weight values are printed without corresponding gross or tare values, they may be printed without any designation or by using a complete word or symbol. The complete word (as shown in S.2.2.3. Visibility of Operation) or symbol “N” shall be used to designate a net weight. This applies also where semi-automatic zero-setting and semi-automatic tare balancing are initiated by the same key.**
- (c) **Gross, net, or tare values determined by a multiple range instrument or by a multi-interval instrument need not be marked by a special designation referring to the (partial) weighing range.**
- (d) **If net weight values are printed together with the corresponding gross and/or tare values, the net and tare values shall be identified at least by the corresponding symbols “N” and “T” or by complete words using all upper-case letters, all lower-case letters, or a combination of upper- and lower-case letters.**
- (e) **If net weight values and tare values determined by different tare mechanisms are printed separately for single transactions with multiple gross, tare, and net values, they shall be suitably identified (e.g., vehicle sequentially loaded with mixed commodities).**

(Added 201X)

Background/Discussion: Additional background information on this item can be found in the Background/Discussion paragraphs on agenda Item 320-1A.

During the NIST presentation on Tare during the 2009 Interim Meeting, the Committee heard several questions that indicated the need for additional clarification on the value of specifying acceptable words and abbreviations for Gross, Tare, Preset Tare, and Net.

Consequently, the Committee recommends that this proposal remain an Informational item and suggests that the WS further clarify the proposed language and consider providing examples of 1) indications and recorded representations of tare and preset tare in consecutive tare transactions, and 2) indications and recorded representations when multiple tares and preset tares are used to determine net weights.

324-2E I S.2.3. Preset Tare Mechanism and S.2.3.1. Indication of Operation

Source: 2008 Carryover Item 324-2. (This item originated from the S&T Committee and first appeared on the Committee's 2007 agenda.)

Recommendation: (NOTE: This item will be considered jointly with Item 320-1D.) This recommendation clarifies the requirements for tare by adding new paragraphs S.2.3. and S.2.3.1. that provide new requirements for metrological tare (e.g., tare objects weighed or balanced off at the time of the transaction), tare accuracy, operating range, visibility, and preset tares (e.g., manually entered or stored tares for multiple transactions).

Add new paragraphs S.2.3. and S.2.3.1. as follows:

S.2.3. Preset Tare Mechanism, Operation. – In addition to the provisions of paragraphs S.2.2. Tare and S.2.2.1. Scale Interval, a preset tare may be operated together with one or more tare devices provided:

- (a) **the preset tare mechanism complies with paragraph S.2.2.6. Consecutive Tare Operations,**
- (b) **the preset tare operation cannot be modified or cancelled as long as any tare mechanism operated after the preset tare operation is still in use,**
- (c) **the preset tare associated with a price look-up (PLU) shall be automatically cancelled at the same time a PLU is cancelled, and**
- (d) **the preset tare values are designated by the symbol "PT"; however, it is permitted to replace the symbol "PT" with complete words.**

A preset tare may operate automatically only if the preset tare value is clearly identified with the load to be measured (e.g., part of the product look-up information).

S.2.3.1. Indication of Operation. – It shall be possible to temporarily indicate the preset tare value (e.g., pressing a tare display button or a negative net weight indication with no load on the load-receiving element). Additionally, paragraph S.2.2.7. Indication and Printing of Weighing Results applies accordingly, provided the calculated net value is printed and at least the preset tare value is printed, with the exception of:

- (a) **a Class II or a Class III automatic weighing system with a maximum capacity not greater than 100 kg (200 lb) used in direct sales to the public, and**
- (b) **automatic weigh/price labeling systems.**

(Added 201X)

Background/Discussion: Background information on this item can be found in the Background/Discussion paragraphs on agenda Item 320-1A.

During the NIST presentation on Tare during the 2009 Interim Meeting, the Committee heard several questions that indicated the need for additional clarification on:

- are itemized indications and recorded representations required for each tare; and
- are different indications and recorded representations required for each tare value when tare and preset tare are used in the same transaction?

Consequently, the Committee recommends that this proposal remain an Informational item and suggests that the WS further clarify the proposed language and consider providing examples of 1) indications and recorded

representations of tare and preset tare in consecutive tare transactions and 2) indications and recorded representations when multiple tares and preset tares are used to determine net weights.

330 LIQUID-MEASURING DEVICES

330-1 I Temperature Compensation for Liquid-Measuring Devices Code

Source: 2008 Carryover Item 330-1. This item originated from the NCWM S&T Committee and first appeared on the Committee's 2007 agenda.

Recommendation: The Committee is considering a proposal to make the following modifications to Section 3.30. Liquid-Measuring Devices (LMD) Code to recognize temperature compensation for retail devices. The Committee has modified the proposal based on comments received as of the 2009 NCWM Interim Meeting.

S.1.6.8. Recorded Representations from Devices with Temperature Compensation. – Receipts issued from devices or systems with activated automatic temperature compensation must include a statement that the volume of the product has been adjusted to the volume at 15 °C for liters or the volume at 60 °F for gallons.

[Nonretroactive as of January 1, 201X]

(Added 201X)

Re-number existing S.1.6.8. Lubricant Devices, Travel of Indicator to S.1.6.9., accordingly.

S.2.7. Wholesale-Devices Equipped with Automatic Temperature Compensators.

S.2.7.1. Automatic Temperature Compensation. – A device may be equipped with an automatic means for ~~adjusting conversion of~~ the indication and registration of the measured volume of product to the volume at 15 °C ~~for liters or~~ (60 °F) ~~for gallons.~~

S.2.7.2. Display of Temperature. – For test purposes, on a device equipped with active automatic temperature compensation, means shall be provided to indicate or record the temperature determined by the system sensor to an a resolution of no greater than 0.2 °F.

[Nonretroactive as of January 1, 201X]

S.2.7.23. Display of Net and Gross Quantity and Provision for Deactivating. – A device or system equipped with an active electronic automatic temperature-compensating mechanism shall indicate or record both the gross (uncompensated) and net (compensated) volume for testing purposes. On a device or system equipped with an mechanical automatic temperature-compensating mechanism that will indicate or record only in terms of ~~gallons~~ liters compensated to 15 °C or gallons compensated to (60 °F), provision shall be made for deactivating the automatic temperature-compensating mechanism so that the meter can indicate, ~~and record if it is equipped to~~ record, in terms of the uncompensated volume. **It is not necessary that both net and gross volume be displayed simultaneously on a device or system equipped with either mechanical or electronic temperature-compensating mechanisms.**

(Amended 1972 **and 201X**)

S.2.7.34. Provision for Sealing Automatic Temperature-Compensating Systems. – Provision shall be made for applying security seals in such a manner that an automatic temperature-compensating system cannot be disconnected and that no adjustment that detrimentally affects the metrological integrity of the device may be made to the system without breaking the seal or automatically providing a record (e.g., audit trail) of the action.

(Amended 201X)

S.2.7.4.1. Provision for Sealing the Temperature Sensor. – **Provision shall be made for applying security seals in such a manner that the temperature sensor cannot be removed or disabled without breaking the seal or providing a record (e.g., audit trail) of the action.**
[Nonretroactive as of January 1, 201X]

S.2.7.4.5. Temperature Determination with Automatic Temperature Compensation. – For test purposes, means shall be provided (e.g., thermometer well) to determine the temperature of the liquid either:

- (a) in the liquid chamber of the meter, or
 - (b) immediately adjacent to the meter in the meter inlet or discharge line.
- (Amended 1987)

S.4.3.2. Temperature Compensation. – If a device **or system** is equipped with **active** automatic temperature compensation, the primary indicating elements, recording elements, ~~or and~~ recorded representation shall be clearly and conspicuously marked to show that the volume delivered has been adjusted to the volume at 15 °C **for liters or (60 °F) for gallons.**
(Amended 201X)

Renumber existing paragraphs and subparagraphs S.4.3. Wholesale Devices, Discharge Rates and S.4.4. Retail Devices accordingly.

N.4.1.1. ~~Wholesale~~ Devices Equipped with Automatic Temperature-Compensating Systems. – On ~~wholesale~~ devices equipped with **active** automatic temperature-compensating systems, normal tests shall be conducted:

- (a) by comparing the **net (compensated)** volume indicated or recorded to the actual delivered volume ~~corrected-adjusted~~ to 15 °C **for liters or (60 °F) for gallons, and**
- (b) ~~with the temperature compensating system deactivated,~~ comparing the **gross (uncompensated)** volume indicated or recorded to the actual delivered volume. **(For some devices this may require that the temperature compensator be deactivated.)**

The first test shall be performed with the automatic temperature-compensating system operating in the “as found” condition. On devices that indicate or record both the compensated and uncompensated volume for each delivery, the tests in (a) and (b) may be performed as a single test.

(Amended 1987 **and 201X**)

N.5. Change in Product Temperature-Correction on Wholesale Devices. – ~~Corrections-Adjustments~~ shall be made for any changes in volume resulting from the differences in liquid temperatures between time of passage through the meter and time of volumetric determination in the prover **or test measure**. When adjustments are necessary, appropriate petroleum measurement tables ~~should~~ **shall** be used.

(Amended 1974 **and 201X**)

UR.3.6. Temperature Compensation, Wholesale.

UR.3.6.1. Automatic.

UR.3.6.1.1. ~~When to be Used of Automatic Temperature Compensation.~~ – If a device is equipped with a ~~mechanical active~~ automatic temperature ~~compensator compensation~~, it shall be connected, operable, and in use at all times. An electronic or mechanical automatic temperature-compensating system may not be removed, nor may a compensated device be replaced with an uncompensated device, without the written approval of the ~~responsible~~ weights and measures jurisdiction with statutory authority over the device.

[**Note:** This requirement does not specify the method of sale for product measured through a meter.]
(Amended 1989 and 201X)

OR

UR.3.6.1.1. ~~When to be Used of Automatic Temperature Compensation.~~ – If a device is equipped with a mechanical automatic temperature compensator, it shall be connected, operable, and in use at all times. Once used, An electronic or mechanical automatic temperature-compensating system may not be removed nor deactivated, nor may a compensated device be replaced with an uncompensated device, without the written approval of the ~~responsible~~ weights and measures jurisdiction with statutory authority over the device.

[**Note:** This requirement does not specify the method of sale for product measured through a meter.]
(Amended 1989 and 201X)

UR.3.6.1.2. Condition of Use. – At a business location which offers fuel products for retail sale on the basis of a temperature-compensated volume, all devices used for retail sales shall have active automatic temperature compensation and all fuel products offered for retail sale shall be dispensed on the basis of temperature-compensated volume.

UR.3.6.1.23. Recorded Representations (Invoices, Receipts, and Bills of Lading).

- (a) ~~An written~~ invoice based on a reading of a device or recorded representation issued by a device or system that is equipped with an active automatic temperature compensator shall show that the volume delivered has been adjusted to the volume at 15 °C for liters or (60 °F) for gallons and decimal subdivisions or fractional equivalents thereof.
- (b) The invoice issued from an electronic wholesale device equipped with an automatic temperature-compensating system shall also indicate:
 - (1) the API gravity, specific gravity or coefficient of expansion for the product;
 - (2) product temperature; and
 - (3) gross reading.

(Amended 1987 and 201X)

UR.3.6.1.4. Temperature Determination. – The means for determining the temperature of measured liquid in a device with an activated automatic temperature-compensating system shall be so located and designed that, in any “usual and customary” use of the system, the resulting indications and/or recorded representations are within applicable tolerances.

(Added 201X)

UR.3.6.4. Temperature-Compensated Sale. – All sales of products, when the quantity is determined by an approved measuring system with temperature compensation, shall be in terms of the liter at 15 °C or the U.S. gallon of 231 in³ at 60 °F.

(Added 201X)

Background/Discussion: Prior to the 2007 NCWM Interim Meeting, the Committee recognized, via reports from the regional L&R Committees and other sources, that there was increasing support within the weights and measures community to address temperature compensation features for the retail sale of petroleum products in the Liquid-Measuring Devices Code. In response to these concerns and to encourage uniformity in applications where temperature compensation is being used, the Committee developed a proposal to provide design, performance requirements, and testing criteria for retail metering systems that incorporate temperature compensation capability. The Committee was also concerned that if the current L&R Committee-proposed language for the Method of Sale of Commodities in NIST HB 130 is adopted, retail motor-fuel devices could be placed in service with no guidelines in NIST HB 44 for type approval and field testing. The language proposed by the L&R Committee at that time would permit the temperature-compensated sale of petroleum products at all levels of distribution.

At the 2007 Interim Meeting, the Committee considered moving the proposal forward as a priority Voting item. However, the Board instructed the Committee to retain the item as Informational and established a steering committee to provide the S&T and L&R Committees with guidance on temperature compensation issues.

As of the 2008 Interim Meeting, the Committee received comments from the WWMA supporting the use of 15.56 °C and presenting the item for a vote and from the CWMA supporting 15 °C and retaining the item as Informational. NEWMA proposed the inclusion of proving equations based on OIML R 120. The SWMA forwarded comments about the printing of a statement regarding the temperature-compensated values.

At the 2008 Interim Meeting, the Committee made some additional modifications to the proposal, including changing the reference to metric units to 15.56 °C based on the ATC Steering Committee recommendation. The Committee did not believe Handbook 44 was the appropriate place to add proving equations based on OIML R 120, noting that, if needed, these would be more appropriately addressed as an example in the EPOs. At that point, the Committee believed the proposal to be essentially complete and, after considerable deliberations and based on urging from officials who anticipated installation of ATC equipment in their jurisdictions, the Committee agreed to designate Item 310-1 as a Voting item on its agenda for the 2008 Annual Meeting.

In its spring 2008 meeting report, the CWMA S&T Committee stated that it heard comments that this item should not move forward for a vote at that time due to the lack of a method of sale regulation. The report also noted that some jurisdictions adopt NIST HB 44 in its entirety and do not have a law that prohibits ATC, and inclusion of ATC criteria in this case could make ATC permissible.

NEWMA reported discussing this item at length during its spring 2008 meeting. Initially it was suggested that this item go back to Informational status but an attendee suggested that it should either be withdrawn or put up for a vote. Another attendee suggested making this item Informational until the report on ATC from the California Energy Commission is released. NEWMA submitted the following concerns and recommended that the item remain Informational:

- A statement similar to the one in the Vehicle Tank Meter (VTM) code which addresses states that prohibit ATC by state law should appear in the text of this item.
- One member referenced the 1978 S&T Committee report which discussed a cost benefit consideration and the desire that the S&T and L&R move forward in unison. The NEWMA membership generally agreed with these points.
- NEWMA continues to believe that it is appropriate to place in HB 44 reference calculations for determining volume at 60 °F. It is also appropriate to reference the specific API tables including version and date. Placing this information in publications such as EPOs would have no legal standing if we were challenged in the future.

At the 2008 NCWM Annual Meeting, the Committee heard numerous comments on the proposed changes to include specifications, test procedures, and user requirements for devices equipped with automatic temperature compensation systems.

Comments/questions were raised about specific items in the proposed language, including:

- The term “active” is not used consistently in all references to “automatic temperature compensation.” For example, it appears in paragraph S.2.7.2., but it does not appear in paragraph S.1.6.8.
- There is a reference to the accuracy requirements for the temperature sensor in paragraph S.2.7.3.; however, there is not a requirement specifying the division size of the temperature sensor.
- Should a corresponding reference to the accuracy requirements for the temperature sensor be included in the “Tolerances” section of the code?
- Is there an expectation that there will be a field test of the temperature sensor? If so, there is not a corresponding test note to indicate this, nor is it clear how the test will be done in the field.
- A user requirement is needed to specify that, if a single business offers product for sale on the basis of a temperature-compensated volume, all devices in that business shall be equipped with automatic temperature-compensating systems. [**Note:** During the Committee’s work discussions, it was noted that Canada permitted a phase-in period based on product or product grades.]
- There is concern about using 15.56 °C rather than 15 °C. In addition to being different from use in international arenas, including Canada, the bulk of the devices in the field, including the retail motor fuel dispensers and the temperature standards used by field officials, do not have the capability to display temperature to two decimal places.
- Devices currently in the field may not have the capability to automatically sense when the device is or is not in the automatic temperature-compensating mode with respect to the requirement to identify volumes as “corrected” volumes on printed indications.
- Although a corresponding paragraph already appears in Section 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices Code, the language in paragraph UR.3.6.1.3. needs clarification.

The Committee asked that the NCWM Automatic Temperature Compensation Steering Committee assist in addressing these issues and encourages interested parties to submit comments to the Steering Committee or provide additional comments to the S&T Committee.

The Committee heard numerous comments encouraging the Committee to delay a vote on this issue while the corresponding method of sale and related requirements are being further developed by the L&R Committee and while other studies in the community are being completed. Comments were also received that cost-benefit analysis of equipment implementation needs to be considered.

Although the Committee did hear opposition to moving forward on this item, the Committee also heard comments in support of moving the item forward for a vote. Some members commented that, if this proposal were adopted, the proposed specifications, tolerances, notes, and user requirements would be available for use in a timelier manner by jurisdictions that do not specifically prohibit the use of temperature compensation. This would encourage uniformity in the implementation of such requirements among those jurisdictions and prevent inconsistencies for consumers doing business in various jurisdictions.

Based on the many suggestions that it heard between the 2008 Interim and Annual Meetings to allow time for additional study and development of the related method of sale requirements, the Committee decided to change the status of this item from Voting to Informational at the 2008 Annual Meeting.

During the 2008 WWMA Annual Technical Conference an update on the California Energy Commission (CEC) cost benefit analysis was given. The WWMA was told that the study is being delayed due to difficulty in obtaining device information. The CEC report to the California legislature, due December 2008, was granted an extension until February 2009, after the NCWM Interim Meeting. Several industry members and weights and measures officials stated that the S&T and L&R Committees needed to work in concert; therefore, this item should remain Informational until the CEC and GAO reports are completed.

One jurisdiction stated during the WWMA meeting that they would like to see technically sound language in HB 44 in the event that temperature-compensated devices are installed and activated. No jurisdictions reported ATC devices in operation at this time. However, one jurisdiction stated that California type approved devices have been installed but the ATC feature has not been activated. Another jurisdiction stated that a company informed them they were considering ATC but would not take action until after the NCWM had made their decision on the L&R and S&T proposals. For these reasons, the WWMA agreed this item should remain Informational.

At its 2008 Interim Meeting, the CWMA took the position that having guidelines in Handbook 44 does have a value in the event that a model law is passed. However, the CWMA believes that until a model law is passed, the guidelines cannot be fully drafted for this item. Therefore, the CWMA recommends this item be a Developing item.

At its 2008 Interim Meeting, NEWMA discussed the following points related to this item:

1. waiting for GAO and California study;
2. financial impact to consumer and retail station owners;
3. extra time for testing and cost of additional equipment;
4. several problems with language of item (e.g., 15.56 °C vs. 15 °C, gravity to be used?);
5. connection to L&R item; and
6. possible perpetuation of fraud.

NEWMA recommends this item be made Developing.

The SWMA heard comments during the open hearings at its 2008 Annual Meeting that the item should remain Informational to allow time for additional information to be gathered. The SWMA also heard that there may be additional information provided from the California Energy Commission study (due to be completed in February 2009, with a possible draft available in December 2008) and the GAO study (due to be completed in the fall of 2008). With regard to the proposed changes to the LMD Code, the SWMA heard suggestions that the requirements for indicating temperature-compensated deliveries be examined to ensure that existing equipment can meet the requirements, particularly with regard to the service station consoles. The SWMA also heard a suggestion that action on the proposed changes to the LMD Code be held off until the NCWM L&R Committee completes its deliberations on the method of sale issue. The SWMA noted the NCWM S&T Committee raised a number of questions during its deliberations in July and asks that, in addition to the NCWM ATC Steering Committee, people provide input to assist the national S&T Committee in its deliberations on this issue. Because of the comments received and the number of outstanding issues, the SWMA decided to maintain this item as Informational on its agenda.

The Committee received copies of the GAO study (available on the GAO website at www.gao.gov) as well as a draft of the California Energy Commission study. (**Technical Advisor's Note:** A final version of this report is now available from the CEC at www.energy.ca.gov.)

The Committee received comments from several members of the ATC Steering Committee in response to the questions it raised in July. A copy of these comments is included in Appendix B of the Committee's Interim Report.

Based on input from these Steering Committee members and the regional weights and measures associations, comments received at the 2009 Interim Meeting, and the Committee's deliberations at the 2009 Interim, the Committee addressed the points it raised in its 2008 Final Report as follows:

- **The reference to the word “active.”** The Committee reviewed the paragraphs and inserted the word as appropriate. The Committee noted that the original intent of paragraph UR.3.6.1.1. was that mechanical compensators should be activated and in use at all times.
- **Division size of temperature sensor.** The Committee changed the reference to “resolution” rather than accuracy. (See S.2.7.3. below.)
- **Should there be a corresponding reference to the accuracy requirements for the temperature sensor in the Tolerances section?** The Committee changed the reference to “resolution” rather than accuracy. (See S.2.7.3. below.)
- **Should inspector test accuracy of temperature sensor?** There is no intention for an inspector to test the temperature sensor in the field. The proposed requirements will be patterned after other NIST Handbook 44 code references in which the results of gross and net test drafts are compared against a specified tolerance.
- **A User Requirement is needed to specify that, if a single business offers products for sale on the basis of a temperature-compensated volume, all devices in that business shall be equipped with active automatic temperature compensation systems.** The Committee agreed that a similar paragraph to that being considered in agenda Item 331-2 should be included in the LMD Code. The proposed paragraph is included as UR.3.6.1.2. as outlined in the recommendation above.
- **Reference to 15.56 °C.** The Committee agreed to change the reference to 15 °C.
- **Ability to sense when a device is in the ATC mode.** The Committee heard mixed opinions on this issue, with some manufacturers and officials commenting that equipment should be able to automatically detect when in the ATC mode and print and display accordingly and some officials stating that equipment should not be required to automatically detect this. The Committee also noted that a longer lead time could be given on the non-retroactive status of the requirement. The Committee is interested in comments on how this point should be addressed.
- **UR.3.6.1.3. needs clarification.** The Committee made some changes to the language to improve the clarity of the paragraph, including clarifying that this requirement applies to systems with activated ATC.

At the 2009 NCWM Interim Meeting, the Committee heard a number of suggestions for changes to specific portions of the recommendation and addressed these comments in its recommendation as follows:

- **S.1.6.8. Recorded Representations from Devices with Temperature Compensation**
 - **Question/Comment:** Depending upon method of sale requirements adopted in a given jurisdiction, devices equipped with electronic temperature compensation systems may not be required to have the ATC feature activated. Shouldn't the provision of S.1.6.8. only apply to systems with activated ATC?
 - **Conclusion:** The Committee agrees and added the word “activated” to clarify that the paragraph only applies to systems with the feature activated.
- **S.2.6. Temperature Determination**
 - **Question/Comment:** Should the term wholesale be deleted? If so, this will require a thermometer well even on non-ATC RMFDs.
 - **Conclusion:** The Committee agreed that the intent was not to require the installation of thermometer wells on existing RMFDs that are not equipped with ATC. Since S.2.7. includes provisions for a

thermometer well or other means for determining the temperature at the meter on liquid-measuring devices equipped with ATCs, the Committee deleted the proposed change to S.2.6. and has eliminated the proposed change from the recommendation above.

- **S.7.2. Display of Net and Gross Quantity and S.2.7.4. Display and Provision to Deactivate**

- **Question/Comment:** Is it necessary to have both paragraphs S.7.2. and S.2.7.4. as shown in the Publication 15 proposal? Could these paragraphs be combined?
- **Conclusion:** The Committee agreed that the paragraphs can be combined, noting that the language needs to reflect the differences between provisions for mechanical and electronic ATC mechanisms. The proposed paragraph numbered S.2.7.2. in the Committee's Interim agenda has been deleted and its provisions incorporated into the existing S.2.7.2. In making these revisions, the Committee also noted that existing User Requirement paragraph UR.3.6.1.1. requires a mechanical compensator to be activated and in use at all times.

- **S.2.7.3. Display of Temperature**

- **Question/Comment:** Is this paragraph intended to specify a tolerance for the temperature sensor? If so, will this be a field test?
- **Conclusion:** Based on guidance provided by the ATC Steering Committee, the Committee agreed to change "accuracy" to "a resolution of no greater than" in proposed paragraph S.2.7.2. (shown as S.2.7.3. in the Committee's Interim agenda). The Committee also agreed that the intent was not to test the accuracy of the system's temperature sensor in the field. The approach for testing devices with ATCs will continue to be a comparison between compensated and non-compensated test drafts.

- **UR.3.6.1.1. Use of Automatic Temperature Compensation**

- **Question/Comment:** Should the words "once used" be inserted prior to "it shall be connected" to clarify that some systems may be equipped with the feature, but the feature may not be activated.
- **Conclusion:** The Committee notes that the intent of the original User Requirement paragraph UR.3.6.1.1. was that mechanical compensators should be activated and in use at all times.

- **References to 15.56 °C:**

- The Committee changed all references to 15 °C to correspond with the proposals on the L&R Committee's agenda for method of sale. The Committee acknowledged that 15.56 °C is an exact conversion for 60 °F. However, the Committee agreed that 15 °C is more appropriate since this is the value used internationally and in light of comments from industry questioning whether or not existing equipment can display values to two decimal places.

- **The Committee also made the following editorial corrections/changes based on comments received:**

- **UR.3.6. Temperature Compensation.** – The word "wholesale" should appear at the end of the title as struck since it is currently in the code.
- **S.4.3. Temperature Compensation.** – The word "active" should not be in italics.

The Committee discussed whether or not this item is ready to move forward for a vote at the 2009 Annual Meeting. The Committee recognizes the need for standards to be in place to encourage uniform evaluation of RMFDs equipped with ATC, and acknowledges that some jurisdictions are already facing the imminent possibility of such equipment in their jurisdictions. While the Committee believes that these standards are necessary whether or not the issue of a model method sale regulation has been resolved, based on the number of comments received on the proposed changes to the LMD code, the Committee believes that the item should be retained as an Informational item until the changes outlined above have been studied by interested stakeholders. The Committee also acknowledged that the General Code paragraph G-A.3. Special and Unclassified Equipment coupled with relevant provisions in existing code paragraphs can be used by jurisdictions to address equipment with ATC features in the

meantime. The Committee also does not believe that delaying the revisions to the LMD code should delay a decision on the method of sale item before the L&R Committee.

(See also the Committee's 2007 and 2008 Final Reports for additional background information on this issue.)

330-2 V N.4.6. Pour and Drain Times for Hand-held Test Measures

Source: 2008 Carryover Item 330-2. This item originated from the CWMA and first appeared on the Committee's 2008 agenda. See also note in Background/Discussion section below regarding the origin of this item.

Recommendation: The Committee is considering a proposal to add a new paragraph N.4.4. Field Standards to address the selection and use of field standards for inspecting and testing liquid-measuring devices covered under the Liquid-Measuring Devices Code.

N.4.4. Pour and Drain Times.

N.4.4.1. Pour and Drain Times for Hand-held Test Measures. – Hand-held test measures require a 30-second (\pm 5 seconds) pour followed by a 10-second drain, with the measure held at a 10-degree to 15-degree angle from vertical during use.

N.4.4.2. Drain Times for Bottom Drain Test Measures or Provers. – Bottom drain field standard provers require a 30-second drain time after main flow cessation.

(Added 2009)

Background/Discussion: Following deliberations at the 2008 NCWM Interim Meeting, Item 330-2 was deleted from the Committee's agenda and the issue addressed under new Item 310-4 as a proposal to add a paragraph to the General Code to designate general requirements for all field standards. At the 2008 NCWM Annual Meeting, the Committee decided (as a result of comments received following the Interim Meeting) to reinstate Item 330-2 (which proposes an addition to the Liquid-Measuring Devices Code to specify pour and drain times for measuring device test standards) as an Informational item based upon the rationale described below. Note that the Committee retained Item 310-4 and presented that item as a Voting item at the Annual Meeting, but that item did not receive sufficient votes either in support or opposition for further action, so the item was returned to the Committee. See Item 310-4 for the Committee's original recommendation and background information and the outcome of that discussion.

The Committee received comments from the CWMA and heard comments during the 2008 NCWM Annual Meeting open hearing that specific hand-held test measure use requirements are still needed in the LMD Code for weights and measures officials and service agents. The Committee also heard comments that key elements for the use of test measures and provers should be included in the Notes section of the LMD Code. In response to the comments, the Committee expanded the proposal to include drain requirements for bottom drain provers and test measures.

The Committee agreed to amend the original proposal to cite the specific document in addition to the test measure use requirements to read as shown in the recommendation above.

At its 2008 Annual Technical Conference, the WWMA supported this companion item to 310-4 and recommended it be a Voting item. To be consistent with other codes in HB 44 and to make the information more prominent, the WWMA believes the item deserves its own paragraph and supports it as a Voting item.

N.6. Field Standards. – Field standards shall be certified to meet the accuracy requirements of NIST Handbook 105-3, Specifications and Tolerances for Graduated Neck-Type Volumetric Field Standards (or other suitable and designated standards) or the accuracy requirements expressed in Fundamental Considerations, paragraph 3.2. (i.e., one-third of the smallest tolerance applied).

N.6.1. Pour and Drain Times for Hand-held Test Measures. – Hand-held test measures require a 30-second (\pm 5 seconds) pour followed by a 10-second drain, with the measure held at a 10-degree to 15-degree angle from vertical during use.

N.6.2. Drain Times for Bottom Drain Test Measures or Provers. – Bottom drain field standard provers require a 30-second drain time after main flow cessation.

(Added 200X)

At its 2008 Interim Meeting, the CWMA recommended this item move forward as a Voting item.

At its 2008 Interim Meeting, NEWMA heard discussion that this item is more suitable for EPOs. Therefore, NEWMA recommends this item be Withdrawn.

The SWMA received no comments on this item during the open hearings at its 2008 Annual Meeting. During its work sessions, the SWMA S&T Committee was unable to reach a consensus on this item. Some Committee members questioned the need for the proposal at all given the current references in the Fundamental Considerations and the corresponding proposal to include a reference in the General Code. One Committee member questioned whether or not the 30-second drain time for the bottom drain provers was necessary and questioned if any study of the time was being done by any metrology labs. One Committee member supported the proposal as written. Some Committee members commented that having something specific regarding pour and drain times would be helpful in getting service technicians as well as weights and measures officials to use the proper procedures, whereas other Committee members acknowledged that even specifying such procedures would not produce a change in the actual practices in the field.

Because of the range of positions among its members, the SWMA S&T Committee did not believe it would reach a consensus on the item. Rather than holding the item up for those who felt the proposal had benefit, the Committee decided to forward the item to the NCWM S&T Committee with a recommendation that it be made a Voting item.

At the 2009 NCWM Interim Meeting, the Committee heard additional support regarding the need for a reference in the LMD Code in addition to any reference in the General Code. Judy Cardin, Wisconsin Weights and Measures, reported that service companies are not able to work with the Fundamental considerations and they are finding many different drain times and procedures in use. Steve Malone, Nebraska Weights and Measures, encouraged the Committee to make the references to the NIST Handbook 105 series identical to that used in the Scales and other codes.

Based on comments received and its deliberations during the Interim Meeting, the Committee agreed that the general references to the NIST Handbook 105 series are adequately addressed in the proposed language in corresponding General Code Item 310-4. The Committee also agreed to modify this text by extracting references from existing language in the Fundamental Considerations rather than modifying the original proposed N.4.4. Consequently, the Committee deleted the reference in the LMD code and retained only the references to pour and drain time as shown in the recommendation above. With these changes, the Committee believes that the remaining proposed paragraphs are most appropriately placed as a subparagraph under N.4. Testing Procedures.

The Committee agreed to recommend this item for a Vote at the 2009 Annual Meeting.

330-3 I Price Posting and Computing Capability and Requirements for a Retail Motor-Fuel Dispenser (RMFD)

Source: 2008 Carryover Item 330-3. This item originated from WMD and the regional associations and first appeared on the Committee's 2007 agenda. This item was previously a Developing item under 360-2, Part 3, Item 2.

Recommendation: The Committee is considering a proposal to make the following modifications to Section 3.30. Liquid-Measuring Devices (LMD) Code to address price posting and computing capability for retail motor-fuel dispensers as follows:

S.1.6.4. Display of Unit Price and Product Identity.**S.1.6.4.1. Unit Price.**

- (a) 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.
- (b) *Whenever a grade, brand, blend, or mixture is offered for sale from a device at more than one unit price, then all of the unit prices at which that product is offered for sale shall be displayed or shall be capable of being displayed on the dispenser using controls available to the customer prior to the delivery of the product. It is not necessary that all of the unit prices for all grades, brands, blends, or mixtures be simultaneously displayed prior to the delivery of the product. This subsection shall not apply to fleet sales, other contract sales, ~~or~~ truck refueling sales, or all purchases of fuel accompanied by an automatically printed receipt of the transaction containing the discount unit price, the total gallons delivered, and total price of the sale.*

[Effective and nonretroactive as of January 1, 1991]

(Amended 1989, ~~and~~ 1997, and 201X)

S.1.6.5.4. Selection of Unit Price. – Except for dispensers used exclusively for fleet sales, other price contract sales, ~~and~~ truck refueling (e.g., truck stop dispensers used only to refuel trucks), and purchases where an automatic printed receipt of the transaction containing the discount unit price, the total gallons delivered, and total price of the sale, when a product or grade 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 product.

[Nonretroactive as of January 1, 1991]

(Added 1989) (Amended 1991, 1992, 1993, ~~and~~ 1996, and 201X)

S.1.6.7. Recorded Representations. – Except for fleet sales and other price contract sales, a printed receipt providing the following information shall be available through a built-in or separate recording element for all transactions conducted with point-of-sale systems or devices activated by debit cards, credit cards, and/or cash:

- (a) the total volume of the delivery,
- (b) the unit price,
- (c) the total computed price, and
- (d) the product identity by name, symbol, abbreviation, or code number.

[Nonretroactive as of January 1, 1986]

(Added 1985) (Amended 1997)

UR.3. Use of Device.**UR.3.2. Unit Price and Product Identity.**

- (a) The following information shall be conspicuously displayed or posted on the face of a retail dispenser used in direct sale:
- (1) except for dispensers used exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks), all of the unit prices at which the product is offered for sale; and
 - (2) in the case of a computing type or money-operated type, the unit price at which the dispenser is set to compute.

Provided that the dispenser complies with S.1.6.4.1. Display of Unit Price, it is not necessary that all the unit prices for all grades, brands, blends, or mixtures be simultaneously displayed or posted.

(b) The following information shall be conspicuously displayed or posted on each side of a retail dispenser used in direct sale:

(1) the identity of the product in descriptive commercial terms, and

(2) the identity of the grade, brand, blend, or mixture that a multi-product dispenser is set to deliver.

(Amended 1972, 1983, 1987, 1989, 1992, and 1993)

UR.3.3. Computing Device. – Any computing device used in an application where a product or grade is offered for sale at one or more unit prices shall be used only for sales for which the device computes and displays the sales price for the selected transaction.

(Added 1989) (Amended 1992)

The following exceptions apply:

(a) Fleet sales and other price contract sales are exempt from this requirement.

(b) A truck stop dispenser used exclusively for refueling trucks is exempt from this requirement provided that:

(1) all purchases of fuel are accompanied by a printed receipt of the transaction containing the applicable price per gallon, the total gallons delivered, and the total price of the sale; and

(Added 1993)

(2) unless a dispenser complies with S.1.6.4.1. Display of Unit Price, the price posted on the dispenser and the price at which the dispenser is set to compute shall be the highest price for any transaction which may be conducted.

(Added 1993)

(c) All purchases of fuel accompanied by an automatically printed receipt of the transaction containing the discount unit price, the total gallons delivered, and total price of the sale.

(Added 201X)

UR.3.4. Printed ~~Ticket~~ Receipt. – **Except for purchases conducted under UR.3.3(c) (*see note below),** ~~the~~ **total price, the total volume of the delivery, and the price per unit liter or gallon shall be shown, on a receipt by either being automatically printed or printed in clear hand script, on any printed ticket issued by a device and containing any one of these values.**

***Note: Purchases conducted under UR.3.3(c) shall only be automatically printed, containing at minimum the total price, the total volume of the delivery, and the discount price per unit.**

(Amended 2001 **and 201X**)

Background/Discussion: In the early 1990s, various sections of the Liquid-Measuring Devices Code in HB 44 (including paragraphs S.1.6.4. Display of Unit Price and Product Identity, S.1.6.5.4. Selection of Unit Price, UR.3.2. Unit Price and Product Identity, and UR.3.3. Computing Device) were modified to address multi-tier pricing applications such as cash or credit. Since that time, marketing practices have evolved to include the addition of new practices such as frequent shopper discounts and club member discounts. Numerous questions have been posed to WMD regarding the requirements for posting unit prices, calculation of total price, customer-operated controls, and other related topics such as the definitions for associated terminology.

It is clear from these questions that changes are needed to HB 44 to ensure the requirements adequately address current marketplace conditions and practices. WMD has raised this issue with the Committee and has also discussed a variety of pricing practices with individual state and local weights and measures jurisdictions.

The WMD reviewed the existing requirements and their application to current market practices and collected information on a number of scenarios, including the following:

- | | |
|--|--|
| (1) Frequent shopper discounts | (8) Full service |
| (2) Club member discounts | (9) Self service |
| (3) Discount for prepaying cash (to prevent “drive-offs”) | (10) Progressive discounts based on volume of motor-fuel purchased |
| (4) Prepay at the cashier for credit sales | (11) Coupons for discounts on immediate or future purchases |
| (5) Discounts for purchasing store products | (12) Rebates (e.g., use of oil company credit card) |
| (6) Discounts for purchasing a service (e.g., carwash) | (13) Day-of-the-week discounts |
| (7) Targeted group discounts (e.g., Tuesday – ladies 5 cents off per gallon) | |

Note: The conditions under some of these scenarios may not typically fall under the authority of weights and measures jurisdictions.

The WMD expressed an interest in receiving input from the weights and measures community about the various practices and pricing structures in use, and indicated it welcomed opportunities to discuss this item at regional weights and measures associations to ensure the item is adequately addressed.

The WWMA acknowledged that marketing practices change on a daily basis and the task to ensure HB 44 codes address each scenario is monumental. However, the WWMA encouraged NIST in its efforts to tackle this ongoing issue. Therefore, the WWMA recommended this item be considered and move forward to the national level as a Developing item as did the SWMA and NEWMA.

At its 2007 Annual Meeting the SWMA was informed that the National Association of Convenience Stores recognized a problem with the current price posting and computing capability requirements in HB 44 and was currently working on information on this item to provide to the NCWM S&T Committee.

At the 2008 Interim Meeting, Ohio Weights and Measures submitted a proposal to the Committee that included specific language for modifying Section 3.30. to address the various pricing and marketing structures being used in retail motor-fuel applications. Based on its review of that proposal, the fact that a specific proposal has now been developed and presented, and the number of jurisdictions reporting a need to move forward with this item, the Committee decided to elevate the status of this item from Developing to Informational. Consequently, the Committee is considering the specific language submitted by Ohio and encourages the weights and measures community to review the proposal and submit comments on this item.

At its spring 2008 meeting, the CWMA S&T Committee reported hearing comments that current language does not meet the needs of what is actually happening in the marketplace. Currently, there are economic issues dealing with fair competition, and there are numerous marketing techniques that the language in NIST HB 44 cannot address. The CWMA S&T Committee believes the item as proposed is a good start on addressing this issue, but it does not entirely provide adequate language to aid in enforcement. The CWMA S&T recommended that a WG be formed to further evaluate this item. Some examples of the panel discussion were, but not limited to:

1. discounts calculated at the pump and other at the counter,
2. level of consumer responsibility,
3. can the dispensers do tier pricing,
4. competitors complaining about non-uniformity of enforcement,
5. discounts should be done electronically, and
6. all is okay as long as the receipt explains the transaction.

NEWMA's spring 2008 meeting report stated that this is a very important item and NEWMA supports continued work on it as an Informational item. One member suggested that at the next NEWMA Interim Meeting a WG spend some time coming up with suggestions for this item.

At the 2008 Annual Meeting, the Committee heard comments on the proposed changes to the Liquid-Measuring Devices Code. Several weights and measures officials expressed concern about the provision in the proposed language that would allow discounts to be calculated at the console after the customer has dispensed product. These officials felt that devices should be able to compute the total sales price at the unit price at which the product is offered for sale. Several industry members expressed support of the proposed language. One member stated that it is important for retailers with mechanical dispensers to be able to offer their customers a cash discount.

Current NIST Handbook 44 requirements state that the selection of the unit price must be made by the customer using controls on the device or other customer-activated controls. One industry member questioned whether making arrangements for a given method of payment at the console might be considered as satisfying that requirement since the customer is initiating the sale and the conditions of payment prior to the transaction. Weights and measures officials acknowledged the comment, but emphasized the need for the customer to retain control over the selection of the price, preferably by making a selection at the dispenser or using customer controls.

The Committee expressed appreciation for the work that had been done thus far, acknowledging that additional work is needed on this item and noted that a WG is being formed to develop this item. The Committee looks forward to receiving input and suggestions from the WG and encourages interested parties to participate in the WG and/or forward comments to the Committee.

A meeting was held on July 15, 2008, (in conjunction with the NCWM Annual Meeting) of individuals interested in the issue of pricing requirements for retail motor-fuel dispensers. Participants in the meeting included weights and measures officials, gasoline pump manufacturers, and other interested parties. The purpose of the meeting was to establish an informal WG to review the issue of price posting and computing capability for retail motor-fuel dispensers. The WG will focus on the development of proposed changes to NIST Handbook 44 necessary to provide flexibility to marketers while ensuring that the buyer and seller have adequate information about all aspects of the transaction with respect to the pricing and method of payment. The CWMA had suggested the formation of this small WG to study this issue with the idea that the issue could be more thoroughly developed than could be done in the limited time available during the NCWM Interim and Annual Meetings. Note that this work does not replace the discussion of this issue at the NCWM Interim and Annual Meetings, but rather is intended to supplement the work and provide the S&T Committee with some proposals to consider.

Participants at that meeting were asked to indicate their interest in the work as either "work group participants" (expected to regularly participate and contribute to the work) or "observers" (will be kept abreast of WG activities, including meeting agendas and summaries). Because there is no budget to support the cost of regular face-to-face meetings, the WG will attempt to accomplish its objectives through e-mail and other electronic communication. Anyone interested in the details of this work should contact Tina Butcher (NIST WMD) by e-mail at tbutcher@nist.gov or by telephone at (301) 975-2196.

During the open hearings at its 2008 Annual Technical Conference, the WWMA received comments that the Committee wait until a national WG is established to develop this item further. The WWMA agreed that the item should be Informational.

During its 2008 Interim Meeting, the CWMA heard the following comments during discussions of this item:

- Lighten the rules of dispensing so consumer can see the actual sale – transparency in the marketplace
- Not enough room on marquee or on pump for posting all prices
- What will appear on customer receipt or final receipt

The CWMA agrees that the item should be Informational until more information is obtained from the national work group.

At its 2008 Interim Meeting, NEWMA supported work on this item and looks forward to information from the WG.

At its 2008 Annual Meeting, the SWMA acknowledged the need to review and revise the requirements in the Liquid-Measuring Devices Code regarding price posting and computing capability. However, the SWMA does not support the proposed language as written. The SWMA heard comments in opposition to the proposed changes to the LMD Code. The SWMA S&T Committee noted that it is important for consumers to have full information about the purchase price of the product before they dispense the fuel and to be able to follow all aspects of the transaction. Also, the Committee is concerned that the proposed language does not provide for this.

The SWMA heard from Tina Butcher, NIST, that a WG has been established to study this issue. The group met in conjunction with the NCWM Annual Meeting in July, and anyone interested in participating in the work should contact Tina. The SWMA supports the continued efforts of the WG and encourages interested parties to provide comments to the WG. Because of the ongoing efforts to develop this item, the SWMA agrees that this item should remain an Informational item and encourages people to study the proposal that has been presented thus far.

At the 2009 NCWM Interim Meeting, the Committee heard from Tina Butcher, NIST WMD, who indicated that, due to staff shortages, she has not been able to devote time to work on this issue further. Several NCWM members offered help in continuing the work, including John Eichberger, National Association of Convenience Stores, who indicated he could coordinate assistance from some of the association's interested members.

The Committee also heard some specific comments on the proposed language from Will Wotthlie, Maryland Weights and Measures, who noted that, should the Committee proceed with its consideration of the proposed changes in the recommendation; the following issues should be addressed:

- Paragraphs S.1.6.4.1.(a); UR.3.2.(a)(1); UR.3.2.(b)(1) and (2) are already in the handbook and should not be underlined. (**Technical Advisor's Note:** These corrections have been made in the report.)
- Where did the printed receipt referenced in S.1.6.4.1.(b) and in UR.3.3.(c) originate?
- Could the references to "computing or money-operated devices" currently found in paragraph S.1.6.4.1. be carried over into paragraph UR.3.3. in the lead statement: "Any computing or money-operated device...?"
- In the proposed changes to UR.3.4., should the reference to "printed" in the phrase "or printed in clear hand script" be "written" instead?
- Does the note under UR.3.4. Printed Ticket infer that all computing devices will be required to have a printer?

The Committee believes that additional work is required on this proposal before it is ready to move forward for a Vote and the Committee supports continued work by the WG. The Committee agreed to maintain this item as an Informational item.

330-4 W T.5. Predominance – Retail Motor-Fuel Devices

Source: Central Weights and Measures Association (CWMA). This item appeared on the Committee's 2008 agenda as Developing Item Part 4, Item 1.

Recommendation: The CWMA recommends the following new proposal developed by the Nebraska Weights and Measures Division to add a new paragraph T.5. to HB 44 Section 3.30. as follows:

T.5. Predominance - Retail Motor-Fuel Devices. – The retail motor-fuel devices in service at a single place of business shall be considered maintained in proper operating condition when evaluation of normal test results indicate the following parameters are met:

- (a) **The number of meters with minus test errors in excess of one-half maintenance tolerance shall be less than 60 % of the meters at the location, and**
- (b) **When there are three or more meters of a single grade or type of fuel, the average error of the meters shall not be a minus value exceeding one-half maintenance tolerance. Meter test results**

that exceed maintenance tolerance shall not be included in determining the average meter error of a single grade or type of fuel.

(Added 200X)

Background/Discussion: In 1991 this same topic was brought before the NCWM as an Informational item. The intent of the proposal at that time was to provide guidance to states in the interpretation of General Code paragraph G-UR.4.1. Maintenance of Equipment. In 1993 the State of Wisconsin adopted a policy that defined “predominance” as shown in the proposal. That policy was similar to the one proposed in 1991, except Wisconsin felt that one-third acceptance tolerance was too stringent because there was a need to take into account normal variability in testing procedures, equipment, and environmental conditions found in the field. Wisconsin, therefore, adopted a “greater than one-third” maintenance tolerance guideline. In 2003 the Wisconsin policy was further refined by deleting the language “all devices are found to be in error in a direction favorable to the device user.” The new guideline for permissible errors was “60 % or more of the devices are found to be in error in favor of the device owner/user by more than one-third of the maintenance tolerance.” Both of these criteria were seldom used in the field because they made the policy confusing.

Just prior to 2005, NIST conducted a national survey of retail motor-fuel dispenser testing, and the results pointed to a need to gain more uniformity in the application of tolerances. The CWMA noted there is a wide variation in how different states handle the “predominance” question. Strides should be continually made to gain uniformity. Adoption of the proposed new paragraph G-UR.4.1.1. would be one step toward gaining greater uniformity. With more than five years of history using the proposed criteria, Wisconsin saw a relatively low number of devices rejected on the basis of “predominance,” and most station owners and all service companies have a working understanding of predominance.

In 2005 the CWMA agreed to submit the modified proposal to the NCWM S&T Committee with a recommendation that it be placed on the Committee’s agenda as a Developing item.

At their fall 2006 meetings, NEWMA, the SWMA, and the WWMA considered an earlier CWMA proposal to modify a General Code requirement and set limits on how to determine predominance in favor of the device operator. NEWMA believed the item was addressed adequately in HB 44 and recommended it be withdrawn from the NCWM S&T Committee’s 2007 agenda. The SWMA recommended this item remain Developing as a user requirement in the General Code. The SWMA encouraged the jurisdictions to review the proposed policy and try it out. The WWMA considered the limits in the proposal too stringent given the effects of temperature and other uncertainties. The WWMA was concerned dispensers would be set to the limits in the proposal rather than as close as practical to zero error. Since the current General Code adequately addresses predominance, jurisdictions may establish policy to gain uniformity in determining predominance. Consequently, the WWMA recommended this proposal be withdrawn from the agenda.

At the 2007 NCWM Interim Meeting, the Committee considered proposals to withdraw this item from its agenda. However, because a jurisdiction involved in developing the current proposal indicated their intention to provide the Committee with considerable data and continue further development of the item, the Committee agreed to keep the item on its agenda as a Developing item through 2007.

At its 2007 Annual Meeting, the WWMA heard comments from state and local jurisdictions stating they have been able to enforce G-UR.4.3. Predominance through administrative policies and rules.

The WWMA believed that:

- existing language in NIST Handbook 44 was sufficient,
- the definition of predominance is anything over 50 %,
- a potential conflict exists with paragraph G-UR.4.3. Use of Adjustments,
- the CWMA proposal addressed only retail motor-fuel devices and a review should also be considered for other weighing and measuring devices, e.g., point-of-sale scales and vapor meters,
- the proposed language did not take into account devices that were clearly out of tolerance, and
- the proposed language did not take into account the uncertainty of the test equipment, reading errors, and temperature changes between device calibration and official test.

The WWMA recommended the CWMA proposal to add paragraph T.5. Predominance to Section 3.30. be withdrawn. The WWMA further recommended the following alternate proposal to address some of the WWMA concerns listed above:

G-UR.4.1. Maintenance of Equipment. – All weighing and measuring equipment in service and all mechanisms and devices attached thereto or used in connection therewith shall be continuously maintained in proper operating condition throughout the period of such service. Equipment in service, by group or entirety, at a single place of business found to be in error predominantly in a direction favorable to the device owner or user shall not be considered “maintained in a proper operating condition.”

(Amended 1973, ~~and~~ 1991, and 200X)

For measuring devices, the term “predominantly” applies to any single product, grade, service level, or payment method, with errors in favor of the device owner or user.

(Added 200X)

At its 2007 Interim Meeting, the CWMA heard comments in favor of this item and from state and local jurisdictions that they have been able to enforce G-UR.4.3. Predominance through administrative policies and rules. However, there was some concern that the proposed tolerance was not stringent enough and allowed meters to be set at acceptance tolerance values. By adding part (c), the concern of misuse of tolerance was adequately addressed.

The CWMA supported the following language as proposed.

T.5. Predominance - Retail Motor-Fuel Devices. – **The retail motor-fuel devices in service at a single place of business shall be considered maintained in proper operating condition when evaluation of normal test results indicate the following parameters are met:**

- (a) **The number of meters with minus test errors in excess of one-half maintenance tolerance shall be less than 60 % of the meters at the location, and**
- (b) **When there are three or more meters of a single grade or type of fuel, the average error of the meters shall not be a minus value exceeding one-half maintenance tolerance. Meter test results that exceed maintenance tolerance shall not be included in determining the average meter error of a single grade or type of fuel.**
- (c) **Upon initial verification or re-inspection of devices rejected for predominance, the criteria for acceptance using paragraphs (a) and (b) shall be based on minus errors greater than 2 in³ rather than 3 in³.**

(Added 200X)

G-UR.4.1. Maintenance of Equipment. – All weighing and measuring equipment in service and all mechanisms and devices attached thereto or used in connection therewith shall be continuously maintained in proper operating condition throughout the period of such service. Equipment in service, by group or entirety, at a single place of business found to be in error predominantly in a direction favorable to the device owner or user shall not be considered “maintained in a proper operating condition.”

For measuring devices, the term “predominantly” applies to any single product, grade, service level, or payment method, with errors in favor of the device owner or user.

At its 2007 Interim Meeting, NEWMA stated that they continue to oppose this item and recommended it be withdrawn as it was already adequately addressed in the General Code.

At its 2008 Annual Meeting, the CWMA recommended the item be Withdrawn. At its 2008 Interim Meeting, the CWMA recommended this item go forward as a Voting item.

The WWMA received no comments on this Developing item during its 2008 Annual Technical Conference open hearings. The WWMA made no changes to the proposal and recommends the item remain Developing.

At the 2009 Interim Meeting, the Committee heard comments supporting the proposal from Judy Cardin, Wisconsin, who indicated that some states are finding it difficult to enforce the general requirement for maintenance of equipment in G-UR.4.1. and citing concerns about lack of uniformity in how the paragraph is enforced. Steve Malone, Nebraska, also supported the proposal, noting his belief that it is being left up to the individual inspector to decide on compliance with the current G-UR.4.1. Julie Quinn, Minnesota, supported the need for a standard interpretation, but supported only paragraph (b) of the proposal. Will Wotthlie, Maryland, opposed the proposal, expressing concern that consideration had not been given for other device types that weights and measures officials inspect. Will also had concern about specifying a specific percentage value since companies may target these values, further noting that, if service companies are not adjusting as close to zero as practical, then the provisions of G-UR.4.3. Use of Adjustments can be used to address the problem. Bob Atkins, San Diego County, California, also expressed concern about specific percentage values and thresholds, noting that this gives the appearance of establishing a tolerance within a tolerance and may encourage adjustments to those thresholds; he also emphasized that the burden of proof is on the inspector to prove predominance, using judgment, information, and an individual assessment of each situation. Mike Cleary, speaking on his own behalf, noted that it is inappropriate to quantify intent with a percentage value. He believes the current paragraph is clear and echoed Bob's concerns that making changes as outlined in the proposal will encourage companies to target these numbers in their adjustments.

While the Committee recognizes the need to encourage uniformity in implementation of handbook paragraphs, the Committee believes that existing General Code requirements, including G-UR.4.1. Maintenance of Equipment, G-UR.4.3. Use of Adjustments, and other handbook provisions are adequate to address the concerns raised. There are other similarly broad paragraphs in the General Code and in the specific codes that are designed to allow for interpretation by the jurisdiction and assessment of individual situations. In addition, the Committee recognized that many jurisdictions have implemented policies to help encourage uniformity among their inspectors and service companies. This allows jurisdictions to retain the flexibility to use other information such as service records and compliance history to more properly assess intent with regard to equipment maintenance and use of adjustments. After reviewing the history of this item, input from the regions, and comments from the Interim Meeting, and after discussing these points, the Committee concluded that there is not enough support for this item to move forward for a vote. Consequently, the Committee has Withdrawn this item from its agenda.

331 VEHICLE-TANK METERS

331-1 I T.2.1. Automatic Temperature-Compensating Systems

Source: 2008 Carryover Item 331-2. This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 2008 agenda.

Recommendation: Amend paragraph T.2.1. as follows:

T.2.1. Automatic Temperature-Compensating Systems. – The difference between the meter error (expressed as a percentage) for results determined with and without the automatic temperature-compensating system activated shall not exceed:

- (a) ~~0.40~~0.2 % for mechanical automatic temperature-compensating systems; and
- (b) ~~0.20~~0.1 % for electronic automatic temperature-compensating systems.

The delivered quantities for each test shall be approximately the same size. The results of each test shall be within the applicable acceptance or maintenance tolerance.

(Amended 201X)

Background/Discussion: For more than 13 years, Alaska has been testing mechanical and electronic temperature-compensating vehicle-tank meters with flow rates ranging from 100 gal/min to 300 gal/min. They have applied the

tolerances of 0.2 % for mechanical and 0.1 % for electronic wholesale meters as specified in the LMD Code, and have found that the devices are fully capable of meeting these tolerances. When devices are found out of tolerance, it is usually because of a broken cable at the probe for the mechanical devices, an electrical fault at the probe on electronic devices, or an incorrect API setting. By keeping the current tolerances that are double the equivalent tolerances in the LMD Code, there is a risk these problems will be missed.

To illustrate how the current tolerances may mask problems such as broken temperature probes or incorrect settings, consider the following example:

1000 gal prover
 Diesel #2
 API 34.5
 Temperature 60 °F
 Mechanical compensated VTM

- A net test draw is run and the result is +2.0 gal or +0.2 %. This meets the maintenance tolerance of 0.3 % or 3.0 gal.
- A gross draw is run and the result is -2.0 gal or -0.2 %. This still meets the tolerance and the difference between the two runs is 0.4 %.
- With the temperature of the fuel at 60 °F, both of these runs should have been equal.
- If an inspector used the system indication of temperature rather than using a certified thermometer in the meter temperature well, calculations show that the current tolerance of 0.4 % for a mechanical automatic temperature-compensating system could allow a system malfunction that provided a temperature error of up to 9 °F difference from the actual temperature taken in the prover and not be recognized as being caused by a faulty system.

At its 2007 Annual Meeting, the WWMA recommended that the item move forward for a Vote. The WWMA was presented with a letter from a meter manufacturer in support of the proposal based on a request from Alaska Weights and Measures for input from manufacturers of the mechanical and electronic compensators. The letter states that the proposed changes will align the VTM tolerances for the difference between meter error for results determined with and without the automatic temperature-compensating system activated with the LMD Code. Current NIST HB 44 language will require this manufacturer to produce different stationary and vehicle-mounted meters; the proposed change will align the United States with Canada and OIML, who currently do not have different standards for these meters.

At the 2008 Interim Meeting, the Meter Manufacturers Association (MMA) and some individual manufacturers opposed this proposal. While they were comfortable with a tighter tolerance being used during type evaluation they were concerned with the impact of a tighter tolerance during routine field examinations. During routine field evaluations, it becomes more difficult to control the influence factors that impact the measurement process leading to higher uncertainty in the accuracy of the test results. The Committee agreed with comments from the CWMA's 2007 Interim Meeting that more information is needed before moving the item forward and, consequently, made 331-2 an Informational item on its 2008 agenda.

In their spring 2008 meeting reports, the CWMA and NEWMA stated that there is not enough data to support the proposed changes in tolerance and recommended that the item remain an Informational item. WMD submitted comments supporting the collection of additional data, and suggested that the tolerances for stationary and vehicle-mounted meters be re-examined and compared to ensure consistency across codes for the same meter type. Additionally, WMD noted that as the use of VTMs with ATC increase, there may be a period of transition as jurisdictions and companies become accustomed to the test procedures and application of tolerances for these systems, and this experience may provide a good indication of how the uncertainties involved in the test process will impact the proposed tolerance change.

At the 2008 NCWM Annual Meeting, the Committee reported that it has not received additional data from other jurisdictions on the impact of this proposal on existing devices. The Committee also heard comments that the tolerances in the VTM code need to be less stringent than equivalent tolerances in the LMD code since VTM meters and accessories are mobile devices that are subject to road vibrations and other environmental factors. The

Committee does not understand the rationale for the comment since the tolerances for Accuracy Class 0.3 in Table T.1. for VTMs are tighter than Accuracy Class 0.3 devices in the LMD code.

The Committee is interested in receiving compliance data from jurisdictions that are enforcing ATC tolerance requirements on VTMs. If no information is received, the Committee will consider recommending that this item move forward as a Voting item in 2009.

No comments were received during the WWMA 2008 Annual Technical Conference open hearing. The WWMA recommends this item remain Informational pending receipt of data from other jurisdictions. At its 2008 Interim Meeting, the CWMA and NEWMA recommended waiting for more information to be submitted before the NCWM Interim Meeting in January 2009. If no more information is received the CWMA and WWMA recommends the item be moved forward as a Voting item.

During open hearings at its 2008 Annual Meeting, the SWMA heard concerns about whether or not existing equipment, particularly electronic equipment can meet the proposed smaller tolerances. The Committee heard that the harsher environment of the vehicle-mounted application may make it difficult for devices to meet the tolerances. The SWMA agreed with the NCWM S&T Committee that additional data is needed prior to making a decision about the proposed tolerance change. Consequently, the SWMA maintained this as an Informational item on its agenda. The SWMA encourages jurisdictions that have VTMs equipped with automatic temperature compensating systems in their jurisdictions to forward compliance data to the NCWM S&T Committee so that a better assessment can be made about the proposed tolerances.

At the 2009 Interim Meeting, the Committee heard from the MMA in opposition to the proposal, citing the need for additional data prior to moving the item for a Vote. Steve Malone, Nebraska, urged caution prior to making the proposed changes noting that inspection procedures such as how the temperature probes are read can have a significant impact on the decision to tighten a tolerance. Juana Williams, NIST WMD, presented technical input noting concerns that have been raised by some members of the community regarding the importance of using NIST Handbook 105-compliant and traceable standards such as thermometers and following appropriate test procedures for assessing compliance with ATC tolerances. Juana also noted the importance of data supporting the proposed changes and commented on WMD's concern over the continued disparity between the tighter VTM tolerances for normal and special tests and the less stringent tolerances for identical meters used in stationary applications. Ross Andersen, New York, noted that some have questioned whether or not we should be establishing tolerances and test procedures for checking the accuracy of the probe; however, the approach we have taken is to establish a tolerance for both the temperature probe and the algorithm used to calculate net values.

Committee technical advisor, Tina Butcher, noted that supporting data has been received from only one source. No data has been submitted to indicate that the proposed change is not appropriate. Tina reported distributing a note to the NIST WMD weights and measures Directors list serve asking for input. She also contacted by telephone the majority of northern tier states who might be likely to have experience testing VTMs with ATC systems. Tina was unable to obtain any additional data, noting that many jurisdictions reported not having VTMs equipped with active ATC systems. Some jurisdictions that do have such systems in their jurisdictions do not have specific data on the compliance of the device with the ATC tolerances. Several states offered to attempt to collect additional data over the next six months and provide any input available to the Committee.

After considering the comments from the open hearings and the regions, the Committee decided to retain this as an Informational item on its agenda. While no data has been provided to support the opposing comments on this item, the Committee is reluctant to propose a change as significant as that of changing a tolerance based upon data from a single source. The Committee appreciates the data provided by Alaska and emphasizes that this position should not be taken to imply that the Committee questions the validity of the data or procedures used in collecting it.

The Committee reiterates its request for jurisdictions to supply test data in support or opposition of the proposal to assist the Committee in making a decision on the item. The Committee also invites input of data from equipment manufacturers.

331-2 V UR.2.5. Automatic Temperature Compensation for Refined Petroleum Products, UR.2.5.1. Use of Temperature Compensation System

Source: 2008 Carryover Item 331-3. This item originated from the Southern Weights and Measures Association (SWMA) and first appeared on the Committee's 2008 agenda.

Recommendation: Add the following subparagraphs to the Vehicle-Tank Meters Code:

UR.2.5. Automatic Temperature Compensation for Refined Petroleum Products.

UR.2.5.1. Use of Temperature Compensation System.

UR.2.5.1.1. When to be Used. – In a state that does not prohibit, by law or regulation, the sale of temperature-compensated product, a device equipped with an ~~operable~~ automatic-temperature compensator shall be connected, operable, and in use at all times. An electronic or mechanical automatic temperature-compensating system may not be removed, nor may a compensated device be replaced with an uncompensated device, without the written approval of the responsible weights and measures jurisdiction.

Note: This requirement does not specify the method of sale for products measured through a meter.

UR.2.5.1.2. Period of Use. – When fuel is bought or sold on an automatic temperature compensation basis, it shall be bought or sold using this basis over at least a consecutive 12-month period unless otherwise agreed to by both the buyer and seller in writing.

Discussion: Currently there are no published guidelines for how a company has to use or operate their VTM with or without temperature compensation. They could choose to operate only part of their fleet with ATC or use ATC only part of the year when it is to their benefit. They may choose to use ATC only on certain products such as home heating oil and not use ATC with diesel, kerosene, or gasoline.

The Committee was originally asked by the SWMA to consider adding two paragraphs intended to help (1) to eliminate the potential for facilitation of fraud with ATC; and (2) to eliminate consumer confusion regarding why certain products are currently sold using ATC and others are not.

The Committee considered several iterations of the original proposal based on the following points raised in open hearings and regional associations in 2008. Details can be found in the Committee's 2008 Final Report.

- The proposal should only apply to fuel products.
- A number of people voiced concern over the possibility of consumers (who generally are not educated regarding the import of compensated versus uncompensated deliveries) unwittingly signing contracts agreeing to gross or net deliveries that may put them at a disadvantage.
- Questions were raised over uniformity between buyer and seller agreements at the retail level.
- The numbering of the proposals is not consistent with current code format.
- Would the language inappropriately allow a seller to include a shorter time period than 12 months facilitating use of the system when it is of most advantage to the business?

Based on the comments received, the Committee decided to change the status of this item from Voting to Informational at the 2008 NCWM Annual Meeting and sent the proposal in the following form to the regional associations for review.

During open hearings at its 2008 Annual Technical Conference, the WWMA heard comments from one jurisdiction questioning why this item is proposed in HB 44 and suggesting that a more appropriate place might be HB 130 since it relates to method of sale. The WWMA noted that similar language exists in another HB 44 Code (LMD Code UR.3.6.1.1.).

The WWMA reviewed the alternative language developed by the Committee at the 2008 NCWM Annual Meeting, and noted that it recommended strikethrough of “unless otherwise agreed to by both the buyer and seller in writing.” This would be inconsistent with LMD Code UR.3.6.1.1., and the WWMA recommended this item remain Informational to allow for further discussion.

During the 2008 CWMA Interim Meetings, one jurisdiction stated they would not support this item with UR.2.5.2.2. Condition of Use. This jurisdiction believes that all VTMs at a location should not be made to be temperature-compensated at a given facility. Other jurisdictions attending the meeting supported the item. For clarification purposes, the CWMA recommends the words “through a vehicle-tank meter” (see italics type below) be inserted after the words “offered for sale...” in UR.2.5.2.2. Condition of Use.

The CWMA recommended this item be moved to a Voting item with the following changes.

UR.2.5.2.1. Period of Use. – When fuel is bought or sold on an automatic temperature compensation basis, it shall be bought or sold using this basis over at least a consecutive 12-month period unless otherwise agreed to by both the buyer and seller in writing.

UR.2.5.2.2. Condition of Use. – At a business location, which offers fuel products for sale on the basis of a temperature-compensated volume, all vehicle-tank meters shall have active automatic temperature compensation and all fuel products offered for sale *through a vehicle-tank* meter shall be dispensed on the basis of temperature-compensated volume.

At its 2008 Interim Meeting, NEWMA heard discussion that allowing uncompensated sales when agreed to by both parties could result in consumers getting sales contracts that contained this language, and consumers may not understand fully what this means. When the phrase “unless otherwise agreed to by both the buyer and seller in writing” language is removed, it appears that UR.2.5.1. already addresses this issue.

Consequently, NEWMA recommends the following changes:

~~UR.2.5.2.1. Period of Use. – When fuel is bought or sold on an automatic temperature compensation basis, it shall be bought or sold using this basis over at least a consecutive 12-month period unless otherwise agreed to by both the buyer and seller in writing.~~

UR.2.5.2.2. Condition of Use. – At a business location which offers fuel products for sale on the basis of a temperature-compensated volume, all vehicle-tank meters shall have active automatic temperature compensation and all fuel products offered for sale shall be dispensed on the basis of temperature-compensated volume.

NEWMA recommends this item be made Informational.

At its 2008 Annual Meeting, the SWMA raised the following concerns and questions about the proposal:

- The SWMA questioned the need for the new proposed paragraph UR.2.5.1. since the VTM Code currently includes a paragraph (also numbered UR.2.5.1.) that appears to cover similar criteria.
- The SWMA heard a suggestion to eliminate the phrase “unless otherwise agreed to by both the buyer and the seller” from the proposed UR.2.5.1. The Committee noted that the same language is already included in the Liquid-Measuring Devices Code; however, the references in that code are to wholesale meters and the buyer and seller are fully educated and understand the ramification of a temperature-compensated vs. non-temperature-compensated sale.
- The SWMA questioned how the proposed paragraph UR.2.5.2.2. is intended to apply to metering devices at a single location. Does the reference to “all fuel products” in this paragraph refer to all vehicle-tank meters? Or does it refer to vehicle-tank meters as well as RMFDs at a single location?

- The SWMA questions the proposed numbering of the paragraphs and whether or not the proposed paragraphs should be included under the section of “invoices” or in another section.

The SWMA also considered a suggestion to split the item into two parts in order to facilitate addressing these and other concerns. While the SWMA is amenable to this approach, it believes the above concerns and questions should be addressed prior to taking additional action.

The SWMA believes that additional work is needed on this item to resolve the above and other concerns. Consequently, the SWMA maintained this as an Informational item on its agenda.

At the 2009 Interim Meeting, Joe Buxton, stated that the MMA supports the proposal with the changes suggested by the CWMA. Bob Atkins, San Diego County, California, expressed support for the item, noting that when ATC is used, it should be used consistently. Tim Tyson, Kansas, opposed the item, noting that there are a few applications in which a company has a VTM dedicated to serving only one business; forcing ATC for all VTMs in the company would be a problem. Ross Andersen, New York, agreed with the first paragraph.

Based on comments received on this issue, the Committee felt that there was general support for paragraph UR.2.5.2.1. Period of Use, but additional work would be needed before paragraph UR.2.5.2.2. Condition of Use is ready for further action. Rather than delay action on the “Period of Use” requirement, which some comments indicate are needed by officials more immediately, the Committee decided to propose UR.2.5.2.1. (as renumbered in the recommendation above) for a Vote. The Committee agreed to create a new item (Item 331-3) under which the originally proposed paragraph UR.2.5.2.2. Condition of Use can be further refined to best meet the needs of the weights and measures community.

331-3 I UR.2.5.2.1. Automatic Temperature Compensation for Refined Petroleum Products

Source: 2008 Carryover Item 331-3. This item originated as a companion proposal to 2009 Interim agenda Item 331-2.

Recommendation: Add the following subparagraphs to the Vehicle-Tank Meters Code:

UR.2.5.1.X. Condition of Use. – At a business location which offers fuel products for sale on the basis of a temperature-compensated volume, all vehicle-tank meters shall have active automatic temperature compensation and all fuel products offered for sale shall be dispensed on the basis of temperature-compensated volume.

Note: If the proposed changes in Item 331-2 are adopted, the above paragraph will be numbered UR.2.5.1.3.

Discussion: Currently there are no published guidelines for how a company has to use or operate their VTM with or without temperature compensation. They could choose to operate only part of their fleet with ATC or use ATC only part of the year when it is to their benefit. They may choose to use ATC only on certain products such as home heating oil and not use ATC with diesel, kerosene, or gasoline.

The Committee was originally asked by the SWMA to consider adding two paragraphs intended to help (1) to eliminate the potential for facilitation of fraud with ATC; and (2) to eliminate consumer confusion regarding why certain products are currently sold using ATC and others are not. The Committee was able reach agreement on a proposal to address the “Period of Use” as outlined in Item 331-2; if adopted these changes will address restrictions on the time period for use of ATC systems. The Committee was not, however, able to reach agreement on the “Conditions of Use” for ATC systems; that is, criteria for stipulating how ATC is used to sell similar products within a single company. Consequently, the Committee created this item at the 2009 Interim Meeting as a companion to Item 331-2 to enable further review and discussion of the proposed criteria.

Concerns were expressed that the language in the recommendation may not allow a business that has a VTM dedicated to serving a single customer to have the option of providing the sale on an uncompensated basis. Comments in support of the language indicate that this will prevent business owners from selectively using a VTM without ATC to serve retail customers (who are not generally well educated with respect to the distinction between

compensated and non-compensated deliveries) when a non-compensated sale would be disadvantageous to the customer. The CWMA has proposed alternative language as shown in Item 331-2 to emphasize that the paragraph applies only to VTM sales by a business, not all of the business' fuel sales (for example, fuel sales made through loading-rack meters also operated by the business).

The Committee invites additional comments and suggestions on how to modify the proposed language to address the concerns raised. The Committee is also interested in comments on how the issue of a meter that can be programmed with multiple products should be addressed; specifically, whether such a meter should be permitted to be programmed to offer compensated and non-compensated sales through the same meter and, if so, what language is needed to address its use. The Committee agreed to keep this proposal on its agenda as an Informational item.

See Item 331-2 for additional background information and a summary of comments on the proposed UR.2.5.1.X. Condition of Use.

336 WATER METERS

336-1 V S.1.1.3. Value of Smallest Unit and S.1.1.6. Proving Indicator

Source: Western Weights and Measures Association (WWMA). This item appeared as Part 5, Item 1 on the Committee's 2008 agenda as a Developing item under consideration by the SWMA.

Proposal: Harmonize HB 44 value of the smallest unit requirements and indicator specifications with American Water Works Association (AWWA) standards by amending paragraph S.1.1.3. subsection (a) and adding a new paragraph S.1.1.6. Proving Indicator as follows:

S.1.1.3. 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) 50 L (10 gal, 1 ft³) on utility-type meters, sizes 1 in and smaller, or
- (b) 500 L (100 gal, 10 ft³) on utility-type meters, sizes 1½ in and 2 in, or
- (c) 0.2 L (¹/₁₀ gal, ¹/₁₀₀ ft³) on batching meters delivering less than 375 L/min (100 gal/min, 13 ft³/min), or
- (d) 5 L (1 gal, ¹/₁₀ ft³) on batching meters delivering 375 L/min (100 gal/min, 13 ft³/min) or more.

Add new paragraph S.1.1.6. as follows:

S.1.1.6. Proving indicator. – **Utility-type meters shall be equipped with either a mechanical-type proving indicator, or a high-resolution digital proving indication. The individual graduations on a mechanical proving indicator shall indicate volumes no larger than ¹/₁₀₀ of the value of the smallest unit of indicated delivery required in S.1.1.3. For digital proving indications, the smallest unit of volume displayed shall be no larger than ¹/₁₀₀₀ of the value of the smallest unit of indicated delivery required in S.1.1.3.**

Add a reference to Code Section 3.36. to the definition for “Proving Indicator” in Appendix D as follows:

proving indicator. The test hand or pointer of the proving or leak-test circle on the meter register or index. [3.33, 3.36]

Background/Discussion: At its 2007 Annual Meeting, the SWMA received a request from a meter manufacturer for clarification of the intent of S.1.1.3. Along with the request, the manufacturer stated that, “our assumption is that this refers to the value of each graduation of the primary indicating element.” If this is indeed the intention of S.1.1.3., then the S.1.1.3.(a) requirement of 10 gal would pose no problem for utility-type meters. However, this would represent very poor resolution for smaller water meters. Again, if S.1.1. is indeed referring to the values for individual graduations, values for utility-type meters under S.1.1.3. should instead be separated into three categories: 0.1 gal for meters 1 in and smaller, 1.0 gal for meters 1½ in through 3 in, and 10 gal for meters 4 in and larger.

Similarly, metric “smallest unit” values would also be in three categories: 1 L for meters 1 in and smaller, 10 L for meters 1½ in through 3 in, and 100 L for meters 4 in and larger.

For meters indicating in inch-pound units, utility-type water meters 1 in and smaller have 10 gal test circles with 100 graduations (i.e., 0.1 gal increments). Utility-type meters 1½ in through 3 in have 100 gal test circles with 100 graduations (i.e., 1 gal increments), and utility-type meters 4 in and larger have 1000 gal test circles with 100 graduations (i.e., 10 gal increments). Comparable registration details are available in metric offerings (with 0.1 m³, 1.0 m³, and 10 m³ test circle offerings for progressively larger meter sizes).

The SWMA also heard comments from the manufacturer that several other water meter manufacturers were having difficulty meeting HB 44 requirements for repeatability that were added in 2002. Additionally part of the problem was the determination of what constitutes the smallest unit of measure for various sizes of their utility meters. The manufacturer is requesting a change to the test draft requirements and/or smallest unit of measure requirements to be more appropriate for the meters they and others manufacture. The SWMA agreed to forward the proposal to the NCWM S&T Committee for consideration.

Just prior to the 2008 NCWM Annual Meeting, the NCWM S&T Committee received a proposal from Scott Swanson, with Sensus Metering Systems, on behalf of five water meter manufacturers, including Badger Meter, Inc., Elster Metering, Master Meter, Neptune Metering, and Sensus Metering to modify the proposed language as outlined in the recommendation above. During the Committee’s open hearings, the S&T Chairman notified NCWM members that copies of this information were available to interested parties and noted that the above proposal will be included in the Committee’s final report.

The five water meter manufacturers state that the vast majority of utility-type water meters sold in the United States are designed to comply with ANSI/AWWA meter standards. All AWWA utility-type meter designs share a common meter proving resolution of 100 scale divisions per revolution of the pointer to verify meter accuracy. All utilities use the odometer indicating device on the dial face of the meter for billing purposes. These utility-type meter designs are quite different from those used for batching-type meters. HB 44 currently addresses the value of the smallest unit for utility-type meters as being 50 L regardless of the size of the meter. As a result, larger utility-type meters are required to be more sensitive than smaller utility-type meters.

For utility-type meters 1 in and smaller, meter registration test hands (proving indicators) have graduations with resolution down to 0.1 gal or 0.01 ft³. For meters 1½ in and 2 in, test hands have graduations with resolution down to 1.0 gal or 0.1 ft³. The smallest unit of indicated delivery is then given by one full revolution of the test hand (amounting to 100 graduations).

During open hearings at the WWMA 2008 Annual Technical Conference, the water meter manufacturers gave a presentation on their justification for the proposed changes which included reducing the uncertainty in testing procedures by increasing the test draft size; clarifying the values for the smallest unit of measure based on utility-type meter size; and limiting the number of graduations of the sweep hand to ≥100 graduations. Additionally, the proposals are intended to align HB 44 test requirements with AWWA standards and test criteria.

The WWMA discussed the difference between the smallest unit and the value of the proving indication. The intent is that the proving indicator only be used in the verification of the device and the “Value of the Smallest Unit” applies to the meter reading for billing purposes (e.g., beginning and ending readings on a utility bill). This would be analogous to Scales Code verification division sizes where d (smallest division that can be indicated) can be different from e (verification scale division by which tolerance values apply). It was noted that similar language and terminology for “Values of the Smallest Unit” and “Proving Indicator” exists in Section 3.33. Hydrocarbon Gas Vapor-Measuring Devices Code (see paragraphs S.1.1.3. and S.1.1.5. in that code).

The WWMA recommends that this item be forwarded to the NCWM S&T Committee as a Voting item.

At its 2008 Interim Meeting, NEWMA heard a presentation from Andre Noel, Neptune. NEWMA has limited experience testing water meters but recognizes the logic of this item. NEWMA has no position at this time.

CWMA heard no comments on this item at its 2008 Interim Meeting and took no position on this item.

The SWMA S&T Committee heard no comments on this item. Because the SWMA S&T Committee members have little experience with water meters, the Committee took no position on the item and the SWMA agreed the item should remain Developing until additional support is heard.

At the 2009 Interim Meeting, the Committee heard comments in support of this item from water meter manufacturers' representatives George DeJarlais (Badger), Andre Noel (Neptune), and Alex Watson (Elster Amco Water). The Committee also received letters of support from Ron Koch (Master Meter, Inc.) and Scott Swanson (Sensus Metering Systems) (see Appendix C, Written Comments Received by the Committee). The Committee also heard support of this issue from members of WWMA. Hearing no opposition to this issue, the Committee decided to recommend this item for a Vote.

336-2 W T.1.1. Repeatability

Source: Western Weights and Measures Association (WWMA)

Recommendation: Amend T.1.1. Repeatability and add new Tables T.1.1. and T.1.2. in HB 44 Section 3.36.

T.1.1. Repeatability. – When multiple tests are conducted at approximately the same flow rate, the range of the test results shall not exceed 0.6 % for tests performed at the normal and intermediate flow rates, and 1.3 % for tests performed at the minimum flow rate, and each test shall be within the applicable tolerances. **When repeatability tests are performed, test draft sizes shall comply with Tables T.1.1. and T.1.2. Repeatability Testing for Utility-Type Water Meters. Repeatability tests shall be conducted during type evaluation testing.**

(Amended 200X)

Table T.1.1. Flow Rate and Draft Size for Utility-Type Water Meters			
Normal Tests for Repeatability			
Meter Size (inches)	Rate of Flow (gal/min)	Maximum Rate	
		Meter Indication/Test Draft	
		gal	ft³
Less than $\frac{5}{8}$	8	100	10
$\frac{5}{8}$	15	100	10
$\frac{5}{8} \times \frac{3}{4}$	15	100	10
$\frac{3}{4}$	25	100	10
1	40	100	10
1½	50	400	40
2	100	500	40

(Table Added 200X)

Table T.1.2. Flow Rate and Draft Size for Utility-Type Water Meters						
Special Tests for Repeatability						
Meter Size (inches)	Intermediate Rate			Minimum Rate		
	Rate of Flow (gal/min)	Meter Indication/Test Draft		Rate of Flow (gal/min)	Meter Indication/Test Draft	
		gal	ft³		gal	ft³
Less than $\frac{5}{8}$	2	40	4	$\frac{1}{4}$	20	2
$\frac{5}{8}$	2	40	4	$\frac{1}{4}$	20	2
$\frac{5}{8} \times \frac{3}{4}$	2	40	4	$\frac{1}{4}$	20	2
$\frac{3}{4}$	3	40	4	$\frac{1}{2}$	20	2
1	4	40	4	$\frac{3}{4}$	20	2
1½	8	400	40	1½	200	20
2	15	500	40	2	200	20

(Table Added 200X)

Background/Discussion: This proposal was originally included with Developing Item Part 4, Item 1 (now Item 336-3) Water Meters. Scott Swanson, with Sensus Metering Systems, on behalf of five water meter manufacturers including Badger Meter, Inc., Elster Metering, Master Meter, Neptune Metering, and Sensus Metering, submitted a proposal to the WWMA suggesting that the proposed changes to paragraph T.1.1. Repeatability in that Developing item be addressed separately. A copy of this proposal was also provided to the NCWM S&T Committee in July 2008 and appears as an Appendix to the Committee's 2008 Final Report.

Mr. Swanson and the other meter manufacturers provided the following justification for the proposed change to the repeatability requirements:

When agencies use inadequate test draft quantities, erroneous test results can be produced. These erroneous test results have and are continuing to have serious financial consequences to manufacturers and distributors.

The vast majority of utility-type water meters sold in the United States are designed to comply with ANSI/AWWA meter standards. Coupled with actual utility metering practices in the field, the result is meter designs sharing common meter reading resolution. These designs are quite different from those used for batching-type meters.

For utility-type meters 1 in and smaller, meter registration test hands (proving indicators) have graduations with resolution down to 0.1 gal or 0.01 ft³. For meters 1½ in and 2 in, test hands have graduations with resolution down to 1.0 gal or 0.1 ft³. In visually reading the test hand position relative to these graduations, resolution is limited to a range of roughly ⅓ or ½ of an individual graduation (at both the start of each test and at then at the end of each test).

A test draft equal to only 100 graduations, while adequate for accuracy testing, will be insufficient when testing for repeatability (given the five-fold tighter tolerance for meter repeatability, compared to the tolerance for meter accuracy). For example, an uncertainty of ⅓ graduation at the initial meter reading, and an additional reading uncertainty of ⅓ graduation at the end of the test, would result in a cumulative meter reading uncertainty of 0.67 %, for such a 100-graduation test. Test draft sizes need to be increased, so that meter reading uncertainties do not consume more than ¼ of the total allowable tolerances for this testing. For a repeatability range requirement of 0.6 %, test draft size should equal 400 graduations of the test index in order to have acceptable meter reading resolution. Similarly, for a repeatability range requirement of 1.3 %, test draft size should be equal to 200 graduations of the test index.

In its review of this issue and 2008 Developing item Part 4, Item 1, Water Meters, N.3. Test Drafts and N.4. Testing Procedures at its 2008 Annual Technical Conference, the WWMA agreed to address this issue separately and agreed to forward this item to the NCWM S&T Committee with a proposal that the item be made a Voting item on the Committee's 2009 Interim agenda. The WWMA noted that repeatability tests of utility-type meters are currently being conducted during the type evaluation process, but are seldom performed in field tests.

The SWMA heard no comments on this item at its 2008 Annual Meeting. In its review of the item, the SWMA S&T Committee raised the questions and concerns outlined below.

- The table is specifying test draft criteria rather than tolerances and, consequently, should appear in the Notes section rather than in the Tolerances section.
- The table is confusing as currently presented. Although the table is patterned after similar paragraphs in the Notes section of the water meters code, there is explanatory text in those paragraphs which assists the user in understanding how the table is to be applied. Such text is missing from the proposed changes to paragraph T.1.1.
- The SWMA S&T Committee believes that the option of running the repeatability test in the field should be retained. While the proposed language does not prohibit conducting a repeatability test in the field, a statement should be included to note that it is permissible to conduct a repeatability test in field.

- The SWMA S&T Committee is concerned about the difference in draft sizes for normal and special tests and repeatability tests. If an inspector conducts a normal test and suspects a problem with repeatability, the inspector is forced to obtain a different test measure/prover in order to conduct the repeatability tests. This does not seem technically logical.

Because of these concerns, the SWMA could not support the proposal as written. The SWMA believes that this item should be made a Developing item until additional input is provided.

At the 2009 NCWM Interim Meeting, the Committee heard support for this proposal from representatives of several water meter manufacturers, including George DeJarlais, Badger Meter; Andre Noel, Neptune; and Alex Watson, Elster Amco Water. In addition, Mr. DeJarlais presented letters from Ron Koch, Master Meter, Inc., and Scott Swanson, Sensus Metering Systems, supporting the proposal (see Appendix C, Written Comments Received by the Committee). Comments from the manufacturers present also indicated that failure to harmonize test draft sizes for water meter tests with current American Water Works Association (AWWA) standards will result in economic harm to U.S. water meter manufacturers. The Committee heard opposition to the proposal from Ed Williams, Director, California Division of Measurement Standards, who commented that there is no justification for increasing test drafts for type evaluation testing and that repeatability test drafts should be the same size as those for normal and special test drafts. Mr. Williams also cited a NIST WMD quarterly newsletter article on “repeatability” by Juana Williams, which described the purpose of repeatability tests, noting that while the purpose of repeatability tests and normal and slow tests are different, it is necessary to have a means for comparing the results from those tests. Juana Williams, commented on behalf of NIST WMD, that the General Code requires that a device be capable of repeating its indications, including normal and slow flow test drafts; it is technically inconsistent to require an inspector to change the size of the test draft in order to compare the results of consecutive tests run under the same conditions.

The Committee acknowledged the concerns expressed by the water meter manufacturers regarding the importance of selecting an appropriate size test draft as one means of reducing uncertainties in the test process. Based on input from the manufacturers and from some weights and measures officials, the Committee believes there may be merit to linking the test draft size to at least the quantity indicated in one revolution of the dial on a mechanical water meter as a means to reduce uncertainties. However, the Committee believes that, if the current test draft size is contributing a significant uncertainty to the test process, this concern would apply equally to all accuracy tests, not just repeatability tests. The Committee also had remaining questions about how one might define the test draft size relative to the indications on a dial, given the wide variety of indicator types in use in the marketplace.

Because members of the WWMA were not convinced at the WWMA’s September 2008 meeting that the contribution of errors from the existing test draft size warranted a change in the test draft size for normal and slow flow tests, the Committee was reluctant to support the proposed change in test draft size for repeatability tests alone. The Committee heard that the California Division of Measurement Standards will be working with jurisdictions in California to collect additional data in conjunction with the Developing item on normal and special test draft sizes, and this information may provide a better indication of which proposal will be acceptable to the weights and measures community. The Committee also noted that some of the proposed changes to test draft size in this item and in a corresponding Developing item (previously designated Item 360-2, Part 4, Item 1; now Item 336-3) are larger than current AWWA standards. The Committee believes that the issue of test draft size must be considered jointly for all accuracy tests to ensure consistent application of these principles. Consequently, the Committee withdrew this item from its agenda and suggested that the idea of increased test drafts for repeatability tests be considered in conjunction with Item 336-3, N.3. Test Drafts and N.4. Testing Procedures.

336-3 I N.3. Test Drafts and N.4. Testing Procedures

Source: Southern and Western Weights and Measures Associations (SWMA and WWMA); this item originally appeared as Part 4, Item 1 on the Committee’s 2009 Interim agenda.

Recommendation: The Committee is studying the following recommendation and encourages input from interested parties.

Amend requirements in paragraphs N.3. Test Drafts and N.4. Testing Procedures Section 3.36. Water Meters as follows by changing the test draft quantities of Tables N.4.1. and N.4.2. of HB 44 as follows:

N.3. Test Drafts. – ~~The normal test of a meter shall be made at the maximum discharge rate developed by the installation. Meters with maximum gallon per minute ratings higher than the values specified in Table N.4.1. Flow Rate and Draft Size for Water Meters Normal Tests may be tested up to the meter rating, with meter indications no less than those shown.~~

(Amended 1990, 2002, and 2003)

- (a) **Non Utility-Type Water Meters. – Test drafts should be equal to at least the amount delivered by the device in 2 minutes and in no case less than the amount delivered by the device in 1 minute at the actual maximum flow rate developed by the installation. The test draft sizes shown in Table N.4.1. Flow Rate and Draft Size for Non Utility-Type Water Meters Normal Tests, and in Table N.4.2. Flow Rate and Draft Size for Non Utility-Type Water Meters Special Tests, shall be followed as closely as possible.**
- (b) **Utility-Type Water Meters. – The test draft sizes shown in Table N.4.X. and N.4.Y. shall be followed as closely as possible. Testing shall be done in like volumes (meters with gallon registration tested in gallon volumes, meters with cubic feet registration tested in cubic feet volumes).**

Table N.4.1. Flow Rate and Draft Size for <u>Non Utility-Type</u> Water Meters			
<u>Normal Tests</u>			
Meter Size (inches)	Rate of Flow (gal/min)	Maximum Rate	
		Meter Indication/Test Draft	
		gal	ft³
Less than ⁵ / ₈	8	50	5
⁵ / ₈	15	50	5
³ / ₄	25	50	5
1	40	100	10
1½	80	300	40
2	120	500	40
3	250	500	50
4	350	1000	100
6	700	1000	100

(Table Added 2003) **(Amended 201X)**

Table N.4.X. Flow Rate and Draft Size for <u>Utility-Type</u> Water Meters			
<u>Normal Tests</u>			
<u>Meter Size (inches)</u>	<u>Rate of Flow (gal/min)</u>	<u>Maximum Rate</u>	
		<u>Meter Indication/Test Draft</u>	
		<u>gal</u>	<u>ft³</u>
<u>Less than ⁵/₈</u>	<u>8</u>	<u>100</u>	<u>10</u>
<u>⁵/₈</u>	<u>15</u>	<u>100</u>	<u>10</u>
<u>⁵/₈ x ³/₄</u>	<u>15</u>	<u>100</u>	<u>10</u>
<u>³/₄</u>	<u>25</u>	<u>100</u>	<u>10</u>
<u>1</u>	<u>40</u>	<u>100</u>	<u>10</u>
<u>1½</u>	<u>50</u>	<u>300</u>	<u>40</u>
<u>2</u>	<u>100</u>	<u>500</u>	<u>40</u>

(Table Added 201X)

Table N.4.2. Flow Rate and Draft Size for <u>Non Utility-Type Water Meters</u>						
Special Tests						
Meter Size (inches)	Intermediate Rate			Minimum Rate		
	Rate of Flow (gal/min)	Meter Indication/Test Draft		Rate of Flow (gal/min)	Meter Indication/Test Draft	
		gal	ft³		gal	ft³
Less than or equal to $\frac{5}{8}$	2	10	1	$\frac{1}{4}$	5	1
$\frac{3}{4}$	3	10	1	$\frac{1}{2}$	5	1
1	4	10	1	$\frac{3}{4}$	5	1
$1\frac{1}{2}$	8	50	5	$1\frac{1}{2}$	10	1
2	15	50	5	2	10	1
3	20	50	5	4	10	1
4	40	100	10	7	50	5
6	60	100	10	12	50	5

(Table Added 2003) **(Amended 201X)**

Table N.4.Y. Flow Rate and Draft Size for <u>Utility-Type Water Meters</u>						
Special Tests						
Meter Size (inches)	Intermediate Rate			Minimum Rate		
	Rate of Flow (gal/min)	Meter Indication/Test Draft		Rate of Flow (gal/min)	Meter Indication/Test Draft	
		gal	ft³		gal	ft³
<u>Less than $\frac{5}{8}$</u>	<u>2</u>	<u>10</u>	<u>1</u>	<u>$\frac{1}{4}$</u>	<u>10</u>	<u>1</u>
<u>$\frac{5}{8}$</u>	<u>2</u>	<u>10</u>	<u>1</u>	<u>$\frac{1}{4}$</u>	<u>10</u>	<u>1</u>
<u>$\frac{5}{8} \times \frac{3}{4}$</u>	<u>2</u>	<u>10</u>	<u>1</u>	<u>$\frac{1}{4}$</u>	<u>10</u>	<u>1</u>
<u>$\frac{3}{4}$</u>	<u>3</u>	<u>10</u>	<u>1</u>	<u>$\frac{1}{2}$</u>	<u>10</u>	<u>1</u>
<u>1</u>	<u>4</u>	<u>10</u>	<u>1</u>	<u>$\frac{3}{4}$</u>	<u>10</u>	<u>1</u>
<u>$1\frac{1}{2}$</u>	<u>8</u>	<u>100</u>	<u>10</u>	<u>$1\frac{1}{2}$</u>	<u>100</u>	<u>10</u>
<u>2</u>	<u>15</u>	<u>100</u>	<u>10</u>	<u>2</u>	<u>100</u>	<u>10</u>

(Table Added 201X)

Background/Discussion: At its 2007 Annual Meeting, the SWMA received a proposal from a meter manufacturer with two options for modifying Section 3.36. as shown above. The manufacturer provided the following justification for the modification:

For proposal A: Water meter “transaction” volumes are based on billing cycles of monthly or quarterly “reads.” As such, each transaction for a residential meter may be on the order of 3000 gal to 30 000 gal. Commercial/industrial accounts with larger meters may have transaction volumes that are one or two orders-of-magnitude larger than this. Meter repeatability over the course of a pattern approval test volume (currently as little as 5 gal for a residential meter, for example) is, therefore, not relevant. Utility-type water meters are not designed to provide the resolution required to meet the Section 3.36. repeatability requirements under typical test drafts.

For Proposal B: The graduations on the primary indicating element for the meter under test can normally be read within an uncertainty of roughly $\frac{1}{3}$ of a graduation. This is the result of limits in optical discernment, minor parallax, minor asymmetries in mechanical gear trains, minor asymmetries in graduation printing, etc. Combining the meter’s reading uncertainty at the start of any single test run with the uncertainty at the end of this same test run, total meter reading uncertainty is, therefore, roughly $\frac{2}{3}$ of a graduation. Keeping in mind there are other resolution/repeatability concerns for any given test series (resolution in reading the reference volume/mass, ability to duplicate parameters such as flow rate, water temperature, water pressure, evaporative losses, etc.), the uncertainty

limitations for reading the meter under test should not “consume” more than $\frac{1}{4}$ of the total repeatability requirement. For the 1.3 % repeatability requirement at the minimum flow rate, this corresponds to a test draft equal to roughly 200 graduations of the primary element. For the 0.6 % repeatability requirement at the intermediate rate, this corresponds to a test draft equal to roughly 400 or 450 graduations of the primary element. Test draft volumes for the maximum flow rate must be even larger since these drafts must address other sources of error unique to testing at higher flow rates (for example, errors due to ramping up and ramping down the flow rates at the beginning and end of the test, which must be done slowly enough so as to not cause water hammer, or mechanical impulse loading of the meter registration device).

The SWMA also heard comments from the manufacturer that several other water meter manufacturers were having difficulty meeting HB 44 requirements for repeatability that were added in 2002. Additionally part of the problem was the determination of what constituted the smallest unit of measure for various sizes of their utility meters. The manufacturer is requesting a change to the test draft requirements and/or smallest unit of measure requirements to be more appropriate for the meters they and others manufacture. The SWMA agreed to forward the proposal to the NCWM S&T Committee for consideration.

Just prior to the 2008 NCWM Annual Meeting, the Committee received a proposal for changes to this item from Scott Swanson, with Sensus Metering Systems, on behalf of five water meter manufacturers, including Badger Meter, Inc., Elster Metering, Master Meter, Neptune Metering, and Sensus Metering. During the Committee’s open hearings, the S&T Chairman notified NCWM members that copies of this information were available to interested parties and noted that a copy of the following three proposals will be included in the Committee’s final report.

The five water meter manufacturers recommend that the tables in paragraph N.4. Testing Procedures be amended (as outlined in the proposal above) to address specific issues related to utility-type water meters. The three related proposals are to add subsections under paragraph N.3., change the title of Tables N.4.1. and N.4.2., and to incorporate two new tables to N.4. that speak directly to utility-type water meters.

1. The first part of this proposal is to amend paragraph N.3.
2. The second part of this proposal is to amend the titles of Table N.4.1. and Table N.4.2., changing the words “for Water Meters” to read “for Non Utility-Type Water Meters.”
3. The third part of this proposal is to include in Sections N.4.1. and N.4.2. two new tables that harmonize test flow rates and draft sizes listed in Section 3.36. with that of the AWWA specification found in the AWWA M6 Manual, Table 5.3.

Note that Mr. Swanson, on behalf of the five water meter manufacturers, further suggested that the proposed changes to T.1.1. Repeatability and its associated tables that were outlined in the original recommendation be separated from this item and addressed as an independent issue. A separate proposal was submitted to reflect this suggestion.

The submitter provided the following justification for the proposed changes to paragraphs N.3., N.4., and associated tables:

Erroneous test results can be produced when agencies use inadequate test draft quantities. These erroneous test results have and are continuing to have serious financial consequences to manufacturers and distributors.

The vast majority of utility-type water meters sold in the United States are designed to comply with ANSI/AWWA meter standards. All AWWA utility-type meter designs share a common meter proving resolution of 100 scale divisions per revolution of the pointer to verify meter accuracy. All utilities use the odometer indicating device on the dial face of the meter for billing purposes. These utility-type meter designs are quite different from those used for batching-type meters.

For utility-type meters 1 in and smaller, meter registration test hands (proving indicators) have graduations with resolution down to 0.1 gal or 0.01 ft³. For meters 1½ in and 2 in, test hands have graduations with resolution down

to 1.0 gal or 0.1 ft³. In visually reading the test hand position relative to these graduations, resolution is limited to a range of roughly $\frac{1}{3}$ or $\frac{1}{2}$ of an individual graduation (at both the start of each test and at then at the end of each test).

As a result, a test draft equal to only 50 graduations will result in large meter reading uncertainties (cumulative uncertainty range on the order of 1.2 % or worse). Compared to the accuracy tolerances for water meters, this level of reading uncertainty is unacceptable, and larger test drafts must be used. See AWWA M6 for examples of the larger test drafts that are required, given these reading resolution limitations.

During the Committee's open hearings, Jeff Humphreys, Los Angeles County, provided a letter and some additional data to consider in conjunction with this item. This information was included in the Committee's final report and is also included in Appendix D in this report. Additionally, concerns were expressed regarding whether or not the size of the test draft for larger meters is realistic. A manufacturer of test equipment noted that the largest prover being manufactured at present is 2000 gal.

During the open hearings at the 2008 WWMA Annual Technical Conference, water meter manufacturers gave a presentation on the justification for the proposed changes which included reducing the uncertainty in testing procedures by increasing the test draft size, clarifying the values for the smallest unit of measure based on utility-type meter size, and limiting the number of graduations of the sweep hand to 100 graduations or more. Additionally, the manufacturers reiterated that the proposals are intended to align HB 44 test requirements with AWWA standards and test criteria.

The WWMA S&T Committee also reviewed the letter and test data submitted by Los Angeles County Weights and Measures about the comparison of failure rates for utility-type meters between current test of 5 gal draft size and a test draft of 20 gal for $\frac{5}{8}$ -in utility-type meters. They summarized their results as follows:

“The enclosed information also shows that very few positive displacement meters fail tolerance tests at any of the current HB 44 flow rates. The claim has been made that the tests as currently being conducted have seriously impacted meter sales for several water meter manufacturers. Our tests show that manufacturers of positive displacement meters should not be negatively impacted by being tested at the current established flow rates.”

According to the data from Los Angeles County, the average error for the 28 new meters that failed the test using the 5 gal test draft was -4.45 %, and -4.32 % for the 10 gal test draft. There was no data for repeatability in this series of data.

The WWMA S&T Committee also received two letters in support of the items from water manufacturers that were not in attendance.

The WWMA acknowledges that there is an increased potential for uncertainty with the current test draft. Manufacturers state that the test should include at least one complete revolution of the dial indicator. However, the data submitted by Los Angeles County suggested that the increase in the test draft size is not justified.

One meter manufacturer submitted test data for five new $\frac{5}{8}$ in positive displacement meters to the Committee. Results showed that three tests out of fifteen failed the accuracy test with a 5 gal test draft size for low flow. When draft size was increased to 10 gal, all meters passed and the range of results decreased by a factor of two. When testing repeatability at low flow, two out of five failed with a 5 gal draft; none failed with a 10 gal draft. At intermediate flow, fifteen out of fifteen passed at 10 gal draft size for accuracy, and four out of five meters failed repeatability at the current 10 gal draft size.

Another meter manufacturer submitted test data for four new $\frac{5}{8}$ in positive displacement meters. Results showed that three out of eight failed the accuracy test with a 5 gal test draft size for low flow. When draft size was increased to 10 gal, all meters passed and the range of results decreased dramatically. When testing repeatability at low flow, four out of four failed with a 5 gal draft; zero failed with a 10 gal draft. At intermediate flow, eight out of eight passed at 10 gal draft size for accuracy, and one out of four meters failed repeatability at the current 10 gal draft size.

The WWMA recommends renaming the item to “N.4. Testing Procedures.” It further recommends the item be given Developing status and requests additional data from industry, California DMS, and other jurisdictions comparing test results between the current and proposed test draft sizes. Data submitted should include information on the proving methods (e.g., narrow neck prover, gravimetric, etc). Additionally, the Committee is interested in the requirements and test methods used by Measurement Canada and additional information on International Activities. It should be noted that the AWWA M-6 Manual has guidelines for accuracy testing but no guidance on repeatability.

The Committee also recommends that the proposed language for paragraph N.3. and Tables N.4.1., N.4.X., and N.4.Y. remain Developing due to insufficient test data to justify the proposed change. Additionally, the Committee recommends that the repeatability and test draft sizes in tolerance paragraph in T.1.1. and Tables T.1.1. and T.1.2. be separated as an independent item (see Committee agenda Item 336-2) since the data submitted by the California CTEP lab indicates a high failure rate with the current tests for repeatability.

At its 2008 Interim Meeting, NEWMA heard a presentation from Andre Noel, Neptune. NEWMA has limited experience testing water meters but recognizes the logic of this item. NEWMA has no position at this time.

At their fall 2008 meetings, the CWMA and SWMA heard no comments and took no position on this item.

At the 2009 NCWM Interim Meeting, the Committee heard comments from Andre Noel, Neptune, indicating that failure to harmonize test draft sizes for water meter tests with current AWWA standards will result in economic harm to U.S. water meter manufacturers. Mr. Noel also noted that AWWA standards are used by over 60 000 utilities. George DeJarlais, Badger Meter, asked the Committee to consider moving this item from Developing status to Voting and provided letters (see Appendix C, Written Comments Received by the Committee) from Ron Koch, Master Meter, and Scott Swanson, Sensus Metering Systems, voicing support for this item as well. Alex Watson, Elster Amco Water, provided similar comments of support for moving the item to a Voting status. Kurt Floren, Los Angeles County Weights and Measures, noted that the data provided by their jurisdiction indicates that two thirds of the meters tested would continue to fail even with larger test draft sizes. Thus, he believes that the increased test time to 90 minutes with the larger test draft sizes is not justified. Ed Williams, Director, California Division of Measurement Standards, indicated his jurisdiction intends to collect additional data, which could be available as early as May 2009.

Given the possibility of additional data, the Committee discussed whether or not sufficient information and justification had been provided to support moving this item from a Developing status to an Informational or Voting status. The Committee acknowledges concerns on both sides of this issue and is particularly sensitive to the reported potential for economic impact of delays to change this standard; however, the Committee did not feel elevating the status of the item to Voting was appropriate without additional support from the region that presented the item as a Developing item (the WWMA). The Committee’s chief concern on this point was that the WWMA did not, as of its fall 2008 meeting, support elevating the item to either an Informational or Voting status, and its members did not agree to accept the proposed changes without additional work. While some WWMA members present at the 2009 NCWM Interim Meeting indicated support for elevating the item to a Voting status, the Committee was concerned that other WWMA members who had expressed concerns about the proposal thus far were not present at the NCWM Interim Meeting to provide comment. Because the other regional associations have essentially deferred to the WWMA’s position and the WWMA’s support in the event of a vote is questionable, the Committee did not feel it was appropriate to advance this item to a Voting status. However, given the possibility of additional data prior to the 2009 Annual Meeting, the Committee did agree that the item could be elevated to an Informational status; this would allow a higher degree of visibility for an issue which is of evident concern to the manufacturers without compromising the due process for issue development.

360 OTHER ITEMS

360-1 I International Organization of Legal Metrology (OIML) Report

Many issues before the OIML, the Asian-Pacific Legal Metrology Forum (APLMF), and other international groups are within the purview of the Committee. Additional information on OIML activities will appear in the Board of Directors agenda and Interim and Final Reports and on the OIML website at <http://www.oiml.org>. NIST WMD staff will provide the latest updates on OIML activities during the open hearing sessions at NCWM meetings. For

more information on specific OIML-related device activities, contact the WMD staff listed in the table below. The OIML projects listed below represent only currently active projects. For additional information on other OIML device activities that involve WMD staff, please contact WMD using the information listed below:

NIST Weights and Measures Division (WMD) Contact List for International Activities	
Contact Information	Responsibilities
Postal Mail and Fax for All Contacts:	NIST WMD 100 Bureau Drive MS 2600 Gaithersburg, MD 20899-2600 Tel: (301) 975-4004 Fax: (301) 975-8091
Mr. John Barton (LMDG) (301) 975-4002	<ul style="list-style-type: none"> •R 21 “Taximeters” •R 50 “Continuous Totalizing Automatic Weighing Instruments (Belt Weighers)” •R 60 “Metrological Regulations for Load Cells” (jointly with Ken Butcher) •R 106 “Automatic Rail-weighbridges”
Mr. Kenneth Butcher (LMG) (301) 975-4859 kenneth.butcher@nist.gov	<ul style="list-style-type: none"> •D 1 “Elements for a Law on Metrology” •TC 3 “Metrological Control” •TC 3/SC 1 “Pattern Approval and Verification” •TC 3/SC 2 “Metrological Supervision” •TC 6 “Prepackaged Products” •R 60 “Metrological Regulations for Load Cells” (jointly with John Barton)
Mr. Steven Cook (LMDG) (301) 975-4003 steven.cook@nist.gov	<ul style="list-style-type: none"> •R 76 “Non-automatic Weighing Instruments”
Dr. Charles Ehrlich (ILMG) (301) 975-4834 charles.ehrlich@nist.gov	<ul style="list-style-type: none"> •CIML Member •B3 “OIML Certificate System for Measuring Instruments” •B6 “OIML Directives for the Technical Work” •B 10 “Framework for a Mutual Acceptance Arrangement (MAA) on OIML Type Evaluations” •TC 3/SC 5 “Expression of Uncertainty in Measurement in Legal Metrology Applications,” “Guidelines for the Application of ISO/IEC 17025 to the Assessment of Laboratories Performing Type Evaluation Tests” •TC 3 “Metrological Control”
Mr. Richard Harshman (LMDG) (301) 975-8107 Richard.harshman@nist.gov	<ul style="list-style-type: none"> •R 51 “Automatic Catchweighing Instruments” •R 61 “Automatic Gravimetric Filling Instruments” •R 107 “Discontinuous Totalizing Automatic Weighing Instruments” (totalizing hopper weighers) •R 134 “Automatic Instruments for Weighing Road Vehicles In-Motion and Measuring Axle Loads”
Ms. Diane Lee (LMDG) (301) 975-4405 diane.lee@nist.gov	<ul style="list-style-type: none"> •R 59 “Moisture Meters for Cereal Grains and Oilseeds” •R 92 “Wood Moisture Meters – Verification Methods and Equipment” •R 121 “The Scale of Relative Humidity of Air Certified Against Saturated Salt Solution” •TC 17/SC 8 “Measuring Instruments for Protein Determination in Grains”

NIST Weights and Measures Division (WMD) Contact List for International Activities			
Contact Information		Responsibilities	
Mr. Ralph Richter (ILMG) (301) 975-3997 ralph.richter@nist.gov		<ul style="list-style-type: none"> •R 35 “Material Measures of Length for General Use” •R 49 “Water Meters” (Cold Potable Water & Hot Water Meters) •R 71 “Fixed Storage Tanks” •R 80 “Road and Rail Tankers” •R 85 “Automatic Level Gauges for Measuring the Level of Liquid in Fixed Storage Tanks” •R 105 & R 117 “Measuring Systems for Liquids Other Than Water” (all measuring technologies) •R 118 “Testing Procedures and Test Report Format for Pattern Examination of Fuel Dispensers for Motor Vehicles” •TC 3/SC 4 “Verification Period of Utility Meters Using Sampling Inspections” •R 137 “Gas Meters” (Diaphragm, Rotary Piston, & Turbine Gas Meters) •R 140 “Measuring Systems for Gaseous Fuel” (i.e., large pipelines) 	
		<ul style="list-style-type: none"> •D 11 “General Requirements for Electronic Measuring Instruments” •D 16 “Principles of Assurance of Metrological Control” •D 19 “Pattern Evaluation and Pattern Approval” •D 20 “Initial and Subsequent Verification of Measuring Instruments and Processes” •D 27 “Initial Verification of Measuring Instruments Using the Manufacturer’s Quality Management System” •R 34 “Accuracy Classes of Measuring Instruments” •R 46 “Active Electrical Energy Meters for Direct Connection of Class 2” •TC 5/SC 2 “General Requirements for Software Controlled Measuring Instruments” 	
		<ul style="list-style-type: none"> •R 81 “Dynamic Measuring Devices and Systems for Cryogenic Liquids” •R 139 “Compressed Gaseous Fuels Measuring Systems for Vehicles” 	
Dr. Ambler Thompson (ILMG) (301) 975-2333 ambler@nist.gov			
Ms. Juana Williams (LMDG) (301) 975-3989 juana.williams@nist.gov			
LIST OF ACRONYMS			
B	Basic Publication	LMDG	Legal Metrology Devices Group
CIML	International Committee of Legal Metrology	P	Project
D	Document	R	Recommendation
ILMG	International Legal Metrology Group	SC	Subcommittee
LMG	Laws and Metrics Group	TC	Technical Committee

The WWMA and the SWMA support these issues and the related device activities as an Informational item.

360-2 Developing Items

The NCWM established a category of items called “Developing items” as a mechanism to share information about emerging issues which have merit and are of national interest, but have not received sufficient review by all parties affected by the proposal or that may be insufficiently developed to warrant review by the Committee. The Developing items are currently under review by at least one regional association, technical committee, or organization.

Developing items are listed in Appendix A according to the specific HB 44 code section under which they fall. Periodically, proposals will be removed from the Developing item agenda without further action because the submitter recommends it be withdrawn. Any remaining proposals will be renumbered accordingly.

S&T Committee 2009 Interim Report

The Committee encourages interested parties to examine the proposals included in Appendix A and send their comments to the contact listed in each item. The Committee asks that the regional associations and NTETC sectors continue their work to develop each proposal fully. Should an association or sector decide to discontinue work on an item, the Committee asks that it be notified.

Todd Lucas, Ohio, Chairman

Brett Saum, San Luis Obispo County, California

Kristin Macey, California

Steve Giguere, Maine

Kenneth Ramsburg, Maryland

Ted Kingsbury, Measurement Canada, Technical Advisor

Steven Cook, NIST, Technical Advisor

Tina Butcher, NIST, Technical Advisor

Specifications and Tolerances Committee

Appendix A

Item 360-2: Developing Items

Part 1, Item 1 Scales: S.1.4.6. Height and Definition of Minimum Reading Distance, UR.2.10. Primary Indicating Elements Provided by the User, UR.2.11. Minimum Reading Distance and Definitions of Minimum Reading Distance and Primary Indications

Source: NTETC WS

Note: This proposal was Carryover Item 320-2 which first appeared in the Committee's 2006 agenda and again on the Committee's 2007 agenda as Item 320-4. (This item originated from the 2005 NTETC WS.) The Committee believes that although the proposal has merit there does not appear to be a consensus on the size and quality of primary indication information on devices used in direct and indirect sales transactions or an enforcement date for such requirements. Therefore, the Committee removed Item 320-4 from its agenda and made it a Developing item to allow sufficient time for the community to fully develop requirements acceptable to those affected.

At its 2008 September meeting, the NTETC Weighing Sector discussed the NTEP labs' recommended changes to the proposal along with the labs' recommendation to move forward with this proposal as a Voting item for the S&T Committee. It was noted that the CWMA and WWMA recommended that the proposal be withdrawn unless it received additional support from the industry. Measurement Canada added that they do not have the 9.5 mm requirement in their laws and regulations.

During the WS discussions, a vote to forward the NTEP labs' proposal to the S&T Committee was conducted. Seven members voted in favor and nine members voted against forwarding the NTEP labs' alternate proposal to the S&T Committee. The NIST technical advisor to the WS believes that the results of the vote indicated that there is no consensus between the NTEP labs' and device manufacturers and agreed to forward the WS discussions to the S&T Committee.

The Committee agreed to remove the Developing agenda item from Appendix A since the CWMA and WWMA recommended that the proposal be Withdrawn and that the proposal cannot be further developed due to a lack of consensus in the WS.

Part 2, Item 1 Belt-Conveyor Scale Systems: UR.3.2.(c) Maintenance; Zero Load Tests

Source: 2005 Western Weights and Measures Association (WWMA)

Recommendation: Modify UR.3.2.(c)

During the 2008 NCWM Interim Meeting, the Committee was informed that the USNWG on Belt-Conveyor Scales was going to further develop the proposal during their next meeting on February 27 - 28, 2008, in St. Louis, Missouri. During that meeting, the WG further amended the proposal as shown in the above recommendation and believes that this item is sufficiently developed to be added to the NCWM S&T Committee agenda as a Voting item. At its 2008 meeting, the WWMA agreed with the WG. The proposal can be found on the Committee's agenda as Item 321-1.

Part 2, Item 2 Belt-Conveyor Scale Systems: N.3.1.4. Check for Consistency of the Conveyor Belt Along Its Entire Length

Source: 2005 Western Weights and Measures Association (WWMA)

Recommendation: Amend NIST Handbook 44, Section 2.21. Belt Conveyor Scales (BCS) Systems Code, paragraph N.3.1.4.

During the 2008 NCWM Interim Meeting, the Committee was informed that the USNWG on Belt-Conveyor Scales was going to further develop the proposal during their next meeting on February 27 - 28, 2008, in St. Louis, Missouri. During that meeting, the WG further amended the proposal as shown in the above recommendation and believes that this item is sufficiently developed to be added to the NCWM S&T Committee agenda as a Voting item. At its 2008 meeting, the WWMA agreed with the WG. The proposal can be found on the Committee’s agenda as item 321-2.

Part 3, Item 1 Vehicle-Tank Meters: T.4. Product Depletion Test

Source: Northeast Weights and Measures Association (NEWMA)

Proposal: Amend paragraph T.4. as follows:

T.4. Product Depletion Test. – The difference between the test result for any normal test and the product depletion test shall not exceed **one-half (0.5 %) percent of the volume delivered in one minute at the maximum flow rate marked on the meter. Tolerances for typical meters are tolerance**-shown in Table T.4. Test drafts shall be of the same size and run at approximately the same flow rate.

[**Note:** The result of the product depletion test may fall outside of the applicable test tolerance as specified in Table 1.]

Table T.4. Tolerances for <u>Typical</u> Vehicle-Tank Meters on Product Depletion Tests, Except Milk Meters Refer to T.4. for meters with maximum flow rates not listed.	
Meter-Size <u>Maximum Flow Rate</u>	Maintenance and Acceptance Tolerances
<u>Up to, but not including, 50 mm (2 in) 114 LPM (30 GPM)</u>	<u>1.70 L (104 in³)¹ 0.57 L (0.15 gal) (34.6 in³)¹</u>
<u>From 50 mm (2 in) up to, but not including, 75 mm (3 in) 225 LPM (60 GPM)</u>	<u>2.25 L (137 in³)¹ 1.1 L (0.30 gal) (69.3 in³)¹</u>
<u>75 mm (3 in) or larger 378 LPM (100 GPM)</u>	<u>3.75 L (229 in³)¹ 1.9 L (0.5 gal) (115 in³)¹</u>
<u>758 LPM (200 GPM)</u>	<u>3.8 L (1.0 gal) (231 in³)¹</u>

¹ Based on a test volume of at least the amount specified in N.3.

(Table Added 2005) (**Amended 201X**)

Alternative language for T.4. with larger tolerance for smaller meters.

T.4. Product Depletion Test. – The difference between the test result for any normal test and the product depletion test shall not exceed **one-half (0.5 %) percent of the volume delivered in one minute at the maximum flow rate marked on the meter for meters rated higher than 378 LPM (100 GPM), or six-tenths (0.6 %) percent of the volume delivered in one minute at the maximum flow rate marked on the meter for meters rated 378 LPM (100 GPM) or lower. Tolerances for typical meters are tolerance**-shown in Table T.4. Test drafts shall be of the same size and run at approximately the same flow rate.

[**Note:** The result of the product depletion test may fall outside of the applicable test tolerance as specified in Table 1.]

Table T.4. Tolerances for <u>Typical</u> Vehicle-Tank Meters on Product Depletion Tests, Except Milk Meters <u>Refer to T.4 for meters with flow rates not listed.</u>	
Meter-Size <u>Maximum Flow Rate</u>	Maintenance and Acceptance Tolerances
Up to, but not including, 50 mm (2 in) <u>114 LPM (30 GPM)</u>	<u>1.70 L (104 in³)[†]</u> <u>0.57 L (0.18 gal) (41.6 in³)¹</u>
From 50 mm (2 in) up to, but not including, 75 mm (3 in) <u>225 LPM (60 GPM)</u>	<u>2.25 L (137 in³)[†]</u> <u>1.1 L (0.36 gal) (83.2 in³)¹</u>
75 mm (3 in) or larger <u>378 LPM (100 GPM)</u>	<u>3.75 L (229 in³)[†]</u> <u>1.9 L (0.6 gal) (139 in³)¹</u>
<u>758 LPM (200 GPM)</u>	<u>3.8 L (1.0 gal) (231 in³)¹</u>

¹ Based on a test volume of at least the amount specified in N.3.

(Table Added 2005) (**Amended 201X**)

Background/Discussion: This item was submitted to NEWMA at its 2008 Interim Meeting as an alternative to Item 331-1 (S.5.7. Meter Size) in 2008 Publication 16. It would base the tolerances for the product depletion test on a percentage of the maximum flow rate rather than meter size. Justification provided to NEWMA by the submitter is as follows:

The S&T Committee received a proposal to add new marking requirements to provide inspectors with a basis on which to assess tolerances since the meter size in inches is not currently marked on meters used in VTM systems. This solution would add a new marking requirement non-retroactively which will not solve the problem until the entire fleet of meters presently in use are replaced with new meters. This could take a very long time since VTMs can see many years of service. In addition, the compromise made when this item originally passed did not address the possibility that smaller meters, e.g., down to ¼ in could be mounted on a vehicle and thus subject to these tolerances. Allowing the smallest current tolerance (104 in³) on a ¼-in meter delivering 2 GPM would be 22.5 % relative error for one minute of flow due to air passing through the meter. Even at 20 GPM for a 1-in meter, the relative error only drops to 2.25 %. That seems unconscionable. New York recommends going back to the 0.5 % of 1 minute of flow at the maximum rated flow rate for the meter that was part of the original proposal. The max flow rate must be marked on every meter under current HB 44 requirements and thus the inspector will have the information necessary to correctly apply the tolerance. We further recommend that the table provide tolerances for the common meter sizes which will handle most cases encountered in the field (i.e., 1¼-, 1½-, 2- and 3-inch meters with 30, 60, 100 and 200 GPM respectively).

There may be concern that users will move to larger meter sizes to take advantage of the larger tolerances. We do not think that will happen since these systems cannot deliver much over 100 GPM without damaging storage tanks. In fact most systems we have seen delivering heating oil are actually delivering at less than 80 GPM. If they move to a 200 GPM, 3-inch meter, rated at 40 to 200 GPM, they will then have to meet acceptance tolerances all the way down to 60 GPM which we don't think they can do on a consistent basis. We believe the typical 2-inch system will remain the mainstay of the industry.

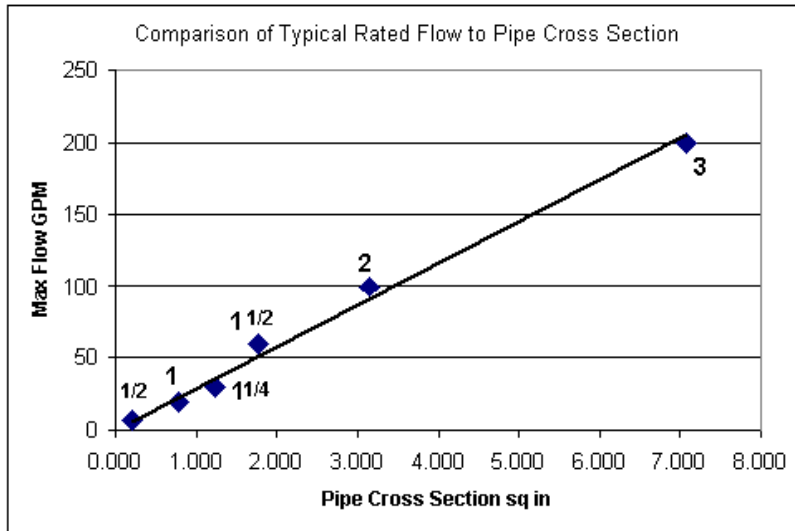
Graphs of the relationship of typical meter ratings to pipe cross section area show that PD flow rates are clearly a function of pipe size. Any tolerance that does not reflect that relationship is fundamentally flawed in our view. For comparison, we have included a graphic comparison of the proposed tolerances.

The submitter also noted the following:

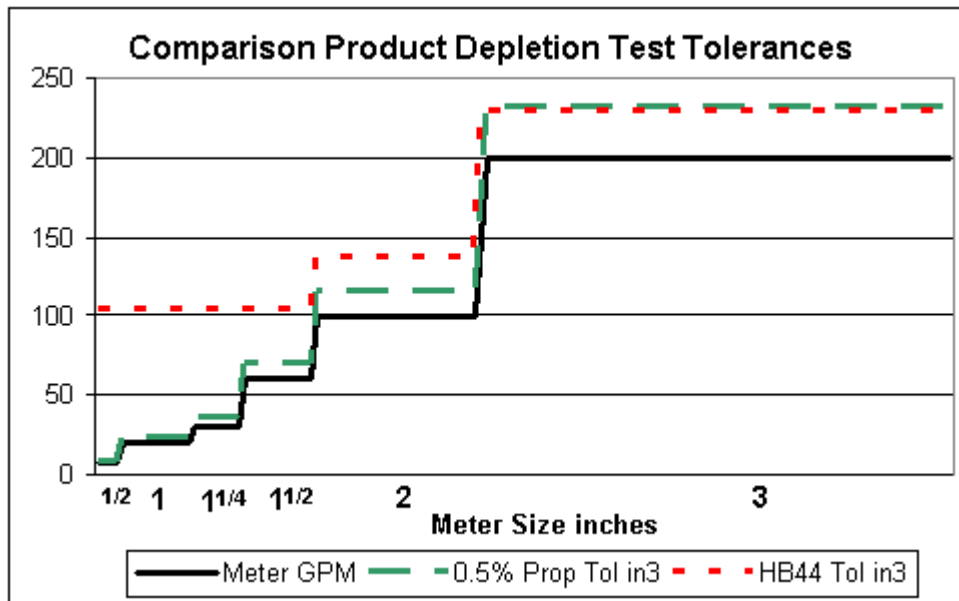
We recognize that the tolerances proposed will reduce the tolerances for meter sizes 2 inch and under. We could support some compromise to recognize diminishing returns on smaller meters and thus allow a slightly

larger tolerance (e.g., 0.6 %) at or below 100 gpm rated flow rate. At 0.6 for a 2 inch (100 gpm) meter the tolerance would be 139 in³, virtually identical to the existing tolerance.

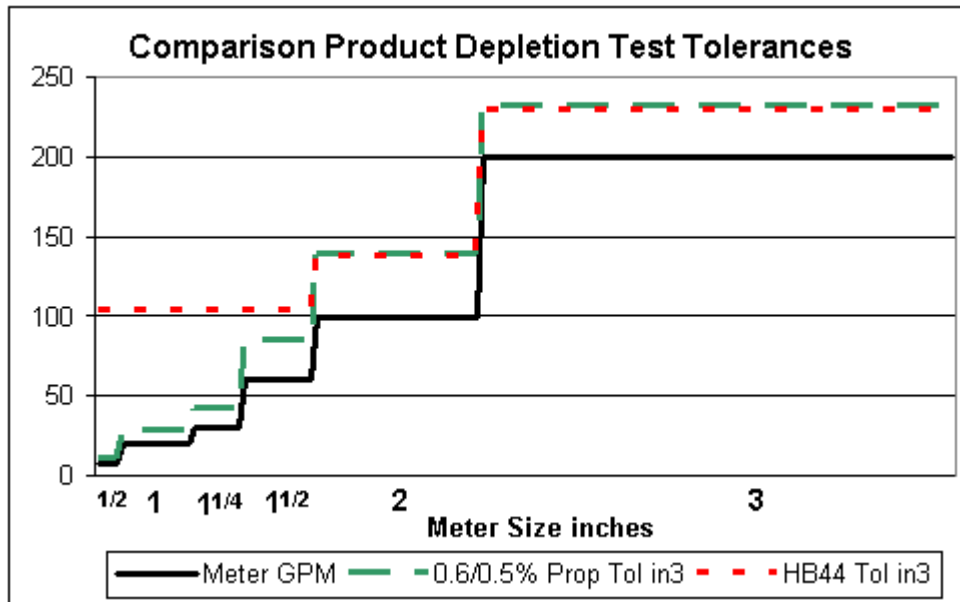
The submitter also provided the following supporting graphics:



Option 1 – 0.5 % across the board:



Option 2 – 0.6 % up to and including 100 gpm and 0.5 % thereafter:



In reviewing this item at its 2008 Interim Meeting, some NEWMA members felt that what is currently in HB 44 is sufficient and did not feel there was a problem determining meter size. Until NEWMA hears further about problems determining meter size from other states it recommends this item be made Informational.

Part 4, Item 1 Farm Milk Tanks: N.5.1. Verification of Master Metering Systems

Source: Central Weights and Measures Association (CWMA)

Recommendation: Amend paragraph N.5.1. as follows:

N.5.1. Verification of Master Metering Systems. – A master metering system used to gauge a milk tank shall be verified before and after the gauging process. A master metering system used to calibrate a milk tank shall be verified before starting the calibration and reverified every quarter of the tank capacity or every 2000 L (500 gal), whichever is greater. A master metering system capable of operating within 25 % of the applicable tolerance in T.3. Basic Tolerance Values needs only be verified before and after the gauging process.

(Added 201X)

Background/Discussion: The CWMA received a proposal at its fall 2008 Interim Meeting to modify paragraph N.5.1. Verification of Master Metering Systems in NIST Handbook 44 Section 4.42. Farm Milk Tanks. USDA provided data suggesting that mass flow meters currently used to test milk tanks would not have to be verified every quarter of the tank capacity, or every 2000 L (500 gal), whichever is greater. The CWMA does not have data that supports that all mass flow meters will perform to the same standard. Based on this information the CWMA recommends this proposal be Informational and is considering the proposal outlined in the recommendation above.

At its fall 2008 Interim Meeting, NEWMA recommended this proposal be Informational. NEWMA forwarded the following additional justification for the proposed change from Mr. Richard Koeberle, Federal Milk Market Administrator:

The use of a mass flow meter has eliminated the variations seen in other types of meters used to calibrate or check farm bulk milk tanks. The reverification of the meter at every quarter of tank capacity adds time and potentially introduces errors by requiring the hose or valves to be moved before the tank is totally filled.

This proposal originated by Tom MacNish from the Cleveland Market Administrator and was presented to the CWMA in September. Mass flow meters have been used extensively in their market with excellent results.

Data submitted with this item is posted on the S&T Committee's web page on the Members Only section of the NCWM website at:

<http://www.ncwm.net/members/index.cfm?fuseaction=st>

Part 5, Item 1 Hydrogen: New Code: 3.3X. Draft Hydrogen Gas-Measuring Devices

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

Recommendation: Review and comment on a DRAFT Hydrogen Gas Measuring Devices Code and modifications to relevant Appendix D – Definitions in NIST Handbook 44 (HB 44) (as outlined in the current USNWG draft found on the USNWG website at www.nist.gov/owm) to address gaseous hydrogen refueling applications.

Discussion: Currently, the U.S. National Work Group (USNWG) for the Development of Commercial Hydrogen Measurement Standards is working to draft a new Hydrogen Gas-Measuring Devices Code and add new and modify existing definitions in Appendix D of NIST Handbook 44. The work to develop the code is an ongoing effort and the USNWG will submit a final draft of the code as soon as its work is complete. The draft code 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, although a draft code was distributed to the community in February 2005. Version 3.1 is provided with this proposal and will receive further review at the August 2008 USNWG meeting. The USNWG is also submitting a corresponding proposal to the L&R Committee that addresses method of sale and engine fuel quality requirements for hydrogen in NIST Handbook 130 (HB 130).

At its 2008 Annual Technical Conference, the WWMA heard comments supporting the work of the USNWG. The WWMA also heard from Kristin Macey (CA DMS) that the draft code has been further amended at the recent meeting of the USNWG. The WWMA agrees that the item remain Developing.

At the 2009 NCWM Interim Meeting, the Committee heard comments from Ed Williams, Director California Division of Measurement Standards supporting this item as a Developing item. The Committee also heard from Kristin Macey, Chairman of the USNWG on Hydrogen Devices Subcommittee, who encouraged those eighteen states who have hydrogen dispensers installed in their jurisdictions to become more actively involved in the USNWG and/or provide input on the draft code. Juana Williams, USNWG technical advisor, thanked those who have participated in the work group's efforts and other NIST-DOE workshops and encouraged participation from the community. Juana also provided an updated copy of the draft code to the Committee and reminded Interim Meeting participants that current information can be found on the NIST WMD website as described below. A copy of the version ("Draft 3.3") provided to the Committee can be found on the Committee's website at: <http://www.ncwm.net/members/index.cfm?fuseaction=st>. Note that the USNWG is actively working on this code and posts updated drafts to their website as they are issued; therefore, readers are encouraged to consult the USNWG's website (see below) for current versions.

More information on the work by the USNWG is available on the NIST WMD website at www.nist.gov/owm under the W&M Resources link to "Developing Commercial Hydrogen Measurement Standards." To comment on this proposal, contact Juana Williams, NIST WMD, at juana.williams@nist.gov, by telephone at (301) 975-3989, by fax at (301) 975-8091 or by postal mail at NIST WMD, 100 Bureau Drive, MS 2600, Gaithersburg, MD 20899-2600.

Appendix B

Comments from the NCWM ATC Steering Committee Members Ross Andersen, Don Onwiler, and Henry Oppermann to the S&T Committee on 330-1 Temperature Compensation for Liquid-Measuring Devices Code

August 2008

COMMENT 1: The term “active” is not used consistently in all references to “automatic temperature compensation.” For example, it appears in paragraph S.2.7.2., but does not appear in paragraph S.1.6.8.

S.1.6.8. Recorded Representations from Devices with Temperature Compensation. – Receipts issued from devices or systems with automatic temperature compensation must include a statement that the volume of the product has been adjusted to the volume in liters at 15.56 °C for liters or the volume in gallons at 60 °F for gallons.

[Nonretroactive as of January 1, 200X]

(Added 200X)

S.2.7.2. Display of Net and Gross Quantity. – A device equipped with active automatic temperature compensation shall indicate or record, both the gross (uncompensated) and net (compensated) volume for testing purposes. It is not necessary that both net and gross volume be displayed simultaneously.

[Nonretroactive as of January 1, 200X]

Don’s Comments: It is reasonable to assume that there may be devices in commerce at some point that have ATC capability, but not activated. The term “active” is used in recognition of this possibility. I suggest amending S.1.6.8. as follows to address the concern raised in this comment.

S.1.6.8. Recorded Representations from Devices with Temperature Compensation. – Receipts issued from devices or systems with automatic temperature compensation activated must include a statement that the volume of the product has been adjusted to the volume in liters at 15.56 °C for liters or the volume in gallons at 60 °F for gallons.

[Nonretroactive as of January 1, 200X]

(Added 200X)

ATC Committee Member Feedback:

Ross’s Comments: I like Don’s wording of S.1.6.8. but that is not going to solve the underlying problem. This requirement is borderline between Specification and User Requirement. Note that the dispenser manufacturer usually provides two face plates where units of measure may differ, since the units are hard printed on firmware and not software selectable. NTEP simply looks at the two face plates and if they comply, the manufacturer has met the requirement. That of course does not mean the device will comply in the field. It remains up to the installer and/or the user to select the right one for their application. My recommendation would be to duplicate the requirement in the UR section, particularly since the use of ATC will be selectable. Otherwise, we are forcing the dispenser manufacturer to build in alpha displays and software control, at considerable cost. How about broadening UR.3.6.1.2. to include indications as follows?

UR.3.6.1.2. Indications, Recorded Representations, Receipts and Bills of Lading

- (a) Indications of volume delivered on a device that is equipped with an active automatic temperature compensator shall be marked with a statement that the volume of the product has been adjusted to the volume in liters at 15.56 °C for liters or the volume in gallons at 60 °F for gallons.

Renumber original (a) and (b) to (b) and (c), respectively.

Henry's Comments: I suggest that we consider the language and approach used in the LPG Code and for wholesale meters in the LMD Code that already address this point. I agree with Ross that user requirements are needed to clarify this situation because RMFDs may be equipped with ATC capability, but it may not be operating in all cases. Hence, the language will have to be modified to address this situation, since both the LPG and LMD codes assume that if a meter is equipped with ATC, then it must be used. Both codes have user requirements that state, "If a device is equipped with a mechanical automatic temperature compensator, ... it shall be connected, operable, and in use at all times." We may have to add the words "once used, it shall be ...". For reference, in the LMD Code, see the paragraphs under S.2.7. and UR.3.6.1.; in the LPG Code see S.2.6., S.4.4., and the paragraphs under UR.2.4.

COMMENT 2: There is a reference to the accuracy requirements for the temperature sensor in paragraph S.2.7.3.; however, there is not a requirement specifying the division size of the temperature sensor.

S.2.7.3. Display of Temperature. – For test purposes, on a device equipped with active automatic temperature compensation, means shall be provided to indicate or record the temperature determined by the system sensor to an accuracy of 0.2 °F.
[Nonretroactive as of January 1, 200X]

Don's Comments: We do not put accuracy requirements in specifications. I wonder if the intent was for a resolution requirement instead of an accuracy requirement. That would make sense to me. Maybe Tina will have some S&T Committee documentation that would disclose the intent. I propose amending the paragraph as follows.

S.2.7.3. Display of Temperature. – For test purposes, on a device equipped with active automatic temperature compensation, means shall be provided to indicate or record the temperature determined by the system sensor to an accuracy of a resolution no greater than 0.2 °F.
[Nonretroactive as of January 1, 200X]

ATC Committee Member Feedback:

Ross's Comments: Don is right on target here. The issue is resolution of the sensor and not the accuracy. I strongly urge the S&T Committee to work on clarifying that the net/gross agreement tolerance is the HB 44 means of ensuring accuracy of the temperature sensor. I was on the S&T Committee when that requirement was added for other ATC systems and that was indeed the purpose. That decision was made on the basis of two important issues. First, verifying the accuracy of a temperature probe installed in a dispenser to accuracy better than 0.5 F is almost impossible. That's tough enough in a lab environment. Second, the temperature probe is only one part of the compensation process. By validating the outcome, we have not only verified the probe accuracy but also verified that the API gravity or CoE is correctly programmed and the software program making the correction is functioning correctly. At the Type Evaluation level this may pose some interesting problems. NTEP will have to evaluate over temperature ranges large enough to cover reasonable use. That includes Arizona and Alaska. Measurement Canada used a probe simulator to do that. The other issue is response time and personally I think this is only a minor issue. Because the system is typically pulsing 0.001 gallons for RMFDs and the system can poll the temperature system several times a second, the probe need only react reasonably fast to still maintain 0.1 % agreement gross/net.

Henry's Comments: I agree with Don and Ross; the reference should be to resolution. I agree with Ross that the sensor is part of the ATC system and should not be tested separately.

COMMENT 3: Should a corresponding reference to the accuracy requirement for the temperature sensor be included in the "Tolerances" section of the code?

Don's Comments: It is the responsibility of the inspector to determine if the system provides measurements within performance tolerances. If the device fails to do that, it may be because the temperature sensor in the

delivery system is faulty, but it is not the inspector's responsibility to determine cause of failure. By modifying S.2.7.3. as recommended above, I think this question is no longer relevant.

ATC Committee Member Feedback:

Ross's Comments: I agree 100 % with Don. The issue is moot when you change accuracy to resolution. NTEP can deal with this within the 0.1 % agreement tolerance and the specific test methods they choose.

Henry's Comments: I agree with Don and Ross.

COMMENT 4: Is there an expectation that there will be a field test of the temperature sensor? If so, there is not a corresponding test note to indicate this, nor is it clear how the test will be done in the field.

Don's Comments: I do not foresee inspectors testing the accuracy of the temperature sensor in the delivery system. If the sensor is faulty, it should be reflected in the results of the test of the measuring system.

ATC Committee Member Feedback:

Ross's Comments: See Comment 1. Inspectors should not be even thinking about verifying probe accuracy.

Henry's Comments: I agree with Don and Ross.

COMMENT 5: A user requirement is needed to specify that, if a single business offers products for sale on the basis of a temperature-compensated volume, all devices in that business shall be equipped with automatic temperature-compensating systems. [**Note:** During the Committee's work discussions, it was noted that Canada permitted a phase-in period based on product or product grades.]

Don's Comments: While this is really a method of sale issue, it may be important to provide such guidance in HB 44 as well as HB 130. All states adopt HB 44 in one form or another, but not all adopt the HB 130 Method of Sale Regulation. Still, I think it is best to let the L&R Committee agenda item make the determinations on this matter and then amend HB 44 to reflect a uniform requirement.

ATC Committee Member Feedback:

Ross's Comments: I agree that this needs to be worked out with L&R, particularly in terms of a phase-in process. I do think it is an important concern when we are looking at dispensers within the single station.

Henry's Comments: I agree with Don and Ross. A consistent approach across the country is needed. I believe that if a station uses ATC on some dispensers, it should be required to be used on all of the dispensers within the station to reduce the potential for confusion.

COMMENT 6: There is concern about using 15.56 °C rather than 15 °C. In addition to being different from use in international arenas, including Canada, the bulk of the devices in the field, including the retail motor fuel dispensers and the temperature standards used by field officials, do not have the capability to display temperature to two decimal places.

Don's Comments: When the Committee deliberated on this item, we noted three things that I believe are critical in the decision. 1) The wholesale system in the U.S. uses 60 °F. 2) Gallon provers/test measures are calibrated to 60 °F. 3) 60 °F and 15 °C are not equivalent. The difference is significant and it was necessary to carry the conversion out two decimal places to ensure clarity that 15 °C is not acceptable.

Our intent was to set the U.S. standard temperature. Our intent was not for 15.56 °C to be used. Manufacturers will use 60 °F. Including the metric equivalent is consistent with the practice implemented by NIST years ago to always do so in our model standards. I recommend we stay the course on this one and recognize 15.56 °C as the metric equivalent to the U.S. standard of 60 °F.

ATC Committee Member Feedback:

Ross's Comments: I agree with Don. The issue here is that 1 gallon at 60 °F has to equal 3.785412 liters at 15.56 °C in order to maintain the relative size of units. That will not be true if we use 15 °C for liters because the reference will be different. I believe the Steering Committee considered the enormous cost to change the entire U.S. infrastructure to a 15 °C (59 °F) reference as the alternative and found that that was not feasible.

Henry's Comments: I have to disagree with Don and Ross on this point. If the United States were using the metric system, we should and would use 15 °C. Due to the coefficients of expansion of steel and stainless steel, there is not much difference in the capacity of metal volume standards whether the reference temperature is 60 °F or 15 °C. There is a difference of 0.07 % in the volume of gasoline based upon 60 °F or 15 °C. If the volume measurement is expressed in gallons, then businesses should use 60 °F as the reference temperature. If the volume measurement is in liters, then the reference temperature should be 15 °C. I don't think that we want the United States to be out of step with the rest of the world if and when we change to the SI. This is a point on which we should get input from the manufacturers and oil companies, who routinely deal in the international market.

Ross's Counterargument: The 15 °C vs. 60 °F issue is going to be difficult. Henry makes some very valid points but I think misses the most important. We have a significant infrastructure that is tied to gallon units and a 60 °F reference. I find it highly unlikely that this will change in our lifetimes. In addition, if I understand it correctly, using the 15 °C would require anyone who wishes to change to liters at 15 °C to deliver 0.07 % more product for the equivalent volume in gallons at 60 °F. That is simply the physics, because 15 °C is 0.56 °C colder than 60 °F. All of a sudden you have lost equivalency that 3.785412 liter = 1 gallon and replaced it with a new factor that ~3.788 liters of gasoline = 1 gallon when both are at 60 °F (15.56 °C). Until the U.S. is willing to change its entire infrastructure to liters and retool the equipment for a 15 °C reference, I cannot support that move as cost beneficial in any sense. It just doesn't make any sense. Also consider that choosing the 15 °C reference actually discourages conversion to liters since in the conversion you would be placed at a competitive disadvantage to those selling in gallons. That 0.07 % increased delivery is certainly not trivial in this large-volume business. It's more than the typical 0.05 % accuracy target at terminal meters. I like liters and don't think we should enact laws and regulations that put conversion at a competitive disadvantage. I welcome additional input from the industry on this subject and thought that we got that at the Chicago meeting before making the decisions to stay with 15.56 °C as the reference.

COMMENT 7: Devices currently in the field may not have the capability to automatically sense when the device is or is not in the automatic temperature-compensating mode with respect to the requirement to identify volumes as "corrected" volumes on printed indications.

Don's Comments: It is my understanding that no devices have been installed in the U.S. marketplace with ATC capability. This is at least true with Gilbarco according to Gordon Johnson. Even if this is incorrect, I believe it is imperative to require this disclosure to the consumer, especially if there is a temporary or permanent permissive method of sale. I think the requirement should remain.

ATC Committee Member Feedback:

Ross's Comments: This goes back to the user requirement UR.3.6.1.2. That requirement already exists for wholesale devices and should absolutely be extended to retail. Since it is a user requirement, the manufacturer may help meet it, but third party consoles and registers are dominant in the market and thus it must remain at the user level. I am not too concerned about the manual nature of this process since it will typically not happen more than once. It will happen when the system is initially changed from gross to net. After that we should not see any further changes back to gross.

Henry's Comments: While printed receipts should (must) identify when the volume is temperature-corrected, I don't believe that it is necessary to require the dispenser or metering system to automatically detect when the ATC is operating or not. There are many meter parameters in Handbook 44 that must be selected at the time of installation. Selecting the proper message for printers with ATC operating and use is just one more metrological parameter. Neither the LPG or LMD (wholesale meter) Codes require that the operating condition

of the ATC be automatically detected for printing. We allow decals to be applied to the display panel of the dispenser, which requires a “mechanical” action. We should not require that the printer automatically detect the operating status of the ATC.

COMMENT 8: Although a corresponding paragraph already appears in Section 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices Code, the language in paragraph UR.3.6.1.3. needs clarification.

UR.3.6.1.3. Temperature Determination. – Means for determining the temperature of measured liquid in an automatic temperature-compensating system shall be so designed and located that, in any “usual and customary” use of the system, the resulting indications and/or recorded representations are within applicable tolerances.

(Added 200X)

Don’s Comments: I can only speculate that the intent was to have the thermometer well located in a position to ensure there is not a significant difference in product temperature at the thermometer well versus the metering chamber. Otherwise, the net indicated or recorded delivery may fall outside the tolerances. I agree that, whether I interpreted this correctly or not, it is poorly worded and can be improved upon – any suggestions?

ATC Committee Member Feedback:

Ross’s Comments: I believe that Measurement Canada specified a fixed distance along the flow path either before or after the measuring element. The approach taken here is to leave that to the manufacturer to ensure the system can maintain compliance with tolerances. I am okay with this since the manufacturers have already dealt with it under the Canadian system and it works. I can’t imagine they will use some other system here.

Henry’s Comments: I don’t see a need to clarify UR.3.6.1.3. Ross probably remembers as he refers to the S&T discussions in his remarks under Comment 2 that the S&T purposely chose not to specify the distance between the thermometer well and the meter temperature sensor. The device manufacturer had to pass the performance requirement on the ATC system regardless of where the thermometer well is installed. We should state this simply as a performance requirement and allow the manufacturers to decide how best to meet the requirement. Whenever possible, W&M should not tell manufacturers how to design their equipment.

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Appendix C

Water Meter Correspondence

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101 REGENCY PARKWAY
MANSFIELD, TX 76063
817-842-8000
FAX 817-842-8100

January 7, 2009

To Whom It May Concern:

Please consider this letter as recognition of Master Meter, Inc. full support for the three agenda items for consideration by the S&T Committee being presented by the water meter manufacturers led by George DeJarlais and Andre Noel. These three items are:

Item 1 - Water Meters (Sec. 3.36): V S.1.1.3 Value of the Smallest Unit labeled as

Item 336-1.

Item 2 – Amending T.1.1. (Repeatability) labeled as

Item 336-2.

Item 3 - N.3. Test Drafts and N.4. Testing Procedures labeled as

Item 360-2

Please feel free to contact me for any additional information needed at 412-847-2097 or at Cell Phone 412-551-2663.

Thank you.

Sincerely,

Ron Koch

Ron Koch
Director of Business Development
Master Meter, Inc.



January 7, 2009

To Whom It May Concern:

A representative from Sensus Metering Systems will not be able to attend the conference, but please accept this letter giving our full support to the three agenda items being considered by the S&T Committee as presented by the water meter manufacturers led by George DeJarlais, Andre Noel and Alex Watson.

These three items are:

Item 1 - Water Meters (Sec. 3.36): V S.1.1.3 Value of the Smallest Unit labeled as Item 336-1.

Item 2 – Amending T.1.1. (Repeatability) labeled as Item 336-2.

Item 3 - N.3. Test Drafts and N.4. Testing Procedures labeled as Item 360-2.

Please feel free to contact me for any additional information at 724-430-4059 or at Cell Phone 412-576-7338.

Thank you.

Regards,

Scott Swanson
Manager, Customer Quality & Engineering Support
Sensus Metering Systems

Appendix D

Jeff Humphrey’s Letter and Comments on 2008 Developing Item Part 4, Item 1 Water Meters

September 2, 2008

TO: Steven Cook, NIST, Technical Advisor
Specifications and Tolerances Committee
National Conference on Weights and Measures

FROM: Jeff Humphreys
Deputy Director – Weights and Measures Bureau

SUBJECT: S&T Committee 2008 Report, Specifically Item 360-2, Part 5, Item 3: Water Meters

This letter is intended to clarify comments made concerning water meter tolerances during the NCWM 2008 meeting open hearing regarding a proposal to amend HB 44 Section 3.36. T.1. Appendix A, Part 5, Item 3, in the S&T Committee report describes a Developing Item proposal to either eliminate HB 44 repeatability requirements, or amend HB 44 Section 3.36., Tables N.4.1. and N.4.2. by increasing test draft sizes. We believe that the results of numerous water meter tolerance tests conducted on this Department’s test bench at our South Gate facility will show that the proposed increases in test draft sizes are unnecessary, and could result in substantial increases in costs to jurisdictions performing these tests.

In the “Background/Discussion” section, the proponents argue that due to uncertainties associated with reading individual graduations, additional water volume is required to be run through the meters in order to obtain a fair test of their accuracy. In order to determine the truth to this claim, especially to the tests conducted at the minimum flow rate, the Department conducted tests at both the 5 gallon test draft size, and at the 10 gallon draft size for those 5/8” meters that failed to meet tolerance at 5 gallons. The accompanying chart summarizing our tests show that substantial numbers of multi-jet water meters that failed their 5 gallon slow-flow tests continued to fail the 3 % tolerance requirement when tested again at 10 gallons.

The enclosed information also shows that very few positive displacement meters fail tolerance tests at any of the current HB 44 flow rates. The claim has been made that the tests as currently being conducted have seriously impacted meter sales for several water meter manufacturers. Our tests show that manufacturers of positive displacement meters should not be negatively impacted by being tested at the current established flow rates.

The Department has received a large number of 5/8” meters for testing over the last several years. The proposed requirement to increase test draft sizes would substantially increase the amount of time necessary to test these meters at the three flow rates (from approx. 30 minutes to approx. 90 minutes). If evidence supported the necessity to conduct these tests, the Department would certainly adopt these larger draft sizes. We believe however, that the evidence shows that larger draft sizes are unnecessary. Such tests would increase costs to the Department, and these increased costs would ultimately have to be borne by all owners of water sub-meters.

The proposal appears to be advanced by a manufacturer of multi-jet meters. Our suggestion to that manufacturer of these meters would be to look to improve the quality of their product.

KEF:RKL:JNH;jh
Enclosure

Water Meter Test Results

January 2008 - June 2008

Minimum Flow Rate (¼ GPM) – 5 Gallon vs. 10 Gallon

5/8 in Positive Displacement Meters

Minimum Rate Tolerances: 1.5 % Overregistration, 5 % Underregistration

Failure Percentages		
	5 Gallon	10 Gallon
Meter #1	-13.0 %	-13.0 %
Meter #2	-6.6 %	-7.1 %
Meter #3	-83.6 %	-87.7 %

(“-” indicates underregistration, “+” indicates overregistration)

*All three meters failed by underregistration on both 5 gallon and 10 gallon tests.

Water Meter Test Results

January 2008 - July 2008

Minimum Flow Rate (1/4 GPM) – 5 Gallon vs. 10 Gallon

5/8 in Multi-Jet Meters

Minimum Flow Rate Tolerances: 3 % Overregistration, 3 % Underregistration

*Meters #3, #9, #10, #19, #21, #22, #23, #26, and #27 failed on the 5 gallon test and passed on the 10 gallon test.

The rest of the meters failed both 5 gallon and 10 gallon tests. All meters except two (#21 and #27) were underregistering.

Failure Percentages			
“-” indicates underregistration, “+” indicates overregistration			
	Error 5 gal	Error 10 gal	% Difference
Meter #1	-3.78 %	-3.38 %	-0.40 %
Meter #2	-3.92 %	-3.30 %	-0.62 %
Meter #3	-3.06 %	-2.98 %	-0.08 %
Meter #4	-3.80 %	-3.71 %	-0.09 %
Meter #5	-3.44 %	-3.47 %	0.03 %
Meter #6	-4.28 %	-3.73 %	-0.55 %
Meter #7	-4.80 %	-4.28 %	-0.52 %
Meter #8	-5.20 %	-4.60 %	-0.60 %
Meter #9	-3.54 %	-3.00 %	-0.54 %
Meter #10	-3.30 %	-2.49 %	-0.81 %
Meter #11	-4.48 %	-3.49 %	-0.99 %
Meter #12	-3.88 %	-4.08 %	0.20 %
Meter #13	-3.32 %	-3.26 %	-0.06 %
Meter #14	-7.34 %	-5.87 %	-1.47 %
Meter #15	-4.10 %	-3.13 %	-0.97 %
Meter #16	-4.38 %	-3.61 %	-0.77 %
Meter #17	-6.34 %	-5.57 %	-0.77 %
Meter #18	-4.78 %	-4.05 %	-0.73 %
Meter #19	-3.50 %	-2.73 %	-0.77 %
Meter #20	-4.34 %	-3.65 %	-0.69 %
Meter #21	3.20 %	0.82 %	2.38 %
Meter #22	-17.40 %	-1.78 %	-15.62 %
Meter #23	-3.80 %	-2.20 %	-1.60 %
Meter #24	-10.20 %	-26.68 %	16.48 %
Meter #25	-3.68 %	-3.54 %	-0.14 %
Meter #26	-3.12 %	-0.92 %	-2.20 %
Meter #27	3.60 %	0.81 %	2.79 %
Meter #28	-7.68 %	-12.95 %	5.27 %
<i>Average</i>	<i>-4.45 %</i>	<i>-4.32 %</i>	<i>-0.14 %</i>
<i>Std Dev</i>	<i>0.036461744</i>	<i>0.049867807</i>	<i>0.0460693</i>

WATER METER TEST RESULTS: JANUARY '08 - JULY '08																
Make	Model	Size	Lots	Meters Tested	Meters Passed	Meters Failing Tolerances within Passed Lots					Misc. Fails	Meters Failing Tolerances within Failed Lots				
						Min. Flow	Int. Flow	Max. Flow	Total Fails	Min. Flow		Int. Flow	Max. Flow	Total Fails	Misc. Fails	
Arad		5/8 in	1	2	0									2	2	
Amco	C-700	5/8 in	16	183	174	9			9							
Amco	C-700	3/4 in	3	22	22											
Amco	C-700	1 in	3	42	42											
Badger	RCDL 25	5/8 in	21	171	165	6			6							
Kent	C-700	5/8 in	1	2	1		1		1							
Neptune	T-10	5/8 in	65	749	655	26	9	1	42	6 mech fails		4		52	34 mech fails	
Master Meter	USA 140 F	5/8 in USG HOT	51	875	765	5	4	8	19	2		11	37	91	7 NoS/N	
Master Meter	MM3C	5/8 in	3	39	26									13		
Master Meter	MM4	3/4 in	3	28	23				1					4		
Master Meter	MM5C	1 in USG COLD	12	337	262	5		6	53			1	21	22		
Master Meter	FAM	5/8 in USG COLD	29	575	466	3	15		21			17	1	88		
Master Meter	FAM	3/4 in	1	14	3							11		11		
Performance	PPD	5/8 in	1	1	1											

PASSING RATES FOR METERS TESTED: JANUARY '08 - JULY '08															
	Arad	Amco C-700 5/8 in	Amco C-700 3/4 in	Amco C-700 1 in	Badger RCDL25 5/8 in	Kent C-700 5/8 in	Neptune T-10 5/8 in	USA 140CF 5/8 in	Master Meter MM3C 5/8 in	Master Meter MM4 3/4 in	Master Meter MM5 C 1 in USG	Master Meter FAM 5/8 in USG	Master Meter FAM 3/4 in	Performance PPD 5/8 in	
% passed of total tested for each model	0	95	100	100	96	50	87	87	67	82	78	81	21	100	
Lots passed	0	13	3	3	21	1	59	27	0	2	7	14	0	1	
Lots failed	1	3	0	0	0	0	6	24	3	1	5	15	1	0	

S&T Committee 2009 Interim Report
 Appendix D – Jeff Humphrey’s Letter and Comments

(Manu A HB 44 data)

1/2/08 Summary

Accuracy and Repeatability tests




Qty 4 -- 5/8 x 3/4 PD meters (new), data from Manufacturer "A", re: HB 44, 3.36

Meter #	Draft size	Flow Rate	% Registr	% Registr	Repeatability
1	5 gallons	1/4 gpm	99.2	99.8	0.6%
2	5 gallons	1/4 gpm	101.4	101.0	0.6%
3	5 gallons	1/4 gpm	101.4	98.0	3.4%
4	5 gallons	1/4 gpm	98.4	102.8	4.4%
Average			100.1	100.4	Ave
Std Dev			1.5	2.0	2.3% Repeat

Meter #	Draft size	Flow Rate	% Registr	% Registr	Repeatability
1	10 gallons	1/4 gpm	99.7	100.4	0.7%
2	10 gallons	1/4 gpm	100.8	101.0	0.2%
3	10 gallons	1/4 gpm	99.7	100.0	0.3%
4	10 gallons	1/4 gpm	100.4	100.2	0.2%
Average			100.2	100.4	Ave
Std Dev			0.5	0.4	0.4% Repeat

Meter #	Draft size	Flow Rate	% Registr	% Registr	Repeatability
1	10 gallons	2 gpm	100.5		
2	10 gallons	2 gpm	101.0		
3	10 gallons	2 gpm	100.8		
4	10 gallons	2 gpm	100.9		
Average			100.8		
Std Dev			0.2		

Meter #	Draft size	Flow Rate	% Registr	% Registr	Repeatability
1	10 gallons	10 gpm	100.5	100.6	0.10%
2	10 gallons	10 gpm	101.0	100.7	0.30%
3	10 gallons	10 gpm	100.8	100.6	0.20%
4	10 gallons	10 gpm	100.9	100.5	0.40%
Average			100.8	100.6	Ave
Std Dev			0.2	0.1	0.3% Repeat

-  Test data results fail to meet the HB44 repeatability requirements
-  Test data results fail to meet the HB44 accuracy requirements
-  Test data results fail to meet manufacturer's internal controls for accuracy




Comments: -- a 5-gallon draft for the 1/4 gpm test results in 2-of-4 meters failing for repeatability
 -- a 5-gallon draft for the 1/4 gpm test results in 1-of-8 individual tests failing for accuracy vs. HB 44 requirements (and 2 additional failures relative to manu internal controls)
 -- moving to a 10-gallon draft for the 1/4 gpm test results in no such failures (but note that the repeatability range may increase if tests are done three times instead of twice)

19 Sep. '08 (0919 manu C HB 44 addition 2008)

Manufacturer "C" additional testing, new 5/8 x 7-1/2 PD meters, 0908 "68" test series

- tested 18-19 September 2008
- meters fitted with standard gallon registers (10-gallon test circle)
- after purging all air, accuracy tested only at the minimum flow (low flow) rate of 1/4 gpm

Background: Water meter manufacturers contend that test drafts in Handbook 44, Section 3.36, when smaller than those in AWWA M6, are too small for standard accuracy tests. Manufacturers further contend that test drafts, even if harmonized with M6, are in some cases too small to be used in enforcing current Handbook 44 repeatability requirements of 0.6% at maximum and intermediate rates, and 1.3% at minimum rate.

-  -- individual test result fails to meet HB 44 accuracy tolerance limits
-  -- individual test result fails to meet manufacturer's internal control limits
-  -- range in accuracy results fails to meet HB 44 repeatability requirement

Meter Ident	Accy, 1/4 gpm x 5 gallons			3-run range	Accy, 1/4 gpm x 10 gallons			3-run range
	Run 1	Run 2	Run 3		Run 4	Run 5	Run 6	
68-a	99.80	97.42	100.23	2.81	100.00	99.89	99.56	0.44
68-b	101.01	101.26	100.59	0.67	99.60	99.79	99.76	0.19
68-c	100.41	99.26	99.79	1.15	99.40	99.29	99.56	0.27
68-d	99.62	99.79	102.20	2.58	99.80	99.79	99.56	0.24
68-e	101.39	102.77	99.82	2.95	99.40	99.99	100.06	0.66

Comments -- for the 5-gallon draft, 3-of-5 meters have repeatability ranges beyond HB 44 tolerances
 -- for the 5-gallon draft, 2-of-15 individual accuracy test results fail to meet HB 44 tolerances (in addition, 4 of the remaining 13 individual tests fail to meet the manufacturer's internal control limits)
 -- after switching to a 10-gallon draft, accuracy and repeatability failures were not seen

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 Appendix D – Jeff Humphrey’s Letter and Comments

21 Jan. '08 (0121 manu C HB 44 2008)

TESTING IN SUPPORT OF PROPOSED CHANGES TO HANDBOOK 44 DRAFT SIZES, FOR JANUARY 2008 DISCUSSIONS WITH NCWM S&T COMMITTEE

Manufacturer "C" testing, new 5/8 x 7-1/2 meters, "0108" test series
 -- tested 14 and 15 January 2008, engineering lab,
 -- meters fitted with standard gallon registers (10-gallon test circle)



Accy, 15 gpm x 50 gallons, three runs

Meter Ident	Summary, results of individual runs	3-run range
a	All 3 meet tolerances	0.11
b	All 3 meet tolerances	0.27
c	All 3 meet tolerances	0.07
d	All 3 meet tolerances	0.18
e	All 3 meet tolerances	0.21
average range :		0.17

Background: Water meter manufacturers contend that test drafts in Handbook 44, Section 3.36, when smaller than those in AWWA M6, are too small for standard accuracy tests. Manufacturers further contend that test drafts, even if harmonized with M6, are in some cases too small to be used in enforcing current Handbook 44 repeatability requirements of 0.6% at maximum and intermediate rates, and 1.3% at minimum rate.

Accy, 2 gpm x 10 gallons, three runs

Meter Ident	Summary, results of individual runs	3-run range
a	All 3 meet tolerances	0.69
b	All 3 meet tolerances	0.61
c	All 3 meet tolerances	0.31
d	All 3 meet tolerances	0.62
e	All 3 meet tolerances	0.69
average range :		0.58

 -- range in accuracy results fails to meet repeatability requirement
 -- note individual results fail to meet accuracy tolerance limits

Accy, 1/4 gpm x 5 gallons, three runs

Meter Ident	Summary, results of individual runs	3-run range
a	2 of 3 meet tolerances	1.14
b	All 3 meet tolerances	0.58
c	2 of 3 meet tolerances	2.62
d	All 3 meet tolerances	0.33
e	2 of 3 meet tolerances	1.31
average range :		1.20

Accy, 1/4 gpm x 10 gallons, three runs

Summary, results of individual runs	3-run range	
All 3 meet tolerances	0.61	
All 3 meet tolerances	1.14	
All 3 meet tolerances	0.37	
All 3 meet tolerances	0.57	
All 3 meet tolerances	0.25	
average range :		0.59

Accy, 1/4 gpm x 20 gallons, three runs

Summary, results of individual runs	3-run range	
All 3 meet tolerances	0.16	
All 3 meet tolerances	0.97	
All 3 meet tolerances	0.95	
All 3 meet tolerances	0.65	
All 3 meet tolerances	0.84	
average range :		0.71

- Overview:
- a- In fifteen individual accuracy tests at low flow into a 5-gallon draft (five different meters), three accuracy failures were seen. When the test draft was increased to 10 gallons, no accuracy failures were seen at low flow.
 - b- In testing five meters for repeatability at low flow into a 5-gallon draft, two of five failed for repeatability. When the test draft was increased, repeatability failures were eliminated, and the repeatability ranges were cut in half.
 - c- In testing five meters for repeatability at the intermediate flow into a 10-gallon draft, four of five failed for repeatability.

(Manu D HB 44 data) **RTR 20080109112916** 1/18/2008
 Repeatability Test (tested **twice** for each rate/draft combination -- additional variation expected if
 meters had instead been tested **three** times at each rate as per HB 44)

Qty 4 - 5/8" x 3/4" PD meters (new), data from Manufacturer "D", re: HB 44, 3.36

Meter #	Volume	Flowrate	Run #1 % Registered	Run#2 Registered	%Repeatability
1	5 Gallons	.25 gpm	97.90	99.90	2.00
2	5 Gallons	.25 gpm	101.70	99.90	1.80
3	5 Gallons	.25 gpm	99.10	100.50	1.40
4	5 Gallons	.25 gpm	96.30	100.70	4.4
Average			98.75	100.25	Average
Std. Dev.			2.28	0.41	2.40 Repeatability


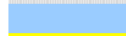

Meter #	Volume	Flowrate	% Registered	Registered	Repeatability
1	10 Gallons	.25 gpm	99.30	99.60	0.30
2	10 Gallons	.25 gpm	99.40	99.00	0.40
3	10 Gallons	.25 gpm	99.20	99.40	0.20
4	10 Gallons	.25 gpm	99.20	99.20	0.00
Average			99.28	99.30	Average
Std. Dev.			0.10	0.26	0.23 Repeatability

Meter #	Volume	Flowrate	% Registered	Registered	Repeatability
1	10 Gallons	2 gpm	101.50	100.70	0.8
2	10 Gallons	2 gpm	100.90	100.90	0.00
3	10 Gallons	2 gpm	100.70	101.20	0.50
4	10 Gallons	2 gpm	100.40	100.80	0.40
Average			100.88	100.90	Average
Std. Dev.			0.46	0.22	0.42 Repeatability

Meter #	Volume	Flowrate	% Registered	Registered	Repeatability
1	40 Gallons	2 gpm	101.30	100.90	0.40
2	40 Gallons	2 gpm	101.20	100.80	0.40
3	40 Gallons	2 gpm	101.40	101.10	0.30
4	40 Gallons	2 gpm	101.30	100.70	0.60
Average			101.30	100.88	Average
Std. Dev.			0.08	0.17	0.43 Repeatability

Meter #	Volume	Flowrate	% Registered	Registered	Repeatability
1	50 Gallon	15 gpm	100.10	100.00	0.10
2	50 Gallon	15 gpm	99.90	99.80	0.10
3	50 Gallon	15 gpm	99.80	99.70	0.10
4	50 Gallon	15 gpm	100.10	99.90	0.20
Average			99.98	99.85	Average
Std. Dev.			0.15	0.13	0.12 Repeatability

Meter #	Volume	Flowrate	% Registered	Registered	Repeatability
1	100 Gallon	15 gpm	100.00	100.00	0.00
2	100 Gallon	15 gpm	99.80	99.80	0.00
3	100 Gallon	15 gpm	99.80	99.70	0.10
4	100 Gallon	15 gpm	100.00	99.90	0.10
Average			99.90	99.85	Average
Std. Dev.			0.12	0.13	0.05 Repeatability

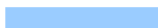
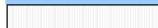
 -- range in accuracy results fails to meet HB 44 repeatability requirements
 -- individual accuracy result fails to meet HB 44 accuracy requirements
 -- individual accuracy result fails to meet manufacturer's internal controls for accuracy requirements

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22 Jan. 2008 (Manu E HB 44 data)

Repeatability test data for quantity six 5/8x3/4 PD meters from Manufacturer "E"
 (also, see note regarding accuracy test failures for some of the individual 5-gallon drafts at 0.25 gpm)
 Meters fitted with US gallon registers
 Each flow test repeated 3 times for each test draft volume.
 Range calculated by subtracting the lowest accuracy from the highest accuracy for each meter

Flow rate (gpm)	15		2		0.25			
Volume (gal)	100	50	40	10	20	10	5	Meter
3-Run Range	0.05	0.08	0.37	0.75	0.20	0.90	1.30	1
	0.05	0.10	0.25	1.00	0.30	1.15	0.80	2
	0.02	0.02	0.40	1.30	0.40	1.05	1.10	3
	0.04	0.04	0.17	1.15	0.15	1.15	0.70	4
	0.04	0.04	0.52	1.35	0.30	0.90	2.70	5
	0.04	0.06	0.47	0.90	0.30	0.45	2.10	6
Average Range	0.04	0.06	0.37	1.07	0.28	0.93	1.45	

 -- range in accuracy results fails to meet HB 44 repeatability requirement
 -- range in accuracy results fails to meet HB 44 repeatability requirement
AND one of three individual accuracy test results fails to meet HB 44 accuracy tolerance limits

Comments:

- for the 10-gallon draft at 2 gpm, 6-of-6 meters have repeatability ranges beyond HB 44 tolerances
- when the 2 gpm test instead uses a 40-gallon draft, all meters comply with the HB 44 repeatability tolerances (and average repeatability range decreases by a factor of three)
- for the 5-gallon draft at 0.25 gpm, 2-of-6 meters have repeatability ranges beyond HB 44 tolerances (and an additional meter has a repeatability range at the upper limit of HB 44 tolerances)
- also for the 5-gallon draft at 0.25 gpm, 2-of-18 individual accuracy test results fail to meet HB 44 tolerances
- when the 0.25 gpm test instead uses a 10-gallon draft, all individual accuracy test results meet HB 44 tolerances (and repeatability ranges decrease slightly, on average)
- when the 0.25 gpm test instead uses a 20-gallon test draft, average repeatability ranges decrease by a factor of five, relative to 5-gallon test drafts (and by a factor of 3, relative to 10-gallon test drafts)

Professional Development Committee (PDC) Interim Report

Ross Andersen, Chairman
New York Weights and Measures
Albany, New York

Reference
Key Number

400 INTRODUCTION

The Professional Development Committee (Committee) submits its Interim Report for consideration by the National Conference on Weights and Measures (NCWM). This report contains the items discussed and actions proposed by the Committee during its Interim Meeting in Daytona Beach, Florida, January 11 - 14, 2009.

Table A identifies the agenda items in the Report by reference key number, item title, and page number. A voting item is indicated with a “V” after the item number. An item marked with an “I” after the reference key number is an informational item. An item marked with a “D” after the reference key number is a developing item. The developing designation indicates an item has merit; however, the item was returned to the submitter for further development before any action can be taken at the national level. Table B lists the appendices to the agenda.

Table A
Index to Reference Key Items

Reference Key Number	Title of Item	Page
400	INTRODUCTION	1
401	EDUCATION	2
401-1	I National Training Program (NTP).....	2
401-2	I Create a Curriculum Plan	5
401-3	D Instructor Improvement	6
401-4	D Certification.....	7
401-5	D Recommended Topics for Conference Training.....	8
402	PROGRAM MANAGEMENT	9
402-1	I Safety Awareness	9
402-2	D PDC Publication	10

Table B
Appendices

Appendix	Title	Page
A	NCWM Curriculum Work Plan.....	A1
B	Model Professional Development Training and Certification Standards Statute for Inspectors and Sealers of Weights and Measures (Legislative Model).....	B1

Details of All Items
(In Order by Reference Key Number)

401 EDUCATION

401-1 I National Training Program (NTP)

Source: Carryover Item 401-1 (This item originated from the Committee and first appeared on its agenda in 2003.)

Background: For complete background information, see the PDC page of the NCWM website, www.ncwm.net/members.

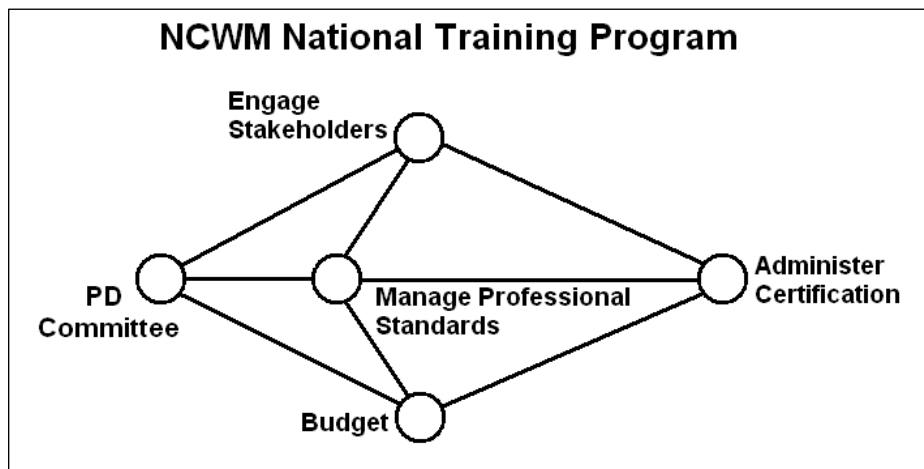
Discussion: The PDC encourages each regional association to dedicate a portion of their Annual Meeting to the National Training Program (NTP).

During the 2008 Interim Meeting, the Committee discussed the Western Weights and Measures Association's (WWMA) suggestion to establish an action plan and timeline. The Committee has developed an NTP, Critical Component Analysis, and an action plan of the components of the NTP. The Committee presents a draft of this document below.

**National Conference on Weights and Measures
National Training Program
Critical Component Analysis
DRAFT, February 21, 2008**

The Committee has begun a comprehensive effort to identify critical resources and tasks necessary for the project, and the logical sequence in which those tasks must be performed, including the possible use of parallel activities.

Critical path analysis techniques were developed to manage complex projects just like the National Training Program. The Committee is planning to use those techniques to the extent possible to plan our future activities as we work toward a certification program.

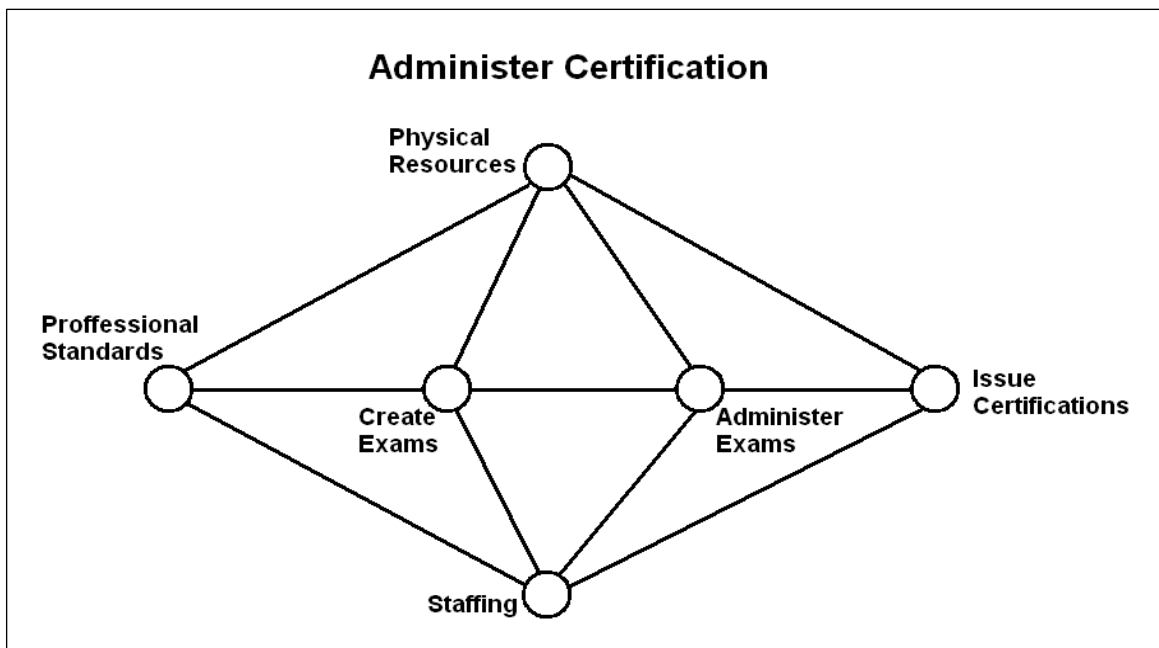
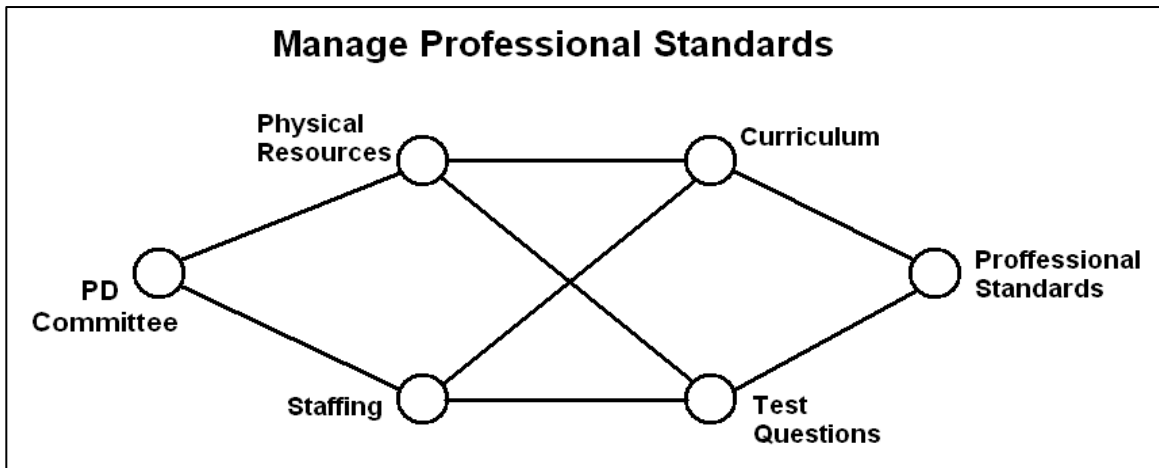


The Committee sees its task as one of managing four critical elements that come together as a certification program (as depicted above). Each bubble in the figure represents a milestone that must be reached in order to complete the objective. Those four main elements are:

Budget – involves tasks to secure necessary funding from the Board and other sources to undertake and complete all the other tasks.

Engage Stakeholders – involves tasks necessary to identify stakeholders and the resources they can bring to the project, encourage them to participate at all levels, and particularly to incorporate the professional standards in their training programs and to eventually take part in the certification program. The stakeholders will conduct the training; not the NCWM. The NCWM will only be coordinating the professional standards and administering the certifications.

Manage Professional Standards – involves tasks necessary to create and manage a set of standards for the profession. The Committee has identified the creation of professional standards (i.e., the Curriculum) as the first task in the process. The completion of the curriculum plan, the curriculum template, the guide to preparing curriculum segments, and the guide to preparing test questions are some of those important steps toward that goal. The work groups are now finalizing the first seven curriculum segments and corresponding test questions. This is a great start and there still is a significant amount of additional work necessary in this area.



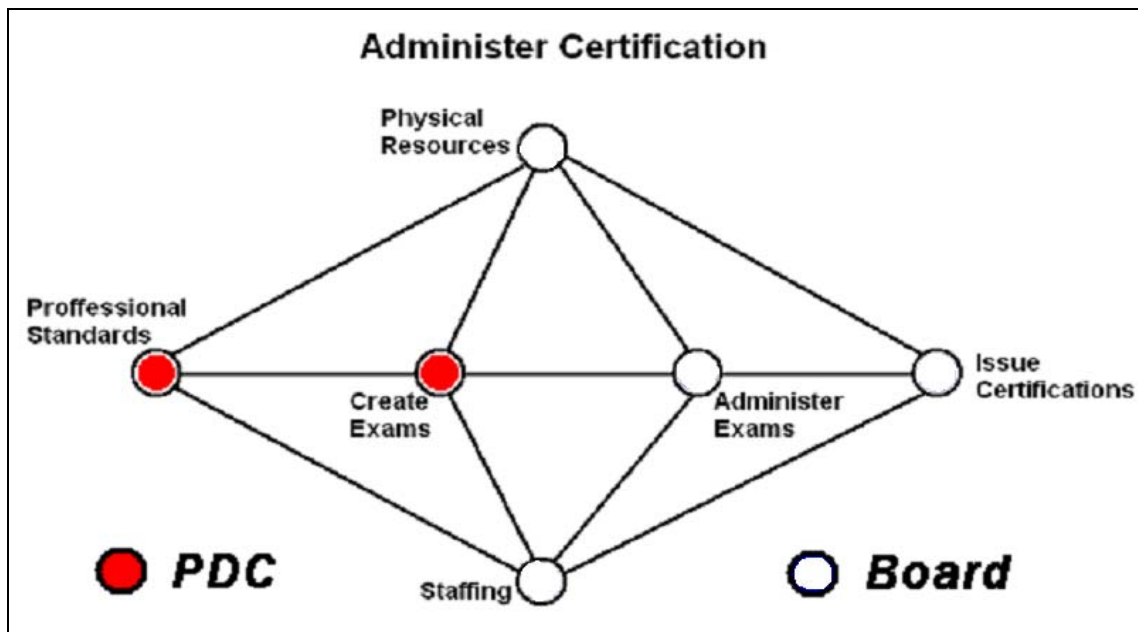
Administer Certification – involves tasks necessary to create certification exams, administer those exams, and issue certifications to those who qualify. The Committee will manage staffing, both paid and volunteer, and physical resources to secure the exams and record and issue the certificates.

As the necessary curriculum segments are completed and test questions prepared, we may begin to embark on some of the steps toward certification. Over the coming months, the Committee will continue to elaborate on the details in this project and keep refining it as we move forward.

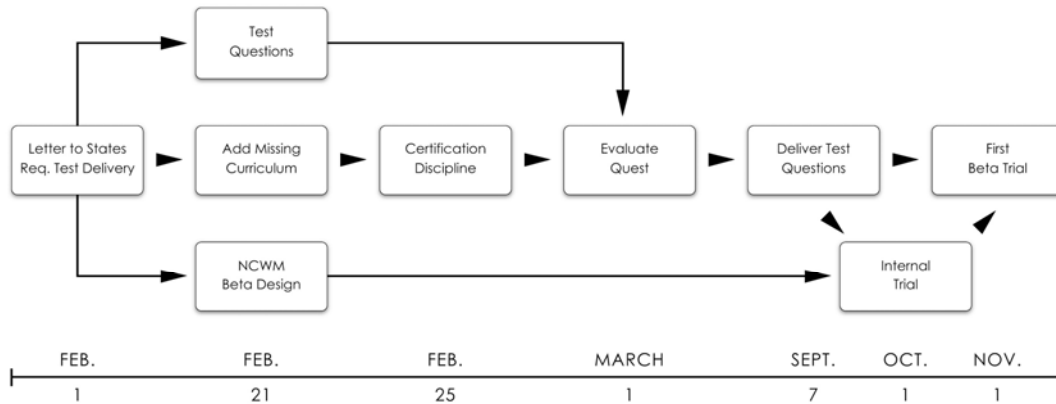
The Central Weights and Measures Association (CWMA) PDC Committee at their 2008 fall meeting proposed changing the name of the program to the National Certification Program. They further made recommendations regarding the creation of a standard like HB 130 or HB 44 that might be the mechanism to document the work on the curriculum and the certification program. (Also, see Item 402-2 for more on PDC publications.)

The PDC had learned that the Associate Membership Committee might be interested in funding the work on the curriculum and the certification package. The Committee will consider suitable projects that might make good use of that funding.

At the 2009 NCWM Interim Meeting, the PDC developed an action plan based upon the critical path analysis already completed. In this plan, responsibilities will be divided between the NCWM Board of Directors and the PDC. The PDC will develop and maintain the curricula and test questions. The Board will provide physical resources and staffing to compile the exams, issue certificates, and maintain records.



A goal was set to have all the elements in place to begin beta-testing a certification examination in one competency area by November 2009, and in three more competency areas by 2010. The initial plans are to target RMFDs, small capacity Class III scales, package checking, and VTMs. See section 401-4 for details of the proposed certification program. The plan below shows action items and target dates for the first certification area (tentatively RMFD's).



Discussion: The Committee was complimented on its work thus far, and it was suggested that the Central Weights and Measures Association (CWMA) might be willing to share the exams member states use for testing service agents. The Committee was asked to share its work with the regions in order to receive feedback on whether the PDC is on the right track. California indicated it has certification experience and extensive testing materials already developed for review. California also has curriculum material available on Investigative Techniques.

401-2 I Create a Curriculum Plan

Source: Carryover Item 401-2 (This item originated from the Committee and first appeared on its agenda in 2003.)

Background: For complete background information, see the PDC page of the NCWM website www.ncwm.net/members.

Discussion: Prior to the 2007 Annual Meeting, the Committee reviewed the curriculum segments submitted thus far. At the 2007 Annual Meeting, the Committee decided, based on comments from several of the regions and its own assessment, it was essential to have a standardized format to ensure uniformity. Based on a collective review of curriculum plans received, the Committee created a sample template and example for regions to use in developing other curricula. The Committee updated its curriculum (Curriculum Package) to include the NCWM Core Competency Model, which provides a model for improving the quality of education in a select discipline. The Committee included this information as a general guideline for the regions to use as they develop other curriculum topics. In addition, the Committee revisited the original “National Training Curriculum Outline” from its 2004 NCWM Annual Report (Final Report). The Committee prepared an accompanying “NCWM Curriculum Work Plan,” which is intended to assist in the management of curriculum development. The Committee also revised the original curriculum outline to match the Work Plan see Appendix A. (This was Appendix H from the 2008 Final Report.)

The Committee updated the Curriculum Package as shown below, which is accessible from the NCWM website members’ page at www.ncwm.net.

- Cover Memorandum (guide to curriculum development),
- NCWM Core Competency Model,
- NCWM Curriculum Template (curriculum guideline),
- NCWM Sample Curriculum (examples of desired format),
- Guide for Writing Test Questions (including examples),

- National Training Curriculum Outline,
- NCWM Curriculum Work Plan.

The Committee has received the following curriculum drafts (Region responsible):

- 4.2 NIST Handbook 44 – Introduction to Device Control, (NEWMA);
- 4.3.1 Static Electronic Weighing Systems, General, (NEWMA);
- 4.3.5 Small Capacity Weighing Systems, Class III, (NEWMA);
- 4.3.7 Vehicle Class III or III L, (SWMA);
- 4.4.1 Retail Motor Fuel Dispensers, (WWMA); and
- 5.3.1 Commodities, General, (CWMA).

The Committee will return the curriculum drafts received, along with the newly-revised curriculum package to the development team in each region to make revisions based on the Committee's recommendations and continue work on preparing test questions related to each segment.

The Committee will also be requesting that each region set aside time for a presentation of the new Curriculum Package at their upcoming Annual or Interim Meeting. In addition, the Committee is requesting volunteers develop additional segments. The Committee acknowledges that the CWMA volunteered to sponsor the first training session on the use of the completed curriculum.

Mike Cleary, California, contacted the PDC in October concerning training on Investigative Techniques. California has developed a course and expressed willingness to share that with the Committee.

The CWMA PDC Committee at its 2008 fall meeting asked to get feedback on the segment they prepared. They also expressed interest in seeing what the other work groups had done on their segments and associated test questions.

At the Interim Meetings, the Committee will review progress on the curriculum including the feedback to the regional work groups. It will then establish priorities for preparing the next segments and search for volunteers to begin the work.

At the 2009 Interim Meeting, the PDC reaffirmed its commitment to completing all the curriculum items, but recognized the need to prioritize the completion of those curriculum items necessary for the four competency areas, which are to be beta-tested by the end of 2010. (See PERT Diagram in section 401-1 for timeline on completion.)

Discussion: The Committee received no additional comments on this item.

401-3 D Instructor Improvement

Source: Carryover Item 401-3 (This item originated from the Committee and first appeared on its agenda in 2003.)

Background: Part of the formal charge to the Committee included coordination of activities to improve the competence of instructors and the uniformity of delivery of the curriculum. For complete background information, see the PDC pages of the NCWM website www.ncwm.net/members. After logging in under the members area, look under the PDC Legacy Documents for the PDC Formal Scope.

Industry has continued to support and sponsor training on their new technology for weighing and measuring devices. NIST has assured the Committee they will continue their work towards providing technical training for the trainers.

The Committee supports the recommendation from the Western Weights and Measures Association (WWMA) to encourage jurisdictions to participate in the NIST, WMD Instructor Training program as those classes become available.

At the NCWM 2009 Interim meeting, a work group from the NCWM BOD provided information to the Committee on initiatives it was considering to use the NCWM website to provide training materials and other trainer aids, such as presentations, videos, etc. The Committee applauds these efforts by the Board and will support the NCWM efforts. However, the Committee will continue to maintain this item as low priority until other parts of the certification program have been completed.

Discussion: The Committee received no comments on this item.

401-4 D Certification

Source: Carryover Item 401-4 (This item originated from the Committee and first appeared on its agenda in 2003.)

Background: For complete background information, please see the PDC page of the NCWM website www.ncwm.net/members.

Subsequent to the 2006 NCWM Annual Meeting, all states not previously contacted received a letter requesting the name of their State Certification Coordinator (SCC). The state director becomes the default SCC in the absence of a designated contact. The SCC contact list is available on the PDC page of the NCWM website (www.ncwm.net/members).

Discussion: The Committee continues to hear support from the regions concerning the establishment of a certification program.

The Committee has contacted the SCC of each state to gather information on its current training and certification programs. The Committee will be reviewing the Model Professional Development Training and Certification Standards Statute for Inspectors and Sealers of Weights and Measures (Appendix B) that was submitted by NEWMA. The Committee will study the sample with the possibility that it might ultimately be used to establish model criteria for a certification program.

The Committee has created a Guide for Developing Test Questions in the curriculum package referenced in Item 401-2. At the 2008 Interim Meeting, the Committee brought forth two options for building the bank of questions for certification. The first option was to build one large bank of questions developed for use in training and during the certification exam. The second option would be to develop two banks of questions using one bank of questions for training and the second bank of protected questions used for certification.

Recommendations during the open hearing included having jurisdictions take the lead on developing the questions, administering the examination, and grading. The NCWM would issue certificates based on the jurisdictions' reported results.

Pursuant to the recommendations from the WWMA and the CWMA, the Committee is in the process of developing a model for the infrastructure of the program. The Committee believes that a model is necessary to determine what the program will look like and what the roles of the states and the NCWM should be.

The CWMA PDC Committee at their 2008 fall meeting proposed changing the name of the program to the National Certification Program. They further made recommendations regarding the creation of a standard like HB 130 or HB 44 that might be the mechanism to document the work on the curriculum and the certification program. (Also see Item 402-2 for more on PDC publications.)

At the 2009 Interim Meeting, the PDC set a goal of being ready to start beta testing a component of a certification program for at least one competency area by November 2009, with the intention of having four areas completed by the end of 2010. The basic elements of the proposed program are:

- The PDC will develop curricula, which will be published in second section of the NCWM National Certification Guide (see also Section 402-2). Until that Guide is created, completed curriculum sections will be posted on the NCWM website (PDC files section under Members Only Section).
- The PDC will develop Certification Disciplines that outline which curriculum segments and objectives will be covered under each certificate, and how they will be weighted on the exam. Those Certification Disciplines will be published in the third section of the NCWM National Certification Guide (see also Section 402-2). Until that Guide is created, completed Certification Disciplines will be posted on the NCWM website.
- The PDC will provide the NCWM BOD with a pool of test questions for each curriculum segment and objective. Pool size will be proportional to the assigned weight of each curriculum item.
- It will be the BOD responsibility to develop and administer a testing program. NCWM staff will compile the exam from the questions pools, issue certificates, and maintain records.

The first draft of a Certification Discipline for RMFD’s is presented below. The Discipline outlines which curriculum segments and objectives must be mastered, what percentage of the test will be devoted to each item, and how many questions will be included from each area on a typical exam. The Committee is considering a fifty-question test format with a two-hour test time limit in the beta-test phase. Refer to the Curriculum Outline which is published on the NCWM website or the Curriculum Workplan in Appendix A for an overview of curriculum areas. The Committee is interested in feedback on the percentage weighting of the various curriculum areas.

Curriculum Discipline for RMFD Certificate		
Curriculum Areas (RMFD Certificate)	# Quest/50 Quest Exam	Approx %
1.0 Fundamentals of Weights & Measures	7	14
4.2 NIST Handbook 44 – Introduction to Device Control	8	16
4.4 Dynamic Measuring Systems - General		
4.4(1) Technology and Terminology	3	6
4.4(2) Device Operations & Functionality	3	6
4.4(3) Technical Requirements	3	6
4.4(4) User Requirements	3	6
4.4(5) Test Methods	3	6
4.4.1 Retail Motor Fuel Dispensers		
4.4.1(1) Technology and Terminology	4	8
4.4.1(2) Device Operations & Functionality	4	8
4.4.1(3) Technical Requirements	4	8
4.4.1(4) User Requirements	4	8
4.4.1(5) Test Methods	4	8

Discussion: The AMC has offered financial assistance to support development of the certification program. The AMC will consider effective ways to utilize such support in the coming months. The Committee recognizes that certification will initially be developed for regulatory inspectors, but they would like to quickly extend the program to the private sector as well.

401-5 D Recommended Topics for Conference Training

Source: Carryover Item 401-5 (This item originated from the Committee and first appeared on its agenda in 2003.)

Background: The Board has charged the Committee with responsibility for selecting appropriate topics for the technical sessions at future Annual Meetings. The Board asked that the Committee review and prioritize possible presentations and submit those to the Chairman. The Chairman would then work with NCWM staff to make the arrangements and schedule the sessions.

The Committee continues to carry the following list and recommends these topics for possible training seminars, roundtables, or symposia for presentation at the NCWM meetings:

- (a) Risk-based Inspections (Robert Williams, Tennessee, volunteered to present his state's Retail Motor-Fuel Device (RMFD) testing program);
- (b) Marketplace Surveys;
- (c) Auditing the Performance of Field Staff (Will Wotthlie, Maryland, volunteered to lead the session);
- (d) Alternative Fuels (including motor-fuel trends and technology updates);
- (e) Device Inspections Using a Sampling Model;
- (f) Emerging Issues;
- (g) Proper Lifting Techniques (recommended by Ken Deitzer, Pennsylvania);
- (h) Overview of OIML and its Relationship to Standards Development (recommended by Julie Quinn, Minnesota);
- (i) Back and Stress Techniques (recommended by Don Onwiler);
- (j) Public Relations, specifically dealing with aggressive/angry people (recommended by the SWMA);
- (k) Inspector Investigative Procedures (recommended by the SWMA);
- (l) General Safety Issues (recommended by the WWMA);
- (m) Defensive Driving (recommended by the WWMA);
- (n) Administrative Civil Penalty Process (recommended by the WWMA);
- (o) Price Verification (recommended by the WWMA);
- (p) Customer Service (recommended by the WWMA);
- (q) Ethics (recommended by the CWMA);
- (r) Automatic Temperature Compensation (ATC) testing for field inspectors;
- (s) Hydrogen Measuring Systems; and
- (t) OSHA Safety.

For the 2008 NCWM Annual Meeting Technical Education Sessions, the Committee recommended Automatic Temperature Compensation (ATC) testing for field inspectors and OSHA Safety. The Board accepted these topics and presentations on both were made during the 2008 Annual Meeting. The Committee will be considering topics for the 2009 Annual Meeting and welcomes suggestions from everyone.

For the 2009 NCWM Annual Meeting Technical Education Sessions, the Committee recommended seven possible topics for consideration of the NCWM Chairman:

1. Investigative Techniques (offered by Michael Cleary)
2. Handbook 44 Scale Code Tare Changes
3. Wet Tare/USDA Issues
4. Automatic Temperature Compensation (ATC)
5. Moisture Loss
6. Fuel Volatility Issues and Ethanol Blending
7. Ergonomic Lifting Techniques

Discussion: The Committee believes that the training sessions at the NCWM could be taped and the video materials made available on the website to start building a library. The Committee plans to approach the AMC for funding for video equipment expressly for this purpose.

402 PROGRAM MANAGEMENT

402-1 I Safety Awareness

Source: Carryover Item 402-1 (This item originated from the Committee and first appeared on its agenda in 2003.)

Background: In the past, the Committee's responsibility extended to the identification of safety issues in the weights and measures field and included efforts to increase safety awareness.

At the 2005 Annual Meeting, Past-Chairman Dennis Ehrhart recommended the Committee make training its highest priority. The Voluntary Quality Assurance Assessment program, NCWM Associate Membership Scholarships, and

safety awareness efforts were carryover items from the Committee on Administration and Public Affairs (A&P) and not PDC items.

Jurisdictions should send their safety reports and issues to their regional safety liaison, who in turn will forward them to Charles Gardner, the NCWM Safety Coordinator. Charles recommends the reports or report summaries be published in the NCWM newsletter. At the 2005 Interim Meeting, a CD-ROM on safety produced for the U.S. Environmental Protection Agency was made available for review. The Committee believes safety awareness should be a part of every aspect of training for NCWM stakeholders. Below is a list of the regional safety liaisons.

SWMA	Steve Hadder, Florida Department of Agriculture & Consumer Services
WWMA	Dennis Ehrhart, Arizona Department of Weights & Measures
CWMA	Julie Quinn, Minnesota Department of Commerce
NEWMA	Michael Sikula, New York Bureau of Weights & Measures

At the 2007 Interim Meeting, the Committee decided to reach out to the regional safety liaisons and ask that they write newsletter articles designed to raise safety awareness and provide safety tips to the weights and measures community. These archived articles are on the PDC page of the NCWM website. The NCWM newsletter is published three times a year and all articles should be e-mailed to the NCWM headquarters at info@ncwm.net.

Association	Issue	Article Deadline
WWMA	2008, Issue 2	March 15, 2008
CWMA	2008, Issue 3	July 15, 2008
NEWMA	2009, Issue 1	November 15, 2008
SWMA	2009, Issue 2	March 15, 2009

Discussion: The Committee is sad to hear that Charles Gardner, our long-standing Safety Liaison has retired. The PDC would like to thank Mr. Gardner for his many years of service to this project, which he initiated. At the Interim Meetings, the Committee will consider how we move forward from here, either seeking a new liaison or changing how it will handle future safety issues.

The Committee will also continue to ask the regions to prepare articles for the NCWM newsletter and will be extending the schedule to cover the next year. At the 2009 NCWM Interim Meeting, the PDC noted that WWMA, and CWMA submitted safety articles per the schedule above. The PDC thanks Kirk Robinson (Washington State Department of Agriculture Weights and Measures Program) and the National Propane Gas Association for their contributions. The NCWM newsletter changed its publication schedule, and, consequently, there will not be a safety article in 2009, Issue 1. The Committee revised the schedule as follows for future issues. The Committee plans to notify the regional safety coordinators as their assignment date approaches.

Association	Issue	Publication Date	Article Deadline
NEWMA	2009, Issue 2	June	April 15, 2009
SWMA	2009, Issue 3	September	July 15, 2009
WWMA	2010, Issue 1	February	January 15, 2010
CWMA	2010, Issue 2	June	April 15, 2010

All articles should be e-mailed to the NCWM headquarters at info@ncwm.net.

Discussion: The Committee received no comments on this item.

402-2 D PDC Publication

This item originally served to record the development of various documents prepared in pursuit of our training and certification programs. These are available on the members section of the NCWM website at www.ncwm.net. At the 2008 Annual Meeting, the Committee indicated its desire to eliminate this item from the agenda. However, in

the report from the CWMA PDC Committee, the Committee received a proposal to create a standard like HB 130 or HB 44 to serve as the work product of the Committee. This standard could be reviewed, amended, and adopted by the NCWM to make it a living document. The Committee will consider this proposal in discussions at the 2009 Interim Meetings.

Based on feedback at the 2009 NCWM Interim Meeting, the PDC decided to move forward on the new Publication to be titled NCWM Publication XX National Certification Program Guide. This publication will serve to document the details of the Certification Program.

The guide will remain under control of the PDC Committee but will not require formal NCWM vote to add new sections or revise existing sections. The Committee will add and modify sections continuously to meet its priority objectives with a concerted effort to respond to feedback from program users and the NCWM membership. The three main sections of the Guide would include:

1. Program Administration – combines historical documentation (curriculum outline and work plan, etc.) with administrative procedures on administering exams and records of certifications,
2. Competency Standards – includes the curriculum segments that describe the objectives and measurable competencies that will be used in certification, and
3. Certification Disciplines – includes one document per certification area delineating the standards from the curricula that will be covered in the exam and the weighting of the competencies.

Ross Andersen, Chair, New York

John Sullivan, Mississippi

Richard Cote, New Hampshire

Stacy Carlsen, Marin County, California

Julie Quinn, Minnesota

Steve Grabski, Walmart

Tina Butcher, NIST, Weights and Measures Division

Professional Development Committee

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Appendix A



National Conference on Weight & Measures National Certification Program

NCWM CURRICULUM WORK PLAN

Revised January 2009

Segment/Subject

Level 1/Level 2/Level 3

1. Fundamentals of Weights and Measures

- 1.1. Introduction to W&M Programs
- 1.2. W&M Laws and Regulations
- 1.3. Field Standards & Test Equipment
- 1.4. State Program Scope and Overview
- 1.5. Enforcement Powers

2. W&M Administration

- 2.1. Fundamentals of W&M Administration (Commercial System, Powers & Duties, etc.)
- 2.2. Administration Functions (Personnel, Management, Budget, Safety, etc.)
- 2.3. Legislation and Regulations (Legal Considerations, Interaction with Legislature, Stakeholders, Industry, etc.)
- 2.4. Regulatory Control (Device inspection, commodities, complaints)
- 2.5. Laboratory Metrology Administration (Purpose of Laboratory, Responsibilities of Metrologist, NIST Expectations for Recognition of Laboratory, Quality System, Training Requirements, etc.)
- 2.6. Public Relations & Communications (Publicity, Public Relations, Communications)

3. Laboratory Metrology

- 3.1. NIST Basic Metrology
- 3.2. NIST Intermediate Metrology
- 3.3. NIST Advanced Metrology

4. Device Control Program

- 4.1. Safety Considerations
- 4.2. NIST Handbook 44 – Introduction to Device Control
- 4.3. Weighing Systems, General
 - 4.3.1. Precision Weighing Systems Class I and II
 - 4.3.2. Small Capacity Weighing Systems Class III
 - 4.3.3. Medium Capacity Weighing Systems Class III
 - 4.3.4. Vehicle Scale Class III or III L
 - 4.3.5. Vehicle Scale Class III or III L – Advanced
 - 4.3.6. Railroad Track Scales
 - 4.3.7. In-Motion Railroad Track Scales
 - 4.3.8. Hopper Scale Systems
 - 4.3.9. Automatic Bulk Weighing Systems
 - 4.3.10. Automatic Weighing Systems

- 4.3.11. Belt Conveyor Weighing Systems
- 4.3.12. In-Motion Monorail Scales
- 4.3.13. Point-of-Sale Scale Systems
- 4.3.14. Other Specialty Weighing Systems
- 4.4. Dynamic Measuring Systems – General
 - 4.4.1. Retail Motor Fuel Dispensers
 - 4.4.2. Loading Rack and Other Stationary Metering Systems
 - 4.4.3. Loading Rack & Other Stationary Metering Systems – Advanced
 - 4.4.4. Vehicle-Tank Meter Systems
 - 4.4.5. Vehicle-Tank Meter Systems – Advanced
 - 4.4.6. Milk Metering Systems
 - 4.4.7. Water Meters
 - 4.4.8. LPG/Anhydrous Ammonia Liquid Metering Systems
 - 4.4.9. LPG/Anhydrous Ammonia Liquid-Metering Systems – Advanced
 - 4.4.10. LPG Vapor Meter Systems
 - 4.4.11. Mass Flow Metering Systems
 - 4.4.12. Other Metering Systems (Cryogenics, Carbon Dioxide, etc.)
- 4.5. Static Volume Measuring Systems – General
 - 4.5.1. Liquid Measures
 - 4.5.2. Farm Milk Tanks
 - 4.5.3. Dry Measures
- 4.6. Other Measuring Systems
 - 4.6.1. Taximeters and Odometers
 - 4.6.2. Wire and Cordage Measuring Systems
 - 4.6.3. Linear Measures
 - 4.6.4. Timing Devices
 - 4.6.5. Weights
 - 4.6.6. Multiple Dimension Measuring Systems
- 4.7. Quality Measuring Systems
 - 4.7.1. Grain Moisture Meters
 - 4.7.2. NIR Grain Analyzers
 - 4.7.3. Carcass Evaluation Systems
- 5. Market Practices, Laws and Regulations (NIST HB 130), & Commodities (NIST HB 133)**
 - 5.1. Safety Considerations – Market Practices, NIST Handbook 130, NIST Handbook 133
 - 5.2. NIST Handbook 130 – Laws & Regulations
 - 5.2.1. NIST Handbook 130 – General Provisions
 - 5.2.2. Packaging and Labeling Regulations
 - 5.2.3. Method of Sale Regulations
 - 5.2.4. Quality of Automotive Fuels and Lubricants
 - 5.2.5. Price Verification
 - 5.3. NIST Handbook 133 – Package Net Contents Control
 - 5.3.1. Commodities – General
 - 5.3.2. Packages Labeled by Weight, Standard and Random
 - 5.3.3. Packages Labeled by Weight, Special Commodities
 - 5.3.4. Packages Labeled by Volume (Volumetric and Gravimetric Testing)
 - 5.3.5. Packages Labeled by Volume, Special
 - 5.3.6. Packages Labeled by Length/Area/Thickness
 - 5.3.7. Packages Labeled by Count
 - 5.3.8. Other Package Types
 - 5.4. Test Purchases
 - 5.5. E-Commerce

Note: Initial Verification has been intentionally left off this listing and will be addressed later.

Appendix B

Model Professional Development Training and Certification Standards Statute for Inspectors and Sealers of Weights and Measures

Submitted by NEWMA, October 2007

DRAFT

1. **Definition of Terms:** Unless defined otherwise by statute, the definitions contained herein shall apply to this statute.
 - 1.1 **Commission:** The permanent advisory Commission appointed pursuant to this statute to develop, plan, and certify training standards, certification, and continuing education.
 - 1.2 **Director [Commissioner or other senior state official]:** Charged by statute to administer, guide, or direct weights and measures activities within the state at state, county, or municipal level.
 - 1.3 **Sealers and Inspectors of Weights and Measures:** Those public officials appointed pursuant to existing law to inspect, approve, or condemn weighing and measuring devices or perform other activities as directed by statute or regulation. This definition shall also apply to deputy, assistant, or associate sealers and inspectors of weights and measures.
 - 1.4 **Industry Specialists:** Those individuals approved and/or licensed by the State Director to inspect, approve, or condemn specific classes or types of weighing and measuring devices.
2. **Certification and Standards Commission**
 - 2.1 **Appointment:** There shall be a permanent standing advisory Commission comprised of the Director of the state weights and measures department or his designee, and a designee from each of the following organizations: the State Weights and Measures Association, the various Regional Weights and Measures Associations, and one individual representing industry specialists. Members of said Commission shall serve without compensation. Said Commission shall be chaired by the Director or Deputy Director of weights and measures.
 - 2.2 **Rule Making Authority:** The Commission shall promulgate rules and regulations necessary to implement and maintain this statute consistent with existing rule-making state legislation.
 - 2.3 **Duties:** The Commission shall develop, and from time to time, revise the certification and continuing education requirements that are established by the Department of Weights and Measures with the advice and consent of the Commission. The Commission shall certify all inspectors, sealers and deputies and industry specialists in accordance with sections [insert specific statute citation covering the appointment of these officials] and regulations promulgated by the Commission including, but not limited to, regulations covering initial written certification testing for inspectors, sealers and deputies and industry specialists as well as mandatory continuing education programs for inspectors, sealers and deputies, and industry specialists to maintain their certifications. Every store, retail establishment, food store or food department and all merchants within the jurisdiction of the state department of weights and measures shall provide adequate space for the display of information relative to how the state inspector, local sealer or inspector or the department of weights and measures can be contacted as provided in regulations to be promulgated by the Commission. Notwithstanding any certification exemption, all sealers, inspectors, deputy sealers, deputy inspectors, and industry specialists shall participate in continuing education programs. The Commission shall establish a training and education fee to be paid by the state, county, municipality, or industry specialist's organization, which employs such sealer, inspector, deputy sealer and deputy inspector, or industry specialist sufficient to offset the cost of providing such training and education.

2.4 **Fees:** There shall be a revolving account established into which shall be deposited any training and education fees paid by the state, county, municipality, or industry specialist. These fees shall be used to offset any cost associated with providing such training and education mandated by the Commission.

3. Appointment of Sealers, Inspectors, Deputy Sealers

3.1 **Appointment:** The sealer, inspector, and all deputies shall be certified by the Commission within one year after assuming their powers and duties. Failure to become certified within one year shall be cause for termination; provided, however, sealers, inspectors or deputy sealers or deputy inspectors, employed by the state, county, or a municipality upon the effective date of this paragraph, shall become certified within two years. Sealers, inspectors or deputy sealers or deputy inspectors who pass a civil service exam for a position as a sealer, inspector or deputy sealer or deputy inspector of weights and measures, shall be exempt from initial certification requirements provided that said civil service exam contains questions and/or practices consistent with initial certification requirements.

3.2 **Continuing Education:** Notwithstanding any certification exemption, all sealers, inspectors and deputy sealers and deputy inspectors shall participate in continuing education programs. The Commission shall establish a training and education fee to be paid by the county or municipality which employs such sealer, inspector, deputy sealer and deputy inspector sufficient to offset the cost of providing such training and education.

4. Appointment of Industry Specialists

4.1 **Appointment:** All industry specialists shall be certified by the Commission prior to assuming their powers and duties as licensed industry specialists; provided, however, industry specialists performing such duties shall become certified within one year from the effective date of this statute. Failure to become certified prior to assuming their powers and duties as industry specialists shall render any inspections conducted null and void and such individuals shall be barred from further inspections for a period of not less than one year.

4.2 **Continuing Education:** Notwithstanding the appointment of industry specialists, they shall participate in continuing education programs approved by the Commission. The Commission shall establish a training and education fee to be paid by the business or organization employing industry specialists sufficient to offset the cost of providing such training and education.

5. **Conflict with other Laws:** Whenever the application of any provision of any other law of this state conflict with the application of any provision of sections one through four, inclusive, said sections shall prevail.

6. **Partial Invalidity:** If any provision of said sections one to four, inclusive, or the application of said sections shall be held invalid, the remainder of said sections, or the application of such provision to any person or circumstance other than that as to which it is invalid, shall not be affected thereby.

National Type Evaluation Program (NTEP) Committee Interim Report

Judy Cardin, Chairman
Chief
Wisconsin, Weights and Measures

Reference
Key Number

500 INTRODUCTION

The National Type Evaluation Program (NTEP) Committee (hereinafter referred to as “Committee”) submits its Interim Report for consideration by the National Conference on Weights and Measures (NCWM). This report contains the items discussed and actions proposed by the Committee during its Interim Meeting in Daytona Beach, Florida, January 11 - 14, 2009.

This report contains many recommendations to revise or amend National Conference on Weights and Measures (NCWM) Publication 14, Administrative Procedures, Technical Policy, Checklists, and Test Procedures or other documents. Proposed revisions to the publication(s) are shown in **bold face print** by ~~striking out~~ information to be deleted and underlining information to be added.

**Table A
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Appendices**

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*NTETC Sector Meeting Summaries are included in the online version of the NCWM Publication 16 but will not be included in hard copies of the publication distributed at the NCWM Annual Meeting.

**Table C
Glossary of Acronyms***

BIML	Bureau of International Legal Metrology	IR	International Recommendation
CD	Committee Draft ¹	MAA	Mutual Acceptance Arrangement
CIML	International Committee of Legal Metrology	OIML	International Organization of Legal Metrology
CPR	Committee on Participation Review	R	Recommendation
DD	Draft Document ²	SC	Subcommittee
DR	Draft Recommendation ²	TC	Technical Committee
DV	Draft Vocabulary ²	WD	Working Document ³
DoMC	Declarations of Mutual Confidence		

¹ CD: a draft at the stage of development within a technical committee or subcommittee; in this document, successive drafts are numbered 1 CD, 2 CD, etc.

² DD, DR, DV: draft documents approved at the level of the technical committee or subcommittee concerned and sent to BIML for approval by CIML.

³ WD: precedes the development of a CD; in this document, successive drafts are number 1 WD, 2 WD, etc.

* Explanation of acronyms provided by OIML.

**Details of All Items
(In Order by Reference Key Number)**

1. I Mutual Recognition Arrangement (MRA)

Background: Both Measurement Canada and the NTEP labs continue striving to improve the data exchange under the Mutual Recognition Arrangement (MRA). During the 2008 NTEP labs meeting, an entire day was spent exchanging information regarding the current MRA for weighing devices. Several areas of improvement were identified including an initial review of new applications to establish an agreed-upon test plan for the evaluation. In addition, a training session was conducted to improve the consistency of data collected by the labs. Consistency in data collection will help to improve the ability of the various labs to exchange data. Measurement Canada has also supplied the U.S. NTEP labs with an updated version of an Excel spreadsheet program to standardize the test report forms for devices that fall under the MRA. This updated version of the spreadsheet checklist has been well received by the labs and is now in use for evaluations conducted by the labs.

Current Comment: NTEP will continue to review progress and work on improvements during the NTEP lab meetings. The Committee was asked to consider expanding the MRA to higher capacity scales. The NTEP Administrator will discuss the possibilities with Measurement Canada and the NTEP labs.

2. I Mutual Acceptance Arrangement (MAA)

Background: Information regarding the OIML MAA can be found at www.oiml.org/maa. NCWM has signed the OIML MAA Declaration of Mutual Confidence (DoMC) for R 60 Load Cells as a utilizing participant.

The 2008 Annual Meeting of the CIML was held in October in Sydney, Australia. Four resolutions pertaining to the OIML MAA were adopted there. These resolutions were the outcome of a May 2008 meeting of the OIML TC 3/SC 5 on conformity assessment, which oversees the following OIML B documents that are classified as Basic Publications:

- OIML B 3 *OIML Certificate System for Measuring Instruments*, identified as project p7,
- OIML B 10-1 *Framework for a Mutual Acceptance Arrangement on OIML Type Evaluations*, identified as project p8, and
- OIML B 10-2 *Checklists for Issuing Authorities and Testing Laboratories carrying out OIML Type Evaluations*, identified as project p9.

The key resolution of most significance to the NCWM is that the ending date for OIML issuing authorities (including NTEP) to be able to issue what are now being referred to as OIML “Basic” Certificates (as distinguished from OIML “MAA” Certificates) for R 60 and R 76 has been extended indefinitely, which means that, in principle, NTEP can continue to issue such Basic Certificates (although it has not done so for many years). The reason for this extension is to provide time for those countries that utilize manufacturers’ test data (under not-completely-supervised conditions) when issuing OIML Basic Certificates to convince other countries that this practice can be carried out successfully if proper safeguards are put in place. In the meantime, it was agreed that manufacturers’ test data cannot be used as the basis of issuing an OIML MAA Certificate. The objective of this delay is to eventually allow manufacturers’ test data to be used as part of the MAA system in a natural progression, rather than artificially and possibly prematurely ending the Basic Certificate System for any category of instrument. The CIML will monitor this situation.

The other resolutions dealt with were when OIML Recommendations can become part of the OIML Certificate System, maintenance of earlier versions of revised recommendations, and revisions of OIML Basic Certificates.

Details of all four resolutions can be found in the Resolutions of the 43rd CIML Meeting on the OIML website. It is the intention of TC 3/SC 5 to begin revision of the B 3 and B 10 documents to incorporate these resolutions along with earlier, related CIML decisions.

A meeting of the MAA Committee on Participation Review (CPR) is scheduled for June 17 - 19, 2009, in Berne, Switzerland. This will include a two-day joint meeting of both the R 60/R 76 CPR and the R 49 (water meters) CPR, to discuss matters of common interest. Single-day meetings of the CPRs will then be held to discuss the individual specialty areas, including review of documentation in order to decide on the acceptance of additional countries into the respective Declarations of Mutual Confidence (DoMCs). The joint meeting will feature a presentation on how the acceptance of “manufacturer’s test data” works in some European countries. NCWM will be represented at the CPR meeting by Jim Truex. Ken Butcher and Charles Ehrlich of NIST will also attend as Secretariats of OIML TC 9 and TC 3/SC 5 respectively.

3. I NTEP Participating Laboratories and Evaluations Reports

Background: At the 2008 NCWM Annual Meeting, Stephen Patoray, NTEP Director, updated the Committee on NTEP laboratory and administrative activities since October 1, 2007.

The NTEP weighing and measuring laboratories held a joint meeting in April 2008 in Ottawa, Canada. The NTEP weighing laboratories also met in September 2008 before the meeting of the Weighing Sector in St. Louis, Missouri. The NTEP measuring laboratories met again in October 2008 prior to the Measuring Sector meeting in Atlanta, Georgia.

Current Comment: The NTEP Committee discussed contingency planning for continuity of NTEP operations. With the state of today’s economy, what if NTEP lost a lab? How will NTEP maintain workflow? Are there additional states interested in applying to become an NTEP field lab or an NTEP brick-and-mortar lab? The NTEP Committee will further discuss the issues during a long-range planning session and welcomes comments from the membership.

The NCWM Board discussed a strategic plan for NTEP as part of the NCWM Strategic Plan. The Board is working on a strategy to insure NTEP services are available at an adequate level. The Board is seeking input from State Directors with NTEP labs, NTEP labs and manufacturers that utilize NTEP.

2009 Schedule of Meetings:

NTETC Belt-Conveyor Sector	February 25 - 26, 2009	St. Louis, MO
NTETC Software Sector Meeting	March 11 - 12, 2009	Reynoldsburg, OH
NTEP Laboratory Meeting	March 31 - April 2, 2009	Reynoldsburg, OH
NTETC Grain Analyzer Sector	August 19 - 20, 2009	Kansas City, MO
NTETC Weighing Sector	August 25 - 27, 2009	Columbus, OH
NTETC Measuring Sector	October 2 - 3, 2009	Clearwater Beach, FL

4. I NTETC Sector Reports

Background:

Grain Moisture Meter and NIR Protein Analyzer Sectors: The NTETC Grain Moisture Meter and NIR Protein Analyzer Sectors held a joint meeting in Kansas City, Missouri, August 20 - 21, 2008. A draft of the final summary was provided to the Committee prior to the 2009 NCWM Interim Meeting for review and approval.

The next meeting of the Grain Moisture Meter and NIR Protein Analyzer Sectors is scheduled for August 19 - 20, 2009, in Kansas City, Missouri. For questions on the current status of sector work or to propose items for a future meeting, please contact the sector technical advisors:

Diane Lee
 NIST WMD
 100 Bureau Drive, Stop 2600
 Gaithersburg, MD 20899-2600
 Phone: (301) 975-4405
 Fax: (301) 975-8091
 e-mail: diane.lee@nist.gov

Jack Barber
 J.B. Associates
 10349 Old Indian Trail
 Glenarm, IL 62536
 Phone: (217) 483-4232
 e-mail: barber.jw@comcast.net

Measuring Sector: The NTETC Measuring Sector met October 3 - 4, 2008, in Atlanta, Georgia. A draft of the final summary was provided to the NTEP Committee prior to the 2009 NCWM Interim Meeting for review and approval.

The next meeting of the Measuring Sector is scheduled for October 2 - 3, 2009, in conjunction with the Southern Weights and Measures Association's Annual Meeting. For questions on the current status of sector work or to propose items for a future meeting, please contact the sector technical advisor:

Tina Butcher
 NIST WMD
 100 Bureau Drive, Stop 2600
 Gaithersburg, MD 20899-2600

Phone: (301) 975-2196
 Fax: (301) 975-8091
 e-mail: tbutcher@nist.gov

Software Sector: The NTETC Software Sector met May 20 - 21, 2008, in Columbus, Ohio. A final draft of the meeting summary was provided to the Committee prior to the 2009 NCWM Interim Meeting for review and approval.

The 2009 Software Sector meeting was held March 11 - 12, 2009, in Reynoldsburg, Ohio. For questions on the current status of sector work or to propose items for a future meeting, please contact the sector chairs and NTEP Administrator:

Jim Pettinato
 Sector Chair
 FMC Technologies
 1602 Wagner Avenue
 Erie, PA 16510
 Phone: (814) 898-5250
 Fax: (814) 899-3414
 e-mail: jim.pettinato@fmcti.com

Norm Ingram
 Sector Chair
 CA Div. of Measurement Standards
 6790 Florin Perkins Road, Suite 100
 Sacramento, CA 95828
 Phone: (916) 229-3016
 Fax: (916) 229-3026
 e-mail: ningram@cdfa.ca.gov

Jim Truex
 NTEP Administrator
 NCWM
 1135 M Street, Suite 110
 Lincoln, NE 68508
 Phone: (740) 919-4350
 Fax: (740) 919-4348
 e-mail: jim.truex@ncwm.net

Weighing Sector: The NTETC Weighing Sector met September 23 - 25, 2008, in St. Louis, Missouri. A final draft of the meeting summary was provided to the Committee prior to the 2009 NCWM Interim Meeting for review and approval.

The next Weighing Sector meeting is scheduled for August 25 - 27, 2009, in Columbus, Ohio. For questions on the current status of sector work or to propose items for a future meeting, please contact the sector technical advisor:

Steven Cook
 NIST WMD
 100 Bureau Drive, Stop 2600
 Gaithersburg, MD 20899-2600

Phone: (301) 975-4003
 Fax: (301) 975-8091
 e-mail: steven.cook@nist.gov

Current Comment: During the Interim Meeting, the NTEP Committee approved the 2008 reports of the NTETC Sectors. The NTEP Committee is working to correct the sector report process to ensure the reports are posted for members on the NCWM website prior to the Interim Meeting.

5. I NTEP Participation in U.S. National Work Group (USNWG) on Harmonization of NIST Handbook 44, NCWM Publication 14 and OIML R 76 and R 60

Background: At its October 2006 meeting in Cape Town, South Africa, the 41st CIML approved DR 7: R 76-1 Non-automatic weighing instruments, Part 1: Metrological and technical requirements – Tests. The DoMC for R 76 was updated at the end of September 2008. Steve Cook, NIST WMD, will provide the current status of activities in these areas to the Committee during the 2009 NCWM Interim Meeting.

Current Comment: Steven Cook reported that the revision of R 76 “Non-automatic Weighing Instruments” is of major importance to U.S. interests because the Recommendation serves as the foundation for a majority of the laws and regulations governing weighing instruments around the world. The revision includes new language addressing metrological controls for type evaluations, conformity, initial and subsequent inspections, suitability of separable components and requirements for metrological software. The USNWG was consulted concerning proposals to harmonize Handbook 44 and R 76. As reported at the 2007 NCWM Interim Meeting, the DR of R 76-1 was approved by the CIML in October 2006. Most recently, the United States voted “yes” on the DR of R 76-2 “Test Report Format.” The Secretariat (United States) to OIML R 60 – “Metrological regulation for load cells” plans to send an inquiry to OIML Participating members about starting a revision of R 60. The questionnaire will ask for feedback on a broad scope of topics from the basic principles of R 60 (e.g., tolerances and accuracy classes) to exploring the addition of new requirements. For more information on these efforts, please contact Steve Cook at (301) 975-4003 or steven.cook@nist.gov.

There was no new information for this item during the Interim Meeting. The NTEP Committee plans to move this item to be included with the report of other OIML activities.

6. I Conformity Assessment Program

Background: The Conformity Assessment Program was established to ensure devices produced after the device has been type evaluated and certified by NTEP continue to meet the same requirements. This program has three major elements: (1) Certificate Review (administrative); (2) Initial Verification (inspection and performance testing); and (3) Verified Conformity Assessment (influence factors). This item is included on the Committee’s agenda to provide an update on these elements.

Certificate Review: The question addresses how this would be accomplished given the limited resources of NCWM. It was suggested this item may need to continue on a “back burner” until resources can be clearly identified to proceed with the project in an efficient, thorough, and accurate manner.

During the 92nd NCWM, it was reported that this item continues on the “back burner” until funding can be identified for this project. The NTEP Committee considered the fact that continuing improvement is occurring on Certificates of Conformance and the improvements are making it easier for inspectors to verify. Therefore, for the time being, the NTEP Committee plans to discontinue reporting on this portion of Conformity Assessment in future NTEP reports.

Initial Verification (IV): Work group (WG) chair, Lou Straub, reported that Initial Verification checklists have been developed for small scales, vehicle scales, and retail motor fuel dispensers. Data has been received from several states on small-capacity price computing scales, and the pilot of Initial Verification for small-capacity scales has been completed. All data has been forwarded to NCWM staff for safekeeping.

The WG asked for direction from the NTEP Committee on how to proceed to the next step. Mr. Straub clarified that not all states or jurisdictions need to participate in submitting information to NCWM on Initial Verification. A subset of states would be sufficient. The NTEP Committee instructed the WG to proceed with development of additional checklists but there was a sense that the WG was reluctant until they know how states will react and use the developed checklists. The NTEP Committee also noted the need to decide how to process the data generated from Initial Verification. The Committee acknowledges that VCAP is the priority and thinks IV is a very important element of conformity assessment but may need to rest until the states are ready to act.

Verified Conformity Assessment Program (VCAP): The National Conference on Weights and Measures (NCWM) and National Type Evaluation Program (NTEP) have been concerned about production meeting type, protecting the integrity of the NTEP Certificate of Conformance (CC) since the inception of NTEP. A WG was developed to assist the NCWM with this effort, which has provided feedback and recommendations to the conference. The NCWM Board of Directors thinks it has reached a point that the Verified Conformity Assessment Program can be launched. Load cells traceable to NTEP certificates have been selected for the initial effort. All holders of NTEP Certificates of Conformance for load cells have been notified. The following timeline for load cell certificate holders has been established and published.

NTEP VCAP Timeline – Load Cells				
Jul 2008 - Dec 2008	Jan 2009 - Dec 2009	Jan 2010 - Mar 2010	Apr 2010 - Nov 2010	Nov 2010
Refine VCAP procedures	LC manufacturers to put VCAP QM system in place	NTEP to evaluate incoming Certification Body audit reports	NTEP to contact manufacturers not meeting VCAP and encourage compliance before annual maintenance fee is due in Nov.	CCs declared inactive if CC holder fails to meet VCAP
Answer incoming questions	Conduct audit by Certified Body		Continue to evaluate incoming audit reports	
Refine/develop appeals process	Submit audit report to NCWM/NTEP			
Notify all CC holders of updated plan, Q&A, etc.				

Current Comment: The NTEP Committee has been asked to announce which device(s) will be next after load cells. The NTEP Committee wants some additional time to see what issues and concerns come to light with the load cell effort before making a decision.

See Appendix E – VCAP Frequently Asked Questions. This document is considered a living document subject to frequent updates as questions continue to be asked.

Jim Truex updated the NTEP Committee and the NCWM Board regarding progress of Conformity Assessment issues. The VCAP/Load Cell Project is progressing. The NTEP Administrator attended the fall SMA meeting to explain the details of the project. At this point in time, it appears the primary issue facing manufacturers is identifying certified registrars and auditors. The NTEP Administrator is expecting a large volume of contacts (e-mail, phone, fax) in 2009 pertaining to VCAP load cell requirements and certified bodies (registrars). It is anticipated many questions may come from the certified bodies and their auditors.

The NTEP Committee has decided to use the current process in Publication 14, Administrative Policy, Section T, “Appeal and Review Process” for all VCAP appeals. To make it clear, the NTEP Committee plans to add a bullet to Section T to read: “A certificate holder may appeal a certificate made inactive due to non-compliance with VCAP. However, the decision of the Certification Body or VCAP auditor cannot be appealed to the NCWM.”

7. I NCWM Publication 14, NTEP Administrative Policy, Section S.1.c. (VCAP)

Source: Load Cell VCAP WG

Background: During discussions the VCAP WG identified sections of the VCAP section of NCWM Publication 14 that needed to be addressed. Based upon decisions of the WG, recommendations were forwarded to the NTEP Committee. Based on feedback at the Interim Meeting open hearings, the NTEP Committee is striking the language published in Publication 15 and inserting the language submitted by the load cell WG. The intent of the Committee is not to change the proposal from the WG, but rather to make it clear and understandable, as it appears the format

used in Publication 15 confused many members. The proposal below will be voted on by the Board after open hearings conclude at the July 2009 NCWM Annual Meeting.

Proposal to change NCWM Publication 14, NTEP Administrative Policy, Section S.1.c. as follows:

NTEP Verified Conformity Assessment Program Procedures:

Introduction

Many NTEP Certified devices must meet NIST Handbook 44 requirements for influence factors. It is not possible to verify these requirements during the Initial Verification in the field. Therefore, manufacturers of metrological devices (instruments) and/or components (modules) which are subject to influence factors, as defined in NIST Handbook 44, must have a Verified Conformity Assessment Program (VCAP) in place to ensure that these metrological devices and/or components are produced to perform at a level consistent with that of the device and/or component previously certified.

The Verified Conformity Assessment Program audit will be a site-specific verification that will focus on the site that controls testing of the device.

For weighing devices that are subject to influence factors, NTEP will require an initial on-site audit of the manufacturer's quality system and on-site random testing and/or review of a production device(s) (instrument(s)) by the Registrar to verify that all items listed below are currently implemented and functioning to verify compliance to the appropriate sections of NIST Handbook 44.

Devices that must meet this requirement are limited to the list below:

1. Load Cell (T.N.8.)
2. Indicating elements (T.N.8.)
3. Weighing/Load Receiving elements with non-NTEP load cells (T.N.8.)
4. Complete Scales (T.N.8.)
5. Automatic Weighing Systems (T.7.)
6. Belt-Conveyor Scales (T.3)
7. Automatic Bulk Weighing Systems (T.7.)

Requirements:

1. The NTEP CC Holder's Control Facility Responsibilities:

- 1.1 A documented Quality Management System governing the design and manufacture of the device.
 - 1.1.1. The NTEP CC holder shall prepare documentation of its various quality activities and practices required by this document and by the NCWM's Verified Conformity Assessment Program policy and procedures; and shall demonstrate the effective implementation of those activities and practices. This should include (and/or reference) the manufacturer's quality manual, written procedures and work instructions, flowcharts, diagrams, drawings, etc., as appropriate.
 - 1.1.2. The NTEP CC holder shall have appropriate testing facilities and equipment necessary to verify Influence Factor compliance. Note: See also 1.14.
 - 1.1.3. The NTEP CC holder shall utilize testing facilities and equipment to ensure that certified devices meet the influence factors appropriate for the device type as designated in NIST Handbook 44.
 - 1.1.4. The NTEP CC holder shall ensure that test equipment used either to: 1) directly perform influence factor testing or 2) calibrate other equipment that may be used to directly perform influence factor testing; is controlled.

- 1.1.4.1. Such control shall include calibration using nationally traceable standards, and shall extend to equipment calibrated internally, and/or to equipment calibrated by an external service provider.
- 1.1.5. The NTEP CC holder shall ensure that all applicable equipment shall have appropriate operating procedures and shall be accurate and repeatable to a degree sufficient to ensure credible influence factor testing and results.
- 1.1.6. The NTEP CC holder shall ensure that results of calibration activity shall be recorded and shall be made available to the VCAP auditor.
- 1.2. Identify the applicable Metrologically Significant Components (MSCs) of the device.
 - 1.2.1. The NTEP CC holder shall ensure that there are processes in place for identification of those components, materials, parts, or assemblies that affect the device's response to the influence factors appropriate to the device type (MSC's).
 - 1.2.2. A metrologically significant component is a part, assembly, material, design or procedure that has a direct influence on the performance or operation of a device or component thereof as identified by the device manufacturer.
 - 1.2.3. Metrological integrity is maintained by verification that the applicable characteristics of those components identified as metrologically significant are unchanged from those used in the device certified.
 - 1.2.4. The following list contains components that may or may not be identified by the device manufacturer as metrologically significant. This list shall not be considered exhaustive and is included as examples.
 - 1.2.4.1. **Load Cell, Analog** – Sensor spring element design, sensor material and heat treat, strain gauge, temperature compensating means, environment sealing design
 - 1.2.4.2. **Load Cell, Digital** – Components listed in load cell, analog, bridge excitation voltage regulation components, temperature sensitive components used to establish gain of amplification stage or reference voltage(s), metrologically significant embedded software, temperature sensing component, analog to digital converter type
 - 1.2.4.3. **Weighing/Load-Receiving Element, Electronic** – Suspension type, restraint system, bearing design, weighbridge construction load cell type, load application to load cell
 - 1.2.4.4. **Indicating Element, Electronic** – Excitation voltage regulation components, temperature sensing elements, metrologically significant embedded software, reference voltage components, analog to digital converter, temperature sensitive components in amplification stage used to establish gain or offset, active filter components, some clock components
- 1.3. Appropriate statistical methods are implemented to ensure that the process is in control as defined by the NTEP CC holder's Quality Management System.
- 1.4. An appropriate sampling plan, and acceptance criteria is in place and operating.
 - 1.4.1. The NTEP CC holder shall establish a random sampling plan appropriate for the production quantity of the device that is traceable to a nationally recognized quality standard, i.e., AQL or equivalent, or meet the minimum requirements as defined in Appendix A of this document.

- 1.4.2. Devices shall be tested in accordance to NCWM Publication 14 as designated by the established sampling plan.
- 1.4.3. Results of the testing, along with values of pertinent control parameters (e.g., time, temperature, humidity, etc.), shall be recorded and shall clearly identify whether the test passed or failed.
- 1.4.4. Records shall be made available to the VCAP auditor of test results since the last VCAP audit.
- 1.5. Required operator's manuals and calibration procedures or other controlled documentation for all appropriate devices and components (either manufactured or purchased).
- 1.6. A Nonconforming Material system to control non/conforming/non-compliant devices and components (either manufactured or purchased).
 - 1.6.1. The NTEP CC holder shall control devices that do not meet specified requirements (i.e., nonconforming) to prevent their unintended use.
 - 1.6.2. This control shall include (as a minimum): identification, recording, segregation or isolation (as practicable), review, disposition approval, and notification to appropriate personnel at the manufacturing site(s).
 - 1.6.3. Review of non-conforming VCAP devices, and disposition approval, shall be performed by authorized and qualified personnel.
 - 1.6.4. Records shall be made available to the VCAP auditor.
- 1.7. Adequate control over subcontractors and sub-tier suppliers that supply metrologically significant components.
 - 1.7.1. Control over subcontractors and sub-tier suppliers shall be defined in the NTEP CC holder's Quality Management System.
 - 1.7.2. Records of such control shall be made available to the VCAP auditor.
- 1.8. Appropriate Corrective Action system to deal with nonconforming/non-compliant devices.
 - 1.8.1. The NTEP CC holder shall identify, implement and record corrective actions needed to remedy the cause(s) of nonconformities and problems as a result of influence factor testing, and to prevent their recurrence.
 - 1.8.2. Corrective actions shall include objective evidence that the action was taken and effective.
 - 1.8.3. Corrective actions shall be reviewed and approved by authorized, qualified personnel.
 - 1.8.4. Results of corrective actions shall be retained and be readily available and easily retrievable by testing facility personnel. Records shall be made available to the VCAP auditor.
- 1.9. An Engineering Change system to control engineering/design changes affecting any MSCs.
 - 1.9.1. An engineering change system to control engineering/design changes affecting any MSCs including appropriate methods to ensure changes are released to production.
 - 1.9.2. Records shall be made available to the VCAP auditor of engineering changes since the last VCAP audit.

- 1.10. A Document and Data Control (including software and firmware) system to control changes affecting any MSCs or components of the VCAP program. Such controls shall include (at a minimum):
 - 1.10.1. review and approval for accuracy, completeness and adequacy prior to release,
 - 1.10.2. identification and availability of current/appropriate version levels,
 - 1.10.3. obsolete/superseded version are prevented from unintended uses (unless otherwise approved),
 - 1.10.4. records of document changes shall be maintained and made available to the VCAP auditor.
- 1.11. A production control system to control changes affecting any MSCs.
 - 1.11.1. The NTEP CC holder's Quality Management System shall identify the processes necessary to ensure that engineering changes are properly implemented throughout production.
- 1.12. An Identification and Traceability System (including serialization and lot/batch control as applicable) applied, as a minimum, to MSCs.
- 1.13. Documentation that personnel have been properly trained.
 - 1.13.1. The NTEP CC holder shall identify training needs, and provide training for personnel whose functions/activities affect the VCAP and particularly for those personnel performing influence factor testing.
 - 1.13.2. Training records shall ensure that personnel are qualified to perform their respective functions.
 - 1.13.3. Training shall be performed by authorized and qualified instructors (either internal to the manufacturer, or external by a service provider).
 - 1.13.4. Training needs and activity shall be recorded and shall be made available to the VCAP auditor.
- 1.14. If the NTEP CC holder contracts with an outside testing facility to conduct the influence factor testing, that facility will be subject to all pertinent VCAP requirements.
- 1.15. The NTEP CC holder shall plan and implement a program of internal self-assessment.
 - 1.15.1. The self-assessment shall be conducted at established intervals, not to exceed one year.
 - 1.15.2. The self-assessment shall evaluate the NTEP CC holder's own VCAP and their associated quality system procedures, practices, activities, and controls.
 - 1.15.3. The self-assessment shall demonstrate effective and compliant operation of the manufacturer's own VCAP.
 - 1.15.4. Results of the self-assessment shall be recorded.
 - 1.15.5. Records shall be made available to the VCAP auditor of self-assessments conducted since the last VCAP audit.
- 1.16. Subsequent audits will be held on-site to verify conformance to these standards. Subsequent audits will be conducted **every three years** until objective evidence is obtained to move to a maximum of every five years.
 - 1.16.1. Audits shall be scheduled as a stand-alone audit; not part of ISO, FM, UL, etc. The audit may be in conjunction with but not part of these audits.

- 1.16.2. Audits shall be scheduled during testing to ensure that the VCAP auditor witnesses devices being tested, data being recorded, actions being taken, etc.
- 1.16.3. An audit report shall be provided by the Certification Body as defined in the VCAP Administrative Policy, Section S.1.c.
- 1.16.4. The NTEP CC holder has the right to appeal to NCWM if a VCAP certificate has been withdrawn due to the results of the on-site audit.
- 1.16.5. The NTEP CC holder shall take corrective action within 90 days of non-conformances sited during the on-site audit. It shall be determined during the audit whether a follow-up audit is needed or a review of objective evidence is necessary to close any non-conformances.

2. Certification Body's Responsibilities:

- 2.1. The selected Certification Body is to be accredited by ANSI-ASQ National Accreditation Board (ANAB) **The ANSI-ASQ National Accreditation Board** is the U.S. accreditation body for management systems. ANAB accredits certification bodies (CBs) for ISO 9001 quality management systems (QMS) and ISO 14001 environmental management systems (EMS), as well as a number of industry-specific requirements, or equivalent.
- 2.2. With accreditation to Standard Industry Classification (SIC) codes (3596/3821) or

Sequence	2007 NAICS,	2007 North American Industry Classification
Number	U.S. Code	System (NAICS) U.S. Title
847	333997	Scale and Balance Manufacturing

or equivalent.
- 2.3. The selected Certification Body shall have international auditors available.
- 2.4. The Certification Body is required to notify NCWM when a major breakdown of the NTEP CC holder's VCAP program is found.
- 2.5. The Certification Body shall submit an audit report to NCWM as defined in the VCAP Administrative Policy, Section S.1.c. This report must contain a clear statement of compliance as a result of the VCAP audit.

3. NCWM Responsibilities:

- 3.1. Ensure that VCAP certification has been met within a one-year cycle of maintenance fee (example: if VCAP certified in July, certification would be required by November of the following year).
- 3.2. Verify that new customer/new certificate have process capability audit successfully completed prior to receiving certificate from NTEP.
- 3.3. As part of annual maintenance, NCWM shall ensure that VCAP audit reports are on file, current, and that all non-conformances have been addressed.
- 3.4. Ensure that an appeals process is in place and made available to Certificate holders.

4. Sample Sizes:

4.1 The following sample sizes are to be used based on annual production.

Units per Year	Minimum Number (Total of Samples Production) per Year
2 - 50	2
51 - 500	3
501 - 35,000	5
35,001+	8

Definition:

Control Facility: The control facility is the facility that is in control of the product before it goes into the marketplace.

8. V NTEP Policy for Issuing Certificates of Conformance (CC) for Software

Source: NTETC Software Sector

Proposal: Change current NCWM/NTEP policy applicable to software.

Software Requiring a Separate CC: Software, which is implemented as an add-on to other NTEP-Certified main elements to create a weighing or measuring system and its metrological functions, are significant in determining the first indication of the final quantity. Such software is considered a main element of the system requiring traceability to an NTEP CC.

NOTE: OEM software may be added to an existing CC or have a stand-alone CC with applicable applications (e.g., a manufacturer adding a software upgrade to their ECR or point-of-sale system, vehicle scale weigh-in/weigh-out software added as a feature to an indicating element, automatic bulk weighing, liquid-measuring device loading racks, etc.) and minimum system requirements for “type P” (built-for-purpose) devices (see proposed software definition below). It may be possible for a manufacturer to submit a single application for both hardware and software contained in the same device. A single CC would be issued.

In this instance, OEM refers to a third party. The request to add software could be made by the original CC holder on behalf of the third party. Alternatively, a new CC could be created that refers to the original CC and simply lists the new portions that were examined.

Background: Excerpts of reports from the 1995 - 1998 Executive Committees were provided to NTETC Software Sector members at their April 2006 meeting. The chair asked the Sector to review the following NTEP policy decision adopted by the NCWM in 1998 relative to the issuance of a separate CC for software.

During the 1998 NCWM, the following recommendation was adopted as NTEP policy:

- “Software, regardless of its form, shall not be subject to evaluation for the purpose of receiving a separate, software CC from the National Type Evaluation Program.”
- “Remove all of the software categories from the index of NCWM Publication 5, NTEP Index of Device Evaluations.”
- “Reclassify all existing software CCs according to their applicable device categories.”

The policy is still in effect today.

Also noteworthy is a statement in Section C of NCWM Publication 14, Administrative Policy. It states:

In general, type evaluations will be conducted on all equipment that affect the measurement process or the validity of the transaction (e.g., electronic cash registers interfaced with scales and service station consoles interfaced with retail fuel dispensers); and all equipment to the point of the first indicated or recorded representation of the final quantity on which the transaction will be based.

Software which is implemented as an add-on to other NTEP-certified main elements to create a weighing or measuring system and its metrological functions are significant in determining the first indication of the final quantity. Such software is considered to be a main element of the system requiring traceability to a CC. Current policy, however, prohibits NTEP from issuing a separate certificate just for the software. The certificate must be issued on the entire system.

The Software Sector considered the possibility of amending the 1998 policy to allow NTEP to issue separate Certificates of Conformance for software. This new policy would not change how NTEP evaluates software; it would simply change how the software is represented on the certificate. For example, software designed to act as a point-of-sale would be represented on the certificate as “Software” with further description as “Point-of-Sale System.” The certificate would allow this software to be implemented as a main element of a weighing system using compatible hardware including scanner/scale, cash register, printer, computer processor, etc. If this fundamental approach is taken, it will allow the Software Sector to move toward the other steps in the process.

The consensus of the Sector is that the current NCWM/NTEP policy should be changed.

As further background, the proposed definitions forwarded to the S&T Committee from the Software Sector are printed below.

Electronic devices, software-based. Weighing and measuring devices or systems that use metrological software to facilitate compliance with Handbook 44. This includes:

- (a) **Embedded software devices (Type P), aka built-for-purpose.** A device or element with software used in a fixed hardware and software environment that cannot be modified or uploaded via any interface without breaking a security seal or other approved means for providing security, and will be called a “P”, or
- (b) **Programmable or loadable metrological software devices (Type U), aka not built-for-purpose.** A personal computer or other device and/or element with PC components with programmable or loadable metrological software, and will be called “U.” A “U” is assumed if the conditions for embedded software devices are not met.

Software-based devices – See Electronic devices, software-based.

Judy Cardin, Wisconsin, NTEP Committee Chair

Jack Kane, Montana, NCWM Chair
Randy Jennings, Tennessee, NCWM Chair-Elect
Charles Carroll, Massachusetts
Steve Malone, Nebraska

NTEP Technical Advisor: Jim Truex, NTEP Administrator

National Type Evaluation Program Committee

Appendix A

National Type Evaluation Technical Committee Grain Analyzer Sector

August 20, 2008 – Kansas City, Missouri
Meeting Summary

Agenda Items

1.	Report on NCWM Administrative Staff Changes	A1
2.	Report on the 2008 NCWM Interim and Annual Meetings.....	A2
3.	Report on NTEP Type Evaluations and OCP (Phase II) Testing.....	A3
4.	Review of Ongoing Calibration Program (Phase II) Performance Data.....	A3
5.	Report on GIPSA/NIST Interagency Agreement Renewal.....	A3
5.5.	Air-Oven Collaborative Study	A4
6.	Proposed Change to Handbook 44, Section 5.57, Paragraph N.1.2. To Modify Tolerances on Standard Reference Samples.....	A5
7.	Proposed Changes to the GMM Chapter of Publication 14 to Address Multi-Class Test Weight per Bushel Type Evaluations	A7
8.	Proposed Changes to the GMM Chapter of Publication 14 to Limit the Moisture Content of Samples Used To Evaluate Test Weight per Bushel Performance and to Add Special Considerations for Multi-Class Calibrations.....	A11
9.	Proposed Changes to Appendix C of the GMM Chapter of Publication 14 to Add Data Fields for Test Weight per Bushel and to Modify Instructions for Submitting to Reflect Current Technology.....	A14
10.	Editorial Correction to the GMM Chapter of Publication 14 § IV. Tolerances for Calibration Performance	A15
11.	Report on OIML TC 17/SC 1 IR 59 “Moisture Meters for Cereal Grains and Oilseeds”	A15
12.	Report on OIML TC 17/SC 8 Draft IR “Protein Measuring Instruments for Cereal Grain”	A16
13.	Marking Requirements for Type P Devices.....	A16
14.	Time and Place for Next Meeting.....	A19

1. Report on NCWM Administrative Staff Changes

Effective October 1, 2008, NCWM, Inc. will have a new management structure. The first step in this transition has been completed with the hiring of Don Onwiler as the new NCWM Executive Director and Jim Truex as NTEP Administrator. Don will work out of the Lincoln, Nebraska, office and Jim will operate from a home office in Ohio. The transition of duties from Management Solutions in Rockville, Maryland, to the new NCWM Headquarters in Lincoln will occur gradually over the coming weeks and will be completed by October 1, 2008. Contact information for the new offices is shown below:

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 Lincoln, NE 68508
 Phone: (402) 434-4880
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2. Report on the 2008 NCWM Interim and Annual Meetings

The Interim Meeting of the 93rd National Conference on Weights and Measures (NCWM) was held January 27 - 30, 2008, in Albuquerque, New Mexico. At that meeting the NTEP Committee accepted the Sector's recommended amendments and changes to the 2007 Edition of NCWM Publication 14. These changes appear in the 2008 Edition (see also *ADDENDUM SHEET Pub 14, Grain Analyzers 2008 Edition ISSUED April 24, 2008* for changes not included in the original 2008 Edition.) For additional background refer to *Committee Reports for the 93rd Annual Meeting*, NCWM Publication 16 – April 2008.

Amendments/Changes to the Grain Moisture Meters Chapter in the 2007 Edition of NCWM Publication 14			
Section Number	Amendment/Change	Page	Source
IV. Tolerances for Calibration Performance	Delete all text relating to "Approved" and "Pending" categories. Amend/modify to show the revised criteria for calibration approval.	GMM-5 thru GMM-7	08/07 Grain Moisture Meter Sector Agenda Item 4
V. Criteria for NTEP Moisture Calibration Review	Add table specifying "Basic 6-Percent Moisture Interval," "Standard Moisture Range," and "Maximum Upper Limit" for each grain type or class. Delete Cases I through VII dealing with inadequately represented moisture intervals. Modify "Special Considerations for 'Multi-Class' Calibrations."	GMM-7 thru GMM-10	08/07 Grain Moisture Meter Sector Agenda Item 4
VII.B. Accuracy, Precision, and Reproducibility	Change Oats moisture range from 10 - 16 % to 8 - 14 % in table.	GMM-13	08/07 Grain Moisture Meter Sector Agenda Item 4
Appendix D – Sample Temperature Sensitivity (For grains/oil seeds other than corn, soybeans, & hard red winter wheat)	Change Oats moisture range from 10 - 16 % to 8 - 14 % in table titled "Moisture Ranges and Tolerance for Sample Temperature Sensitivity."	GMM-44	08/07 Grain Moisture Meter Sector Agenda Item 4

The 93rd Annual Meeting of the NCWM was held July 13 - 17, 2008, in Burlington, Vermont. No Grain Moisture Meter (GMM) or Near Infrared (NIR) Grain Analyzer items were presented for consideration by the NCWM at the 2008 Annual Meeting.

3. Report on NTEP Type Evaluations and OCP (Phase II) Testing

Cathy Brenner of the Grain Inspection, Packers, and Stockyards Administration (GIPSA), the NTEP Participating Laboratory for Grain Analyzers, briefed the Sector on NTEP Type Evaluation activity. No new devices had been submitted for evaluation since the Sector's 2007 meeting. Annual GMM calibration reviews were completed on schedule and updated Certificates of Conformance (CCs) were issued for six device types. She reported that the following device types are enrolled in the OCP (Phase II) for the 2007 harvest:

[Note: Models listed on a single line are considered to be of the same "type."]

DICKEY-john Corporation	GAC2000 NTEP, GAC2100, GAC2100a, GAC2100b
Foss North America	Infratec 1241
Foss North America	Infratec 1227, Infratec 1229
Perten Instruments	AM5100
The Steinlite Corporation	SL95

Ms. Brenner explained that although the CC for DICKEY-john's OmegAnalyzer G does not expire until July 1, 2009, DICKEY-john has elected not to enroll in Phase II for the 2008 harvest. Because there are now only five devices in the program, the cost to manufacturers for Phase II drops from \$7,730 to \$5,300 per meter type.

4. Review of Ongoing Calibration Program (Phase II) Performance Data

At their August 2005 meeting, the Sector agreed that comparative OCP data identifying the Official Meter and listing the average bias for each NTEP meter type should be available for annual review by the Sector. Accordingly, Cathy Brenner, representing GIPSA, the NTEP Participating Laboratory for Grain Analyzers, presented data showing the performance of NTEP meters compared to the air oven based on the last three crop years (2005–2007) using calibrations updated for use during the 2008 harvest season.

Ms. Brenner pointed out that data on the DICKEY-john OmegAnalyzer G and Perten's AM5100 were not included in the comparisons because they have not been in the program for three full years. Comparisons of GMMs with less than three years of data against GMMs with the full three years of data are not meaningful as they may be unduly influenced by a single unusual crop year. Also, to preserve confidentiality sunflower results were not included because only two meters were approved for sunflowers and one of them was the Official Meter.

Dr. Richard Pierce, GIPSA, explained that GIPSA, to avoid making calibration changes that might be unduly influenced by unusual growing conditions in a single year, looks at both the most recent three years and the most recent five years of data before making decisions on changes. This year, as a matter of curiosity, results based on 13 years of Official Meter Phase II data were also reviewed and were found to be quite different from results based on data from the last three years. Some Sector members speculated that advancements in genetic engineering have led to accelerated introduction of new plant varieties resulting in a different overall genetic population for the most recent three years when compared to the previous 13 years. Grain moisture meters (GMMs) may respond differently to grains of different genotypes.

Dr. Charles Hurburgh, Iowa State University, remarked that with the increase in grain prices, moisture measurements have a greater economic impact (one percentage point difference in moisture is worth 25 cents for soybeans and 12 cents for corn). As a result, he has received phone calls concerning moisture meter alignments. He was of the opinion that the comparison data looked very good for corn and soybeans, and that it may not be possible to be any better. He cautioned that state weights and measures personnel may see an increasing number of complaints at harvest due to corn and soybeans sold earlier at very high prices for fall delivery.

5. Report on GIPSA/NIST Interagency Agreement Renewal

The present five-year Interagency Agreement that provides funding for the Grain Moisture Meter On-going Calibration Program (OCP) will expire at the conclusion of data collection for crop year 2009. Renewal of the Agreement is subject to an annual review to determine if changes should be made. Under the terms of the present

agreement NIST and GIPSA each contribute one third of the cost of the program subject to an annual maximum of \$26,500 each. The balance of costs is borne by manufacturers and depends on the number of meter models in the NTEP “pool” according to a fee schedule (see table below). NIST and GIPSA are currently reviewing costs associated with the program to determine what changes should be made to the funding arrangements and fee schedule.

NTEP On-going Calibration Program Fee Schedule For Fiscal Years 2005 - 2009							
(1) Total Meters (including Official Meter)	(2) Meters in NTEP Pool	(3) Cost per NTEP Pool Meter	(4) Total Program Cost	Funding Contribution from Participants			
				(5) NIST	(6) GIPSA	(7) Manufacturers (total funding from manufacturers)	(8) Cost per Meter Type
2	1	19,875	19,875	6,625	6,625	6,625	3,315
3	2	19,875	39,750	13,250	13,250	13,250	4,415
4	3	19,875	59,625	19,875	19,875	19,875	4,970
5	4	19,875	79,500	26,500	26,500	26,500	5,300
6	5	19,875	99,375	26,500	26,500	46,375	7,730
7	6	19,875	119,250	26,500	26,500	66,250	9,465
8	7	19,875	139,125	26,500	26,500	86,125	10,765
9	8	19,875	159,000	26,500	26,500	106,000	11,775

Dr. Pierce, representing GIPSA, reported that there is no agreement yet on the funding arrangements or on the duration of the program. GIPSA may consider transferring a greater portion of the program cost to the manufacturers. If the program is approved for a 5-year period, it is possible there will be an inflationary factor built in for each year of the program. The program currently appears to be carrying its weight, but it did better at the beginning of the period. There have been questions as to whether all the time of NTEP laboratory staff has been considered in reporting program costs.

Dr. Pierce believes that USDA will participate in the program, but questions how long it will remain feasible to continue the program. If the present Official Meter is replaced by a meter utilizing a very high frequency (VHF) universal moisture algorithm there would be no need for the OCP. Meters could be aligned by other less expensive means and calibrations could be transferrable between different models designed to use that algorithm. Dr. Pierce cited GIPSA’s goal to ultimately approve multiple models for use in the Grain Inspection System and suggested that the Sector may need to look ahead if GIPSA drops their existing calibration maintenance program.

Diane Lee, representing NIST, stated that NIST recognizes the value of keeping meters aligned with the standard reference method and would continue to contribute to the support of appropriate means to do so.

5.5. Air-Oven Collaborative Study

Submitted by: Karl Cunningham, Illinois Department of Agriculture. [Note: This item was received after the Sector agenda had been published. Because of the importance of this issue the Sector agreed to include this issue on the agenda at its August 2008 meeting.]

Background: Under the NTEP program for grain moisture meters, calibrations are based on USDA/GIPSA air ovens while field inspection is based on state air ovens. For the program to be effective, procedures must be in place to assure that state oven results (and manufacturers’ oven results) agree with the USDA/GIPSA air oven, which is considered the standard. NIST-WMD’s laboratory measurement traceability program requires that laboratories participate in interlaboratory and other collaborative experiments. This requirement has been met by one of two methods: 1) individual laboratories independently send samples to GIPSA for air oven analysis, and subsequently compare their results to those obtained by GIPSA; or 2) a structured collaborative study where every lab, including GIPSA, measure the same sample. A structured collaborative air oven study was last conducted following the 2000 harvest. Results of that study were reported at the Sector’s August 2001 meeting.

Discussion/Recommendation: A structured collaborative study has at least two advantages over independent submission of samples to GIPSA by individual laboratories: 1) in addition to a check against the “standard,” it provides information on how individual labs compare with each other; 2) it allows GIPSA to plan for a known work load. The Sector agreed that a collaborative study was long overdue. It was also noted that such a study addresses the measurement traceability requirements of ISO 17025. Two manufacturers, Dr. Hurburgh of Iowa State University, and the two state weights and measures representatives present expressed a desire to participate in the study. Although Karl Cunningham was not present, it was suggested that Illinois serve as the “pivot” laboratory. Diane Lee, NIST, will write up the procedures to be followed and will send out a memo soliciting additional participants to all states with a grain moisture program. GIPSA will be the reference laboratory.

6. Proposed Change to Handbook 44, Section 5.57, Paragraph N.1.2. To Modify Tolerances on Standard Reference Samples

Background: This is a carryover item from the Sector’s August 2007 meeting. During that meeting a question was raised regarding how the standard reference samples needed for field testing would be provided to the states. It was pointed out that, at present, states must provide the samples. Paragraph N.1.2. of the NIR Grain Analyzer Code of NIST Handbook 44 stipulates:

N.1.2. Standard Reference Samples. – Reference samples used for field inspection purposes shall be clean and selected to reasonably represent the constituent range. These samples shall be selected such that the difference between constituent values obtained using the GIPSA standard reference method and an official GIPSA NIR grain analyzer does not exceed one-half of the acceptance tolerance shown in Table T.2. for individual test samples or 0.375 times the acceptance tolerance shown for the average of five samples.
(Amended 2001 and 2003)

At that time Dr. Richard Pierce, GIPSA, did not immediately recall the origin of the traceability numbers, but suspected they came from the original Tentative Code that covered only wheat protein. He noted that they would not apply to soybeans.

A table showing the acceptance tolerance from Table T.2. and the resulting tolerances for standard reference samples, calculated using the current multipliers (0.50 and 0.375) from paragraph N.1.2., has been reproduced below for convenience.

Tolerances for Standard Reference Samples (GIPSA Reference Method Minus GIPSA Official NIR Grain Analyzer)					
Type of Grain	Constituent	Acceptance Tolerance Individual Samples (percent)	Tolerance for Standard Reference Samples (percent)	Acceptance Tolerance Average for Five Samples (percent)	Tolerance for Standard Reference Samples Average for Five Samples (percent)
All Wheats (including Durum)	protein	0.60	0.30	0.40	0.15
Soybeans	protein	0.80	0.40	0.60	0.23
	oil	0.70	0.35	0.50	0.19
All Barleys	protein	0.70	0.35	0.50	0.19
Corn	protein	0.80	0.40	0.60	0.23
	oil	0.70	0.35	0.50	0.19
	starch	1.00	0.50	0.80	0.30

Discussion/Recommendation: The Sector was asked to consider making this issue an item for further study. Additional data and actual field experience are needed before an intelligent recommendation can be made on tolerances for standard reference samples.

Commenting on the tolerances shown in the above table, Dr. Pierce, GIPSA, noted that with current technology the reference standard tolerances shown for wheat may be too wide. On the other hand, for corn and soybeans he was concerned that the standard reference method may use up most of the tolerance making sample selection very difficult if not impossible. Dr. Hurburgh noted that the reproducibility error standard deviation for the standard reference method for oil testing was 0.25.

Several questions were raised regarding the possible use of grain samples as “transfer standards.”

1. Can we establish traceability using GIPSA field office instrument results?
2. How important is sample selection if we use meter-assigned values?
3. Do meter-assigned values have to be device-type specific?

In partial answer to questions 2 and 3, above, Dr. Hurburgh replied, “If all [instruments] are transmittance using 18 mm path length, sample selection is not important, but if reflectance instruments are involved results are often diametrically opposed.”

It was suggested that this issue might best be handled by a subcommittee charged with determining:

1. How should samples be selected for field testing?
2. Who will assign the official value of the sample used?

One Sector member pointed out that a method for selecting samples and assigning official values had already been specified. Members were generally reluctant to commit to expending extra effort because of lack of interest from the states. Significant effort had been expended in developing the original Handbook 44 specifications and the corresponding tests/check lists in Publication 14. As far as the Sector has been able to determine not a single state has a program for inspecting NIR Grain Analyzers for anything other than moisture. Developing revised procedures for selecting field samples will require active participation not only by manufacturers and GIPSA but also by interested state weights and measures personnel to provide feedback during method development and to provide field test results and additional feedback using proposed methods.

Diane Lee, NIST, has agreed to send a memo to states to determine if there is a true need for revising the existing method and if so, to see if they are willing to actively participate.

7. Proposed Changes to the GMM Chapter of Publication 14 to Address Multi-Class Test Weight per Bushel Type Evaluations

Background/Discussion: The GMM Chapter of NCWM Publication 14 was amended in 2006 to allow multi-class moisture calibrations. Since that time devices have become available with the potential for using multi-class calibrations for both moisture and Test Weight per Bushel (TW). The current edition of the GMM Chapter of Publication 14 provides procedures and tolerances for addressing multi-class calibrations for moisture but not for TW.

The Sector agreed by consensus to recommend changes to the 2008 Edition of Publication 14 to address devices with multi-class calibrations for TW and to forward the recommendation below to the NTEP Committee for consideration.

Recommendation: Amend § VII. Additional Type Evaluation Test Procedures and Tolerances for Grain Moisture Meters Incorporating an Automatic Test Weight per Bushel Measuring Feature, Subsection B. Accuracy, Precision, and Reproducibility of the GMM Chapter of Publication 14 to address multi-class type evaluations for TW.

VII. Additional Type Evaluation Test Procedures and Tolerances for Grain Moisture Meters Incorporating an Automatic Test Weight per Bushel Measuring Feature

B. Accuracy, Precision, and Reproducibility:

The automatic test weight per bushel measuring feature of grain moisture meters will be tested for accuracy, repeatability (precision), and reproducibility with 12 samples of each grain type for which the meter has an approved moisture calibration. Samples will be chosen to represent the moistures and test weights per bushel shown in the following table. The reference method for test weight per bushel is the quart kettle test weight per bushel apparatus as specified by the USDA GIPSA. The reference value will be the average of 3 replicates. Samples will be dropped three times through each of two meters. The reference value will be re-checked after the meters have been tested. The average of the initial and final reference values shall be used as the reference value in calculations of meter performance.

Three replicates will be run on each instrument for each sample, resulting in a total of 72 observations of test weight per bushel per grain type (2 instruments x 12 samples x 3 replicates).

Type of Grain	Moisture Range	Minimum Test Weight per Bushel Range	Criteria for Sample Selection
Corn	12 - 18 %	54 - 58	<p>a) No less than 8 samples should come from the lowest two-thirds of the 6 % moisture range.</p> <p>b) No less than 2 samples should come from the highest one-third of the 6 % moisture range.</p> <p>c) Samples should represent a distribution of Test Weights per Bushel (TW) that minimizes the correlation between TW and moisture.</p>
Soybeans	10 - 16 %	55 - 59	
Hard Red Winter Wheat	10 - 16 %	59 - 63	
Durum Wheat	10 - 16 %	59 - 63	
Soft White Wheat (except White Club)	10 - 16 %	58 - 62	
Hard Red Spring Wheat (and White Club)	10 - 16 %	58 - 61	
Soft Red Winter Wheat	10 - 16 %	56 - 60	
Hard White Wheat	8 - 14 %	60 - 64	
All-class wheat*	10 - 16 %	56 - 63	
Wheat Excluding Durum*	10 - 16 %	56 - 63	
Two-Row Barley	10 - 16 %	47 - 51	
Six-Row Barley	10 - 16 %	43 - 47	
All-class Barley*	10 - 16 %	43 - 51	
Oats	8 - 14 %	33 - 39	
Sunflower Seed (Oil Type)	6 - 12 %	28 - 31	
Long Grain Rough Rice	10 - 16 %	43 - 47	
Medium Grain Rough Rice	10 - 16 %	44 - 48	
All-class Rough Rice*	10 - 16 %	43 - 48	
Grain Sorghum or Milo	10 - 16 %	58 - 62	

Note: Calibrations marked with an asterisk () are “multi-class” calibrations*

Accuracy. The two tests for accuracy are bias (meter versus the standard reference method) and the Standard Deviation of the Differences (SDD) between the meter and the standard reference method. Each instrument will be tested individually.

$$Bias = \frac{\sum_{i=1}^n (\bar{x}_i - r_i)}{n}$$

where,

\bar{x}_i = average predicted test weight per bushel for sample i (3 replicates)

r_i = reference test weight per bushel for sample i

n = number of samples (n=12, see Note 1 below regarding “multi-class” calibrations.)

$$SDD = \sqrt{\frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n - 1}}$$

where,

y_i = $\bar{x}_i - r_i$ (see above)

\bar{y} = average of the y_i

n = number of samples (n=12, see Note 1 below regarding “multi-class” calibrations.)

Tolerances for bias and SDD tests are one-half the absolute value of the NIST Handbook 44 acceptance tolerance. Specific tolerances are:

Grain Type	Tolerance
Corn, oats	0.4 pounds per bushel
All wheat classes	0.25 pounds per bushel
Soybeans, barley, rice, sunflower, sorghum	0.35 pounds per bushel

The manufacturer may adjust the calibration bias to compensate for differences from the type evaluation laboratory in reference methods or sample sets.

Note 1: “Multi-class” calibrations will be tested using full test sets for all included classes (12 x number of classes). In addition to meeting accuracy requirements (bias and SDD) for the tests sets of each individual class, “multi-class” calibrations must meet the accuracy requirements (bias and SDD) when the data from all included classes is pooled.

Note 2: A single slope and bias will be used for “multi-class” calibrations.

Repeatability. The Standard Deviation (SD) of the three test weight per bushel replicates will be calculated for each sample and pooled across samples. Each instrument will be tested individually. The equation used to calculate SD is:

$$SD = \sqrt{\frac{\sum_{i=1}^n \sum_{j=1}^3 (P_{ij} - \bar{P}_i)^2}{2n}}$$

where,

P_{ij} = predicted test weight per bushel for sample i and replicate j

\bar{P}_i = average of the three predicted test weight per bushel values for sample i

n = number of samples ($n=12$, see note below regarding “multi-class” calibrations.)

Tolerances for repeatability for all grain types except corn and oats are 0.4 x the absolute value of the Handbook 44 acceptance tolerance. The tolerance for repeatability for corn and oats is 0.5 x the absolute value of the NIST Handbook 44 acceptance tolerance. Specific tolerances are:

Grain Type	Tolerance
Corn, oats	0.40 pounds per bushel
All wheat classes	0.20 pounds per bushel
Soybeans, barley, rice, sunflower, sorghum	0.28 pounds per bushel

Note: “Multi-class” calibrations will be tested using full test sets for all included classes. “Multi-class” calibrations must meet the repeatability requirements (SD) for the test sets of each individual class.

Reproducibility. The results for each of the three test weight per bushel replicates will be averaged for each instrument, and the Standard Deviation of the Differences (SDD) between instruments will be calculated using the following equation:

$$SDD = \sqrt{\frac{\sum_{i=1}^n (d_i - \bar{d})^2}{n-1}}$$

where,

$$d_i = \bar{P}_{1i} - \bar{P}_{2i}$$

\bar{P}_{1i} = average of three replicates for sample i on instrument 1

\bar{P}_{2i} = average of three replicates for sample i on instrument 2

\bar{d} = average of the d_i

n = number of samples ($n=12$, see note below regarding “multi-class” calibrations.)

Tolerances for reproducibility are 0.5 x the absolute value of the Handbook 44 acceptance tolerance. Specific tolerances are:

Grain Type	Tolerance
Corn, oats	0.40 pounds per bushel
All wheat classes	0.25 pounds per bushel
Soybeans, barley, rice, sunflower, sorghum	0.35 pounds per bushel

Note: “Multi-class” calibrations will be tested using full test sets for all included classes. “Multi-class” calibrations must meet the reproducibility requirements (SDD) for the test sets of each individual class.

8. Proposed Changes to the GMM Chapter of Publication 14 to Limit the Moisture Content of Samples Used To Evaluate Test Weight per Bushel Performance and to Add Special Considerations for Multi-Class Calibrations

Background/Discussion: During the August 2006 Sector meeting, a consensus was reached to require monitoring test weight per bushel (TW) calibration performance using data collected as part of the on-going moisture calibration program (Phase II).

Cathy Brenner, representing GIPSA, the NTEP participating laboratory for Grain Analyzers, has compiled a table showing the composition of TW samples for the three most recent years of Phase II data (see Table 1, below). Table 1 data indicate that several grains besides corn can have samples with moistures greater than 20 %. Also of interest is the fact that a surprising number of Phase II samples have not been of sufficient size to obtain a reference TW measurement using the quart kettle method.

Table 1. Yearly TW Sample Set Composition						
Grain	Year	N - Moisture	N - TW	% N - TW	Moisture Range	TW Range
Corn	2005	141	140	99.3	9.1 - 19.9	53.5 - 61.8
	2006	189	174	92.1	9.5 - 20.0	50.1 - 62.7
	2007	151	139	92.1	11.8 - 19.9	54.5 - 61.1
Durum	2005	30	10	33.3	7.9 - 20.3	47.8 - 62.9
	2006	24	9	37.5	7.4 - 13.7	56.9 - 63.6
	2007	70	44	62.9	8.0 - 16.3	56.7 - 63.7
Grain Sorghum	2005	38	31	81.6	11.8 - 17.7	57.8 - 61.6
	2006	45	18	40.0	12.5 - 18.3	54.5 - 61.6
	2007	18	18	100.0	10.8 - 19.5	54.3 - 62.1
Hard White Wheat	2005	31	23	74.2	7.2 - 15.4	54.9 - 65.7
	2006	39	9	23.1	8.6 - 14.9	57.4 - 64.1
	2007	27	20	74.1	7.7 - 15.0	57.8 - 64.8
Hard Red Spring Wheat	2005	51	31	60.8	7.5 - 26.9	36.6 - 62.9
	2006	67	45	67.2	7.1 - 17.3	51.0 - 64.1
	2007	55	37	67.3	6.9 - 22.2	57.5 - 64.7
Hard Red Winter Wheat	2005	89	76	85.4	7.7 - 23.1	45.6 - 65.1
	2006	79	70	88.6	7.3 - 19.7	51.8 - 64.0
	2007	98	77	78.6	8.1 - 20.0	50.9 - 64.5
Long Grain Rough Rice	2005	36	36	100.0	8.0 - 22.5	42.6 - 47.5
	2006	55	55	100.0	10.0 - 27.1	41.7 - 48.2
	2007	71	71	100.0	10.8 - 26.1	41.6 - 48.3
Medium Grain Rough Rice	2005	57	57	100.0	8.1 - 29.7	43.8 - 49.6
	2006	53	53	100.0	11.6 - 25.6	42.1 - 50.3
	2007	61	61	100.0	11.0 - 28.0	41.3 - 50.1
Oats	2005	17	11	64.7	9.8 - 12.1	36.8 - 41.4
	2006	22	20	90.9	8.3 - 15.3	30.0 - 44.6
	2007	26	17	65.4	10.0 - 14.7	35.0 - 43.6
Six-Row Barley	2005	28	23	82.1	7.8 - 16.8	41.7 - 51.8
	2006	42	34	81.0	7.6 - 14.4	40.8 - 51.8
	2007	36	28	77.8	7.9 - 20.6	43.5 - 51.9
Soft Red Winter Wheat	2005	34	34	100.0	7.2 - 20.2	54.8 - 64.6
	2006	65	63	96.9	10.2 - 20.2	55.4 - 63.4
	2007	88	87	98.9	9.0 - 28.0	52.4 - 64.1
Soft White Wheat	2005	24	24	100.0	7.8 - 15.4	57.6 - 63.6
	2006	35	33	94.3	7.1 - 15.3	57.7 - 63.0
	2007	51	42	82.4	7.5 - 18.3	57.5 - 62.7
Soybeans	2005	161	141	87.6	7.7 - 19.8	51.7 - 58.5
	2006	221	214	96.8	7.9 - 24.5	48.7 - 59.3
	2007	246	225	91.5	7.1 - 20.5	52.3 - 59.3
Sunflower Seeds	2005	66	62	93.9	4.8 - 18.2	24.5 - 35.7
	2006	56	55	98.2	5.7 - 20.7	22.7 - 36.2
	2007	48	38	79.2	6.3 - 18.5	24.7 - 34.1
Two-Row Barley	2005	17	17	100.0	7.1 - 19.3	45.5 - 55.6
	2006	41	31	75.6	8.0 - 14.2	43.6 - 53.7
	2007	27	26	96.3	8.3 - 15.0	42.8 - 53.8

The NTEP Laboratory has suggested that the moisture content of samples used to evaluate Phase II TW performance be limited to 20 % for all grains. Also suggested was adding criteria for evaluating Phase II multi-class TW calibration results that was similar to the criteria used for reviewing the performance of multi-class moisture calibrations.

The Sector agreed by consensus to accept the recommendation below incorporating changes suggested by the NTEP laboratory and to forward it to the NTEP Committee for consideration.

Recommendation: Amend § VII. **Additional Type Evaluation Test Procedures and Tolerances for Grain Moisture Meters Incorporating an Automatic Test Weight per Bushel Measuring Feature**, Subsection C. **Tolerances for Test Weight per Bushel Calibration Performance** of the GMM Chapter of Publication 14 to limit the moisture content of samples used to evaluate test weight per bushel performance and to add special considerations for multi-class calibrations for TW as shown below:

VII. Additional Type Evaluation Test Procedures and Tolerances for Grain Moisture Meters Incorporating an Automatic Test Weight per Bushel Measuring Feature

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C. Tolerances for Test Weight per Bushel Calibration Performance:

In addition to the Basic Instrument Tests and the Accuracy, Precision, and Reproducibility Tests cited previously, test weight per bushel calibration performance will be monitored using test weight per bushel data collected as part of the on-going national moisture calibration program (Phase II). Evaluation of test weight per bushel performance for all grains will be limited to data collected on samples with moisture content not exceeding 20 percent as determined by the USDA air-oven reference method.

For up to three years of available test weight per bushel data:

- a. The difference between the average bias to quart kettle for all samples in a given year and the average bias to quart kettle for any other year shall not exceed: 0.80 for corn and oats; 0.50 for wheat; and 0.70 for all other grains.
- b. The average calibration bias with respect to quart kettle shall not exceed: 0.40 for corn and oats; 0.25 for wheat; and 0.35 for all other grains calculated using the most recent calibration and all available raw data collected within the last three years for samples with moisture content not exceeding 20 percent.

Failure to meet the requirements in either item a. or b. above will cause removal of test weight per bushel approval status for the affected grain type(s) on the NTEP Certificate of Conformance (CC) for that instrument.

Test weight per bushel data from Phase II may be used at the manufacturer's discretion to support a grain-specific bias adjustment change in a test weight per bushel calibration. A repeat of the Basic Instrument Tests and the Accuracy, Precision, and Reproducibility Tests cited previously is not required for a grain-specific bias-adjustment change in a test weight per bushel calibration supported by Phase II data.

Any change in a grain-specific test weight per bushel calibration (including changes in grain-specific bias adjustments) must be reflected on the CC in a manner obvious to field inspection personnel.

Special Considerations for “Multi-Class” Calibrations.

For Phase II, data for each individual grain class included in a “multi-class” calibration will be reviewed to determine what adjustments, if any, are needed.

Data for each individual grain class and the combined data for all grain classes included in the “multi-class” calibration will be reviewed to verify calibration performance for each individual grain class and the combined data.

9. Proposed Changes to Appendix C of the GMM Chapter of Publication 14 to Add Data Fields for Test Weight per Bushel and to Modify Instructions for Submitting to Reflect Current Technology

Background/Discussion: Several changes are required to **Appendix C, Standard Data Format**, of the GMM Chapter of Publication 14 to bring Appendix C up to date with current practice:

1. Recent changes to the GMM Chapter of Publication 14 stipulating the monitoring of Phase II TW data will require manufacturers to submit re-predicted TW data for review in the event that changes are made in TW calibrations. Data fields for TW are not defined in the current issue of Publication 14.
2. The instructions for submitting re-predicted data for calibration review require updating to reflect current technology.
3. The table of File Names to be used in submitting re-predicted data requires amending to specify file names for multi-class calibrations.

Because multi-class calibrations are evaluated using full test sets for all included classes and must meet the requirements for the test sets of each individual class, the Sector decided that the table **File Names for Submitting NTEP Meter Data for Calibration Review** should not be modified to specify file names for multi-class calibrations. The Sector agreed by consensus to recommend amending/modifying Appendix C in the 2008 Edition of the GMM Chapter of Publication 14 to add additional data fields for TW data and to update instructions for submitting data to reflect current practice. The Sector’s recommendation, below, will be forwarded to the NTEP Committee for consideration.

Recommendation: Amend/modify Appendix C of the GMM Chapter of Publication 14 as shown below to address these issues:

Appendix C

Standard Data Format

(For Submitting NTEP Meter Data for Calibration Review)

1. Data Fields:

Sample I.D.	Meter Moist	A.O. Moist	Meter Model	Meter S.N.	Calibration I.D.	Grain Type	Crop Year	Reference T.W.	Meter T.W.
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2. Description of Data Fields:

- Sample I.D. The unique sample number assigned by FGIS.
- Meter Moist The meter-predicted moisture.
- A.O. Moist The FGIS air oven moisture result.
- Meter Model The name of the model submitted by the manufacturer.
- Meter S.N. The instrument serial number assigned by the manufacturer.
- Calibration I.D. The unique name or number of the calibration used to predict the moisture value.
- Grain Type The abbreviated name of the grain type (see accompanying table).
- Crop Year The crop year in which the sample was received.

- Reference T.W. The FGIS test weight apparatus result.
- Meter T.W. The meter-predicted test weight per bushel.

3. Instructions for submitting:

E-mail as a Microsoft Excel® file or as a comma-separated text file with each grain in a separate file. Name the files using the abbreviations in the accompanying table and report each observation as a single record on a single line.

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10. Editorial Correction to the GMM Chapter of Publication 14 § IV. Tolerances for Calibration Performance

Background: At its August 23, 2007 meeting the Sector recommended that the portion of § IV specifying the categories of calibrations that will be listed on a Certificate of Conformance would be removed from Publication 14. This recommendation was subsequently approved by the NTEP Committee in January 2008. When the 2008 Edition of the Grain Analyzer Book of Publication 14 was issued, the paragraphs regarding Approved, Pending, and Not Available had not been removed from the GMM Chapter. When this oversight was discovered, an addendum sheet dated April 24, 2008, was included with the Grain Analyzer Book of Publication 14 instructing readers to strike through the portions of what should have been deleted.

The Sector agreed to re-submit the changes to ensure that they won't be over looked when the 2009 Edition of Publication 14 is published.

Recommendation: In the 2008 Edition of the Grain Analyzer Book of Publication 14, pages GMM-6 and GMM-7, delete the portion of § IV specifying the categories of calibrations to be listed on a Certificate of Conformance. Details are shown below:

IV. Tolerances for Calibration Performance

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Until calibrations for NTEP grains have been evaluated successfully they shall not be used on NTEP instruments. Calibrations for any of the NTEP grain types that have not been evaluated (or that a manufacturer chooses not to provide) will be listed on the CC as "Not Available."

11. Report on OIML TC 17/SC 1 IR 59 "Moisture Meters for Cereal Grains and Oilseeds"

Background: This item was included on the Sector's agenda to provide a summary of the activities of OIML TC 17/SC 1. The Secretariat (China) is working closely with the United States and a small IWG to revise OIML R 59 "Moisture meters for cereal grains and oilseeds." All drafts have been distributed to the USNWG, which for the most part is a subset of the NTEP Grain Sector. A 4 CD was circulated to the IWG in August 2006. U.S. comments on the 4 CD were returned to the Secretariat in November 2006. A TC 17/SC 1 meeting was hosted by NIST in September 2007 to address comments received on 4 CD.

Discussion: Diane Lee, NIST/WMD, reported that the U.S. delegation to the September 2007 meeting included the following Sector members: Diane Lee, NIST; Rich Pierce, GIPSA; Cathy Brenner, GIPSA; and Cassie Eigenmann, DICKKEY-john. The subcommittee reached decisions on several issues of interest to the Sector.

The reference method for determining grain moisture content will be defined by the national responsible bodies. In re-affirming this decision (originally agreed to at the June 2001 meeting of TC 17/SC 1) the subcommittee noted that because different reference methods may be used in each country, accuracy may have to be tested in each country. It was also likely that the grain samples used for testing would have to be country specific unless a globally acceptable sample set could be agreed upon.

During a discussion of how maximum permissible errors (MPEs) would be presented in R 59, the U.S. delegation had the opportunity to explain in detail how grain moisture meters are evaluated in the U.S. NTEP program. The subcommittee subsequently agreed that while acceptable results of some evaluation tests would best be specified by MPEs, the acceptability of other test results would more suitably be specified by error shifts and error limits. A table will be added to R 59 that includes MPEs, error shifts, and error limits for accuracy and repeatability.

The subcommittee also agreed that a test for reproducibility was necessary for grain moisture meters. Consequently the type evaluation laboratory must receive two instruments for testing.

Ms. Lee noted that the format of 5 CD has been revised to meet the guidelines of the document *Format for OIML Recommendations* that was provided to participants in the April 2008 OIML Secretariat Training Session in Paris. The 5 CD of R 59 is expected to be distributed for review sometime in September 2008. A final date for USNWG comments will be specified when 5 CD has been distributed. The Secretariat expects to submit the final version of 5 CD to CIML for consideration at their meeting scheduled for early 2009.

12. Report on OIML TC 17/SC 8 Draft IR “Protein Measuring Instruments for Cereal Grain”

Background: This item was included on the Sector’s agenda to provide a summary of the activities of OIML TC 17/SC 8. A new subcommittee has been formed to study the issues and write a working draft document “Measuring instruments for protein determination in grains.” Australia is the Secretariat for this new subcommittee. A work group meeting was held in September 2006 in Ottawa, Canada, to discuss comments on the 1 CD. A TC 17/SC 8 meeting was hosted by NIST in September 2007 to discuss 2 CD.

Discussion: Diane Lee, NIST/WMD, reported that discussions on 2 CD dealt mostly with maximum permissible errors (MPEs) and harmonization of the TC 17/SC 8 Recommendation for protein with the TC 17/SC 1 Recommendation for moisture. It is unlikely that 3 CD will be ready for submission to CIML in time for their January 2009 meeting.

13. Marking Requirements for Type P Devices

Background: This item was included on the Sector’s agenda to provide information on the activities of the NTEPTC Software Sector that may have an impact on Grain Moisture Meters (GMMs) and Near Infrared (NIR) Grain Analyzers.

Two NTEPTC Software Sector items were accepted as developing items by the Specifications and Tolerances (S&T) Committee for inclusion in the Committee Reports for the NCWM 93rd Annual Meeting. A developing item has merit, but has been returned to the submitter for further development before any action can be taken at the national level. The Software Sector is interested in receiving input from the weights and measures community about these items. Working with input from the weights and measures community, the Software Sector plans to introduce proposed modifications to current requirements through the regional weights and measures associations and other technical committees. In the meantime, the Software Sector welcomes opportunities to discuss these items at regional weights and measures associations to ensure the items are adequately addressed.

The two developing items are shown below:

- 1) **Item 360-2: Developing Items, Part 1, Item 2** – Add a new definition and cross-reference term to Appendix D in HB 44 for “Electronic devices, software-based” as follows:

Electronic devices, software-based. Weighing and measuring devices or systems that use metrological software to facilitate compliance with Handbook 44. This includes:

- (a) Embedded software devices (Type P), aka built-for-purpose. A device or element with software used in a fixed hardware and software environment that cannot be modified or uploaded via any interface without breaking a security seal or other approved means for providing security, and will be called a “P,” or**
- (b) Programmable or loadable metrological software devices (Type U), aka not-built-for-purpose. A personal computer or other device and/or element with PC components with programmable or loadable metrological software, and will be called “U.” A “U” is assumed if the conditions for embedded software devices are not met.**

Software-based devices – See Electronic devices, software-based.

- 2) **Item 360-2: Developing Items, Part 1, Item 1** – Amend HB 44 General Code G-S.1. and/or G-S.1.1. to include the following:

Method	NTEP CC No.	Make/Model/Serial No.	Software Version/Revision ¹
TYPE P electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X	X	Not Acceptable
Continuously Displayed	X	X	X
By command or operator action	Not Acceptable	Not Acceptable	X ²
TYPE U electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X ³	X	Not Acceptable
Continuously Displayed	X	X	X
Via Menu (display) or Print Option	Not Acceptable	X ⁴	X ⁴
¹ If the manufacturer declares that the primary sensing element “software” is integral, has no end user interface and no print capability, the element may be considered exempt from the marking requirement for version/revision. Example: Primary sensing element may be Positive Displacement (P.D.) meter with integral correction, digital load cell (only for reference, not limiting). ² Information on how to obtain the Version/Revision shall be included on the NTEP CC. ³ Only if no means of displaying this information is available. ⁴ Information on how to obtain Make/Model, Version/Revision shall be included on the NTEP CC. Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.			

At their May 2008 meeting, the Software Sector reviewed the above table and made both corrections and further clarifications. The table was split into two separate tables, one for Type P devices and one for Type U devices, to make it clear that although there are similarities between the two types, they are unique and must be treated separately.

[Editor’s Note: At the 93rd NCWM Annual Meeting held July 13 - 17, 2008, the Software Sector Chairman advised the Specifications and Tolerances Committee (S&T) that the sector had gone as far as they could go in developing the criteria listed under S&T Item 360-2: Developing Items, Part 1, Items 1 & 2. He asked that these be moved up to Informational items on the S&T agenda. Grain Analyzer Sector members should review the Informational items

in the S&T Committee 2008 Final Report in the Report of the 93rd Conference on Weights and Measures when it is published.]

The table for Type P devices proposed by the Software Sector at their May 2008 meeting is shown below:

Method	NTEP CC No.	Make/Model/Serial No.	Software Version/Revision ⁺
TYPE P electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X	X	Not Acceptable ¹
Continuously Displayed	X	X	X
By command or operator action	Not Acceptable	Not Acceptable	X ²
¹ If the manufacturer declares that the primary sensing element “software” is integral, has no end user interface and no print capability, the element may be considered exempt from the marking requirement for version/revision. the version/revision shall be hard marked on the device. Example: Primary sensing element may be Positive Displacement (P.D.) meter with integral correction, digital load cell (only for reference, not limiting).			
² Information on how to obtain the Version/Revision shall be included on the NTEP CC.			
<u>Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.</u>			

[Editor’s Note: The Software Sector has considered alternate versions of the “Marking” tables. For the latest version of these tables, Grain Analyzer Sector members should review the Informational items in the S&T Committee 2008 Final Report in the Report of the 93rd Conference on Weights and Measures when it is published.]

Discussion: All GMMs and NIR Grain Analyzers currently holding active CCs are of Type P. For these devices it would appear that the requirement for marking the Software Version/Revision of the metrologically significant portion might be the only change required to comply with the proposed marking for Type P devices.

Concern was expressed that the “NTEP CC No.” marking requirement might require marking with the base CC number plus the addendum number. GMM manufacturers have strong objections to requiring the addendum number to be marked or displayed on the device. GMM CCs automatically expire on June 30 of each year. To maintain a current GMM CC, the manufacturer must participate in the NTEP on-going calibration program (OCP). Data collected in the OCP are used to determine if existing (or revised) calibrations meet specified tolerances. If tolerances are met, the CC is re-issued with a new effective and expiration date and a new addendum number.

The Sector also had questions regarding interpretation of the second sentence of the note:

Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.

What was not clear to the Sector was whether there could be several metrologically significant portions, each having a separate (and unique) identification. This is of particular concern to the Grain Analyzer Sector because of the way grain calibrations (very significant metrologically significant portions) are currently handled. For both GMMs and NIR Grain Analyzers, grain calibrations are individually identified and are required to be “self-checking” against data corruption or alteration (see paragraphs S.2.4.1. Calibration Version and S.2.4.2. Calibration Corruption in HB 44, § 5.56.(a) and paragraphs S.2.5.2. Calibration Version and S.2.5.3. Calibration Corruption in HB 44, § 5.56.). Considering that procedures are already in place to control (and verify) changes in individual grain calibrations, and that changes in grain calibrations are likely to be more frequent than changes in other metrologically significant software modules, Sector members doubted that assigning a single identification to all metrologically significant software (including grain calibrations) is practical for GMMs and NIR Grain Analyzers.

For additional information on Software Sector activities that may affect GMMs and NIR Grain Analyzers, manufacturers are encouraged to review Appendix A, Item **360-2: Developing Items, Part 1, Items 1 and 2** of the S&T Committee Interim Reports in NCWM Publication 16 dated April 2008 and the Summary of the Software Sector's May 2008 meeting. These documents are available online at:

<http://ts.nist.gov/WeightsAndMeasures/Publications/upload/11-ST-08-Pub16-Final.pdf>
http://www.ncwm.net/ntep/pdf/software_sector_summary_05_08.pdf

The WELMEC software document referenced in the Software Sector's Meeting Summary is available online at <http://www.welmec.org/publications/7-2en.pdf>. The second committee draft of *General Requirements for Software Controlled Measuring Instruments* (TC 5/SC 2 CD2-N12, dated 2008-01-24), referred to in the Sector's Meeting Summary as "OIML DSW-2 CD" can be found at <http://www.oiml.org/download/cds.html>.

14. Time and Place for Next Meeting

The next meeting is tentatively planned for Wednesday, August 19 and Thursday, August 20, 2009, at the Chase Suites Hotel in Kansas City, Missouri. Sector members are asked to hold these days open pending determination of agenda items, exact meeting times, and meeting duration. Final meeting details will be announced by early June 2009.

If you would like to submit an agenda item for the 2009 meeting, please contact any of the following persons by May 1, 2009:

Jim Truex, NTEP Administrator at jim.truex@ncwm.net
G. Diane Lee, NIST Technical Advisor, at diane.lee@nist.gov
Jack Barber, Technical Advisor, at barber.jw@comcast.net

Change Summary

Recommended Amendments/Changes to the Grain Moisture Meters Chapter in the 2008 Edition of NCWM Publication 14			
Section Number	Amendment/Change	Page	Source
VII.B. Accuracy, Precision, and Reproducibility	Amend to address multi-class type evaluations for TW.	GMM-11 through GMM-15	<u>08/08</u> <u>GMM Sector</u> <u>Agenda Item 7</u>
VII.C. Tolerances for Test Weight per Bushel Calibration Performance	Amend to limit the moisture content of samples used in evaluating TW performance and to add special considerations for multi-class calibrations.	GMM-15	<u>08/08</u> <u>GMM Sector</u> <u>Agenda Item 8</u>
Appendix C	Amend to add additional data fields for TW data and to update instructions for submitting data to reflect current practice.	GMM-41	<u>08/08</u> <u>GMM Sector</u> <u>Agenda Item 9</u>
IV. Tolerances for Calibration Performance	Delete the portion of § IV specifying the categories of calibrations to be listed on a Certificate of Conformance.	GMM-6 and GMM-7	<u>08/08</u> <u>Grain Moisture</u> <u>Meter Sector</u> <u>Agenda Item 10</u>

Appendix B

National Type Evaluation Technical Committee Measuring Sector

October 3 - 4, 2008 – Atlanta, Georgia
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National Type Evaluation Technical Committee Measuring Sector Annual Meeting Summary

October 3 - 4, 2008
Atlanta, Georgia

Carryover Items

1. Table of Key Characteristics of Products in Product Families for Meters Table

Source: Carryover Item – 2007 Measuring Sector Agenda

Background: At its 2006 Annual Meeting, then-NTEP Director Steve Patoray submitted a number of comments concerning the Product Families for Meters Table in NCWM Publication 14. Steve noted that, while improvements had been made to the table in past years, there were still a number of areas where additional improvements are needed to ensure consistent application of the table. For example, the basis for viscosity values are not clear, there is a lack of reference temperatures for viscosity values, and when possible source documents are consulted for these values, there are differences in viscosity values listed for the same product. In addition, Steve noted that the numerous special notes and separate product categories make the table difficult to follow. As a result of discussions at its 2006 meeting, the Measuring Sector tasked a small work group (WG) to address these issues and report back to the Sector.

At its 2007 Annual Meeting, the work group gave a progress report to the Sector and presented a number of proposed revisions that were being considered (see the 2007 Final Summary of the Measuring Sector for details of that proposal). The WG noted that additional work was needed to list the various liquids, describing the viscosity, specific gravity, and conductance. After hearing comments on the proposed changes, the Sector agreed that the WG should continue developing this item and present its recommendations for discussion at the 2008 Measuring Sector meeting.

Recommendation: The Sector was asked to consider the latest proposal from the WG, which was distributed in two attachments: (1) Attachment #1: a proposed a table listing product families/groups along with typical product names and their corresponding viscosities and specific gravities (shown in Appendix 1 to this meeting summary); and (2) Attachment #2: a proposed revision to the Product Families Table outlining test requirements for different meter types within each product family (shown as Appendix 2 to this meeting summary).

Note: See also agenda Items 7 (Categorization of Liquid CO₂ in the Product Families for Meters Table) and 8 (Product Families for Meters Table, Inclusion of Milk and Dairy Products), both of which which address topics related to the Product Families Table.

Discussion: Mike Keilty (Endress and Hauser), Sector Chairman, explained that the WG took the approach of separating the test requirements and product characteristics, including viscosity and specific gravity, into two separate tables. The proposed revisions were not intended to change what is currently in Publication 14, but rather to make the information more usable. The group did note that there may be a need to discuss the category of compressed liquids in greater detail once the general approach for revising the tables is agreed upon; beyond this, they did not identify a need to change any of the proposed test criteria. With regard to product characteristics, Mike indicated that the WG was unable to find a single definitive source for the values listed in that table, but was able to gather representative values from published sources, including product manufacturers, application guides, and other industry sources, for most of the products; there are a few products for which values must still be identified. The WG also found information indicating that some of the trade names listed in the original tables under the agrichemicals section are no longer relevant; thus, these names were deleted from the proposed revision. Mike noted that the WG had difficulty determining how to address conductance of products in the criteria and decided to first focus efforts on viscosity values. The WG wanted to see if the NTEP measuring laboratories would find the approach of separating the information into two easier to follow and apply tables.

The Sector acknowledged that there are currently differences in the way that CCs state what is covered and Sector members share the common goal of improving consistency in the CCs. The Sector recognized that the tables respond to the Sector's 2007 discussions regarding the need to improve references to product characteristics in the Product Families Table. Sector members, particularly the NTEP laboratories, generally expressed appreciation for the more detailed information on product viscosities and specific gravities provided in Attachment #1. The Sector also recognized that the list of products is not an all-inclusive list, but rather an attempt to identify some common products in each category in an attempt to assist laboratories and manufacturers in identifying typical products for a particular category.

The Sector spent considerable time during the first day of its meeting debating the merits of the proposed revisions and the format of the two tables. There were some questions about the "Normal Liquids" category and testing with low and high viscosity products. Some commented that the two attachments don't appear to correlate because one attachment has five categories, whereas the other attachment has many more. The Sector considered combining the two tables by adding columns to list typical products and associated characteristics, but felt that this would add significant length to the basic table and may make it more difficult to follow. Based on the comments made during the first day of the meeting, Marc Buttler (Emerson) and Mike Keilty agreed to work on the tables during the evening and invited participation by others. The Sector agreed that the footnotes in the current table need to remain in any revision, including the statement regarding temperature references. The Sector also noted that better information is needed for product conductivities for magnetic flow meters, particularly since conductivity may vary for different batches of product. The Sector agreed that this should be addressed separately as a future effort.

On the second day of its meeting, the Sector members present received a hardcopy of revisions prepared by Mike Keilty, Marc Buttler, Dmitri Karimov (Liquid Controls), and Tina Butcher (NIST Weights and Measures Division, Sector technical advisor) with input from several others overnight. The revisions proposed reorganizing the information to create three tables: Table C.1. Tests to be Conducted (identifying tests to be conducted); Table C.2. Product Families Table (outlining product families broken down by meter technology and referencing tests from Table C.1.); and Table C.3. Typical Product Family Characteristics (listing typical products in each product family and the viscosity and specific gravity of each, taken from agenda Attachment #1). The group had discussed various approaches, including combining the tables, but felt that maintaining separate tables would allow more flexibility to add new "typical" products at a later date.

The Sector reviewed these revisions and made multiple changes to the draft in "real-time" by viewing the changes on a projected screen as the technical advisor made participants' suggested modifications. Key changes included reversing the order of Tables C.1. and C.2.; re-inserting a note regarding LPG and NH₃ under the PD meter and turbine meter columns (previously, these references were in a single cell); reinstating the footnotes in the Product Families Table; deleting the reference to "centistokes;" and correcting the abbreviation for "centipoise."

Maurice Forkert (Tuthill Transfer Systems) noted that the original table in Pub 14 includes a viscosity range for "Fungicides;" however, there is no value listed in the new table for Fungicides. He also suggested including crop chemicals after water for better flow of information. Mike Keilty observed that additional input is needed from those with expertise in agrichemicals; in the meantime, he noted this should not create any conflicts since there are presently no values listed for many of these products. Dmitri Karimov suggested working toward combining "crop chemicals" into a single category for simplification. In the meantime, the Sector agreed to differentiate groups as Crop Chemicals 1, 2, 3, and 4 to provide a correlation with the old table.

The Sector identified other editorial and content changes to be addressed or considered:

- Flowables is missing from the table.
- Suggest putting crop chemicals after water to make the table flow better.
- The terms in Table C.2. and Table C.3. should match for the various product families.
- Listing the items in order from lowest to highest viscosity would make the table easier to follow.

Though acknowledging the need for revision to some sections of the table (for example, improving the categorization of crop chemicals), the NTEP laboratories indicated that the changes thus far represent major progress. They noted that they will need to try using the new format to assess how well it will work, but anticipated that it should be much easier to use. Other Sector members agreed that the proposed revisions are an improvement over the current version, even if there remain areas requiring additional work.

Dmitri Karimov stated that the note for a single test to cover NH₃ and LPG should apply to turbine meters as well as PD meters, commenting that the original table did not specify that the note applied to PD meters only and noting that he has found CCs for turbine meters on which both products were covered based upon a single test. Other manufacturers agreed with this point of view. The labs believe that the original table had a note requiring only one test and that the note was not specific as to either technology. However, the criteria in “Test A” require a test for each product. By virtue of this point, the labs have raised the point that the note would not apply. Several of the labs further noted that they don’t have a lot of experience with turbines and are not certain whether it is appropriate to include both based on a single test. They feel they would need additional information to make that assessment.

After the morning’s discussion, the Sector agreed that they have reached a consensus on the layout of the table, but acknowledged there are still some content and editorial changes that need to be made as described above. During lunch, Mike Keilty and Tina Butcher worked on revisions to the table based on the Sector’s morning comments and presented the revisions to the Sector. In addition to minor refinements based on the Sector’s morning discussions, key changes made or still needing to be addressed include the following:

Summary of Key Changes Made or Needed:

- The original table in Pub 14 includes a viscosity range for fungicides; however, there is no value listed in the new table for fungicides. Until specific values can be included, these are to be identified as crop chemicals 1, 2, 3, and 4.
- “Flowables” is missing from the table.
- Consider putting crop chemicals after water and other changes to make the table flow better.
- The order of the tables originally numbered C.1. and C.2. was reversed for better flow.
- The note for a single test to cover NH₃ and LPG should also apply to turbine meters. The original table did not specify that the note applied to PD meters only. (*Note: This was a point of contention that was not resolved during the meeting, as referenced earlier.*)
- The terms in Table C.2. and Table C.3. (original numbers) should match for the various product families.
- The term for “centipoise” needs to be consistent.
- The term “centistokes” was deleted from the headers.
- The footnotes from the original Product Families Table were pulled back into Table C.2. (original number).

The following “maintenance” issues requiring further work and development were also identified:

Maintenance Issues:

- Start to combine the “crop chemicals” into a single category.
- There is no reference to heated products below 50 °C.
- If you list the items in order from lowest to highest viscosity, it would make the table easier to follow. By viscosity? By specific gravity? Alphabetically by name?
- Need to include references to the footnotes included in Table C.1.

The Sector reviewed these changes and made a few additional modifications. The latest version of the table as of the end of the Sector meeting appears in Appendix 3 to the Sector Summary.

The labs indicated they welcome any additions to Table C.3. However, with regard to the combination of some of the categories, they expressed a desire to see the information before it becomes final. Paul Glowacki (Murray Equipment) proposed eliminating from the table those products that are no longer used. Dmitri Karimov reported difficulty locating information for some of the products listed in the current table. Several Sector members noted that some crop chemicals may still be used; however, they may be labeled under a different name. Dmitri volunteered to assist in obtaining information on crop chemicals, noting that he had previously contacted the Fertilizer Association of America and they promised to send additional information. Jim Truex (NTEP Director) also suggested contacting NCWM members representing Dow Chemical, Cargill, and other chemical manufacturers to see if they can assist in providing information.

Rich Tucker (RL Tucker Consulting) asked about the “juices and beverages” category, noting that it was not referenced in the new Table C.3., though it is referenced in the current Product Families Table for magnetic flow

meters. The Sector discussed how to handle this category and agreed that “juices and beverages” can be added to the “water/milk” category for other meter technologies. Tina Butcher noted that an additional maintenance issue to consider is how to handle other food products such as corn syrup, etc. since these are not presently referenced in the table. The Sector agreed that this could be handled as a maintenance issue.

At the conclusion of the meeting, the Sector once again agreed that a consensus had been reached on the general revisions to the format, but that additional content changes are needed. The Sector recognized the amount of work put into developing the revised format and identifying corrections needed to improve consistent application of the criteria. Sector members present expressed a reluctance to wait an entire year to implement these corrections. Some members noted that ballots on more complicated topics have been successfully distributed in the past and suggested that changes identified at the meeting be made and the Sector balloted. The Sector agreed that the best approach to ensuring continuity of the work would be to have a small number of people work to make editorial corrections in the areas identified and distribute it to the entire Sector via letter ballot in the hopes of getting sufficient consensus to move the revisions into the 2009 Edition of NCWM Publication 14. Mike Keilty and Dmitri Karimov agreed to take on the task of following up on these changes, preparing a revised version, and forwarding it to the technical advisor for balloting of the Sector members.

The Sector agreed that maintenance issues can be addressed at a future point following additional research and discussion.

Conclusions:

- The Sector agreed on the revised format, noting that it is an improvement over the current version. However, there is additional work to be done. Mike Keilty and Dmitri Karimov will work together to better define the crop chemicals category. They will do a search of existing CCs for the specific product names and determine if these names are still used. They will also go to product manufacturers who have products listed and ask for information on the products. They will also add the category for “water, milk, juices, and beverages” to Table C.3. The proposed revisions are to be sent to the Sector technical advisor by November 24, and the Sector will be balloted with a response requested by December 12. Comments will be incorporated and, assuming Sector agreement, submitted to the NTEP Committee by the NCWM Interim Meeting for proposed incorporation into the 2009 Edition of NCWM Publication 14.
[Note from Technical Advisor: The Sector was balloted prior to the NCWM Interim Meeting on additional proposed changes to the criteria; however, the results of the vote (8 affirmative, 6 negative, and 4 abstain) indicated a lack of consensus to support these additional changes. Consequently, while the Sector supported the revised format, there was not support for the additional changes without further review and discussion.]
- The Sector agreed to add “juices and beverages” to the “water/milk” category for other product types (PD and turbine).
- The Sector agreed to address other food products like corn syrup, etc. for the next Sector meeting as a maintenance/updating issue.

2. NTEP Checklist for Hydrocarbon Gas Vapor Meters in Sub-metering Applications

Source: NTEP Director

Background: At its 2006 meeting, the Measuring Sector was asked by the NTEP Committee to consider and develop a checklist for residential hydrocarbon gas vapor meters. These devices will most likely be used for submetering. At that meeting, the Sector heard that several states had recently contacted NTEP regarding these devices. California already has evaluation and certification of these devices in their state. The Sector was asked to review the procedures used by California (which were included as Appendix D of the 2006 meeting agenda) and rework them into a format acceptable for NCWM Publication 14. At its 2006 meeting, the Sector agreed the best approach for developing a Publication 14 checklist for LPG vapor meters would be the utilization of a WG made up of technical experts and other interested parties. Dan Reiswig, California NTEP laboratory, was to provide a list of vapor meter manufacturers to be contacted for participation in the WG.

At the time of development of the 2007 meeting agenda no information had been received from the WG. At the meeting, the Sector reviewed a recommendation and considered changes to Publication 14 deemed appropriate. After reviewing a draft presented by the California NTEP laboratory, the Sector agreed that “LPG” in the title should be changed to “Hydrocarbon Gas” so that the measurement of natural gas would be included. The California NTEP laboratory and the NTEP Director were to continue to develop this checklist for presentation and discussion at the next Sector meeting.

Recommendation: The Sector was to hear an update at the Sector’s 2008 meeting from from the California NTEP laboratory and the NTEP Director on the progress on this issue.

Discussion: Steve Patoray (Consultants on Certification), past NTEP Director, indicated that this issue originally arose because some states indicated an interest in having NTEP conduct evaluations on these devices as a result of pending legislation in some of those states to put sub-meters under weights and measures’ authority. In the NTEP laboratory discussion of this issue, the labs asked the Sector to raise the question to manufacturers of whether or not there is interest in developing this checklist; the California laboratory representatives noted that they receive only one or two requests per year for this type of evaluation. From an NTEP management perspective, Jim Truex questioned whether it is necessary for NTEP to address these devices given the small number of devices submitted for evaluation over the last five years and the fact that states may be willing to accept California’s Certificate of Approval in lieu of an NTEP CC.

Dan Reiswig (California) reported that the draft checklist was given to members of industry to review and the feedback was positive; however, the manufacturers who commented indicated that they did not have any products affected by the proposed checklist. Steve Patoray noted that, should the work continue, a decision must be made regarding the placement of the criteria into Publication 14; for example, should it be placed into a new section or incorporated into the LMD chapter.

Ralph Richter (NIST, WMD) reported that the American Gas Association is revising the ANSI standard for all of the natural gas distribution system, though he noted that the proposed revisions should only affect utility-type meters, not sub-meters. Ralph indicated that he believes that the issue of hydrocarbon gas vapor sub-meters is very much like that for water sub-meters in that there are numerous meters in use in landlord-tenant applications including residential as well as commercial, such as strip malls; however, the bulk of weights and measures inspections in the country as a whole are limited primarily to complaints rather than routine inspection. Jim Truex noted that some weights and measures authorities may not have jurisdiction over some of these meters.

There was little discussion of the proposed checklist among Sector members during the meeting. Mike Keilty suggested that, because of the limited interest, the Sector should consider removing the item from its agenda as a carryover item if no progress to finalize a checklist is made within the next year.

Jim Truex reported that he received an e-mail from Maurice Van Puten, PhD, whose company manufactures a digital hydrocarbon vapor meter recently approved by California and Massachusetts. Dr. Van Puten offered his help and indicated an interest in becoming a member of the Sector. Dan Reiswig indicated that the bulk of the remaining work is in reformatting the checklist to fit within the Publication 14 structure and stated the California laboratory could look at this over the next year.

Conclusion: The Sector agreed that the California NTEP laboratory will work to reformat the checklist into a Publication 14 format. Norma Ingram (California) agreed to coordinate with Maurice Van Puten and Jim Truex to work on this issue between now and the next Sector meeting.

3. Testing Meters Made of Different Materials

Source: California NTEP Laboratory – Carryover from 2007 Measuring Sector Agenda

Background: The Sector reviewed this issue at its 2007 meeting, but was unable to reach a consensus on the item. Consequently, the item was carried over for review at the 2008 Sector meeting. The Sector was asked to revisit this issue and interested parties to report on any updates or new information that might assist the Sector in bringing this

issue to a resolution. The background information and discussion from the Sector's 2007 Final Meeting Summary is included below for reference.

Excerpt from Item 5 of the 2007 Measuring Sector Final Meeting Summary:

Background/Discussion: The California NTEP laboratory is conducting an NTEP evaluation of a family of meters using multiple products in different product families. The meter family includes meters made of aluminum and stainless steel. Because Publication 14 does not specifically address this scenario, the laboratory is asking for input from the Sector before testing starts.

At the 2006 meeting the Sector discussed the scenario described above. The following proposal was offered as a possible solution. The Sector reviewed the proposal for possible forwarding to the NTEP Committee for inclusion in Publication 14.

Proposal: Add a new Section F. to the Publication 14 Technical Policy as follows and renumber subsequent sections:

U. Meters Made of Different Materials within the Same Family

When multiple meters made of different materials within a meter family are submitted for evaluation all meters will be tested with at least one product from each product family to be included on the CC and at least one meter will be tested with the range of products required in the Product Families Table for the meter type (e.g., positive displacement, turbine, mass meter, etc.) submitted for evaluation.

The MMA provided the following white paper for Sector consideration during the discussion:

Meter Manufacturers Association

Speaking as experienced manufacturers of PD Meters, Turbine Meters, and Mass Meters, it is our experience that the materials of construction do not affect the quality of measurement over the specified operating range of a particular metering technology, as these have been considered and accounted for during the design phase of the meter.

It is the manufacturer's responsibility to ensure that the meter meets type; additionally, material selection is the manufacturer's responsibility and is typically driven by the requirements of chemical compatibility with the liquid products that are being measured or by industry regulations (e.g., non-ferrous meters for aircraft refueling).

Materials are not selected or modified for reasons of accuracy. The market does identify and eliminate the inferior products through the normal surveillance process as well as the manufacturer's warranty process.

It is normal industry practice to include material varieties such as stainless steel, aluminum, cast iron, plastic, etc., into one meter; for example, some of our PD meters have cast steel outer housings, stainless steel bearings, cast iron rotors, anodized aluminum blades or cast iron blades or plastic blades. Non-ferrous aircraft meters will utilize aluminum cast components and SS bearings. We manufacturer turbine meters with stainless steel housings and aluminum rotors. The point being the measurement accuracy is a function of the manufacturing process, not the materials used.

It is not the intent of HB 44 to differentiate between measurement technologies, only the intended application.

Doesn't material selection fall under measurement technology?

Where do you draw the line on NTEP lab decisions on the materials of construction?

The manufacturers believe that the answer to the question is in the **LONG** history of meters themselves. There are hundreds of thousands of meters in service in the United States used for direct sales (e.g., home heating oil delivery, loading rack wholesale deliveries, aircraft refueling, agriculture chemical deliveries, etc.). These meters

are verified routinely by the local W&M agencies, and if problems are detected (accuracy out of range) then they are taken out of service.

Summary: The meter manufacturers make determination of materials of construction. Meter manufacturers make the determination of what particular attributes of a meter enable it to be considered as part of a family.

Questions that need to be answered in order to make an informed decision:

- 1.) Is there a real world problem that requires a solution by the inclusion of a new section specifically aimed at materials in Pub 14?
- 2.) Is there an inequity in the market, facilitation of fraud?

One of the NTEP laboratories stated that during an evaluation of a mass flow meter the performance was different for two meters with different “tube” materials. Two mass flow meter manufacturers stated that if both meters were calibrated for the product being measured there should be no difference in performance due to “tube” material. Another laboratory stated that the permanence test of a meter conducted after 30 days is not a true indicator of long-term permanence. Another member stated that NTEP should be interested in testing key characteristics and metrologically significant components.

After further discussion at the 2006 meeting, the Sector agreed that the best approach for resolving the issue of what components are “metrologically significant” and require additional evaluation was to include the discussion and development of a proposal for Sector consideration in the tasks of the WG formed to develop a new Family Product Table approach, as discussed in agenda Item 5.

Recommendation/Discussion: At the time of development of the 2007 meeting agenda no information had been received from the WG nor was any formal update presented at the meeting. One industry member suggested the item be withdrawn. The Sector technical advisor cautioned the group that withdrawing the item would not resolve the question as to whether or not a change in material used in the construction of a meter would require that the model be resubmitted for NTEP evaluation in order to maintain a valid CC. The manufacturers present at the meeting met following the conclusion of the first day’s agenda and came back with some suggestions for resolving the problem. One suggestion was for the manufacturer to submit a drawing listing material used, similar to what is done with Underwriters Laboratories, Inc. (UL), who evaluates or tests what they consider to be the worst case. Another suggestion was to include ASTM specifications for the original material and any replacement material. Some of the NTEP laboratories believed that changing material constitutes a change of design and, therefore, requires a new model designation.

Discussion: Steve Patoray described (from his perspective as past NTEP Director) the scenario discussed at the 2006 and 2007 Sector meeting. He noted that materials used in devices are considered metrologically significant for weighing applications and questions were raised about whether or not materials are metrologically significant for metering applications. Some had suggested that using criteria similar to that used by Underwriters Laboratories might be considered. He indicated that many were uncomfortable with the concept of defining a “worst case” scenario for particular materials. He further noted that the question was raised of where to stop in the examination of device components: the body of the meter, or the seals, or other location? Manufacturers indicate that these questions are all part of the design process and inherent with assembling a device intended for a given application. Steve concluded his overview by noting that a key question is whether or not additional testing is needed based on variations in the materials used in the metering system and further commented that it is not likely that a field official will be able to determine these differences by visual examination. The inspector just needs to have confidence that the meter they are examining is covered by the CC. An overriding concern of NTEP is to ensure that the evaluation is fair and that the requirements are being applied consistently to all manufacturers. At present, NTEP has no guidance on how to handle these different scenarios.

Allen Katalinic (North Carolina) commented that while changes to significant components of a meter will make a difference, there are many parts in a meter where changes will not have any metrological impact. Mike Frailer (Maryland) noted that a key difficulty on the part of the evaluator is in assessing how to consistently assess whether a given change is metrologically significant, and Jim Truex noted that this depends on how one defines

“metrologically significant.” Paul Glowacki commented that Jim’s point touches on the basic issue, which is how to define what changes can be made without re-evaluation. A manufacturer may be confident that a change in material will not affect a meter’s performance; however, an evaluator may not agree and may require re-evaluation. There have to be some guidelines because, at present, Paul feels as if every CC is a negotiation and what is applied to one company may be different than what is applied to another company. Tina Butcher commented that the technical policies in Publication 14 strive to minimize the amount of testing required for a manufacturer to list the maximum number of devices on a CC. She stated that, for the NTEP laboratories, key questions are: (1) whether the laboratories and NTEP management have adequate information to enable them to assess when additional testing is needed in order to list particular variations on the CC, and (2) how they can make that assessment consistently from manufacturer to manufacturer and from laboratory to laboratory. NTEP has developed experience with some basic types of changes to devices through trial and error and in consulting with manufacturers; the laboratories are asking for specific guidelines with regard to materials variation. Mike Keilty noted that manufacturers submit a sample(s) of a device in good faith and expect a rigorous evaluation; however, manufacturers are concerned that the amount of testing not be expanded beyond what is economically feasible.

Relaying discussions from the NTEP laboratory meeting prior to the Sector meeting, Jim Truex commented that the laboratories also have a dilemma in assessing how to avoid “horror stories” such as experiences with E85 while establishing reasonable guidelines. Jerry Butler (North Carolina) also noted that, while many manufacturers such as those who have long participated in NTEP Sector meetings and evaluations, are conscientious and laboratories may trust their judgment, laboratories are seeing an influx of equipment from sources (sometimes off-shore) with which they have had little experience and whose manufacturers sometimes have little if any experience with legal metrology requirements, let alone U.S. requirements. This concern was echoed by other laboratories who also noted confidence in manufacturers participating in this discussion, but recognized that policies must be in place to ensure fair treatment. Several manufacturers commented that the industry will take care of substandard products produced by competitors by bringing such instances to NTEP’s attention; reputable manufacturers cannot afford to allow substandard products to undercut the market when they themselves are expending the resources needed to comply.

The Sector also had some discussions about replacement parts and how these affect metrological integrity, with some members noting that field officials are unable to determine when non-metrologically equivalent or inferior components are used by visual examination. Several members commented that this is not something that can be prevented by increased evaluation at the type evaluation level, but is rather addressed by performance testing in initial and subsequent verification. In addition, the manufacturer is equally concerned about unauthorized substitutions since this can affect the reputation of their product. In that same vein, a manufacturer would not make a change in materials unless he is confident that the change would not affect the performance of the device in his customer’s application. Rodney Cooper (Actaris) pointed out that reputable manufacturers police themselves to ensure their customers’ continued confidence. Norm Ingram pointed out that manufacturers have designed these products and know from experience what will work, so perhaps the best approach is to allow them to make these changes and allow the marketplace to take care of itself. Norm did note, however, as did Dan Reiswig (California), that even if the issue is tabled, the laboratories still need guidance on how to consistently approach proposed changes with regard to issuing CCs.

Dmitri Karimov and others pointed out that NTEP has largely relied on the integrity of the manufacturer in reporting changes to devices and that, in many cases, NTEP or a field official would never be able to tell the difference. For example, if a rotor is changed, there is no reasonable way that weights and measures officials can determine that the clearances are different. In addition, NTEP has also relied primarily on the manufacturer to provide guidance on when a particular change is metrologically significant. With regard to material, the manufacturer’s concern is in making sure that the materials are compatible with the product being measured in the application. Mike Keilty questioned how conformity assessment might factor into this issue and contribute to resolving some of these questions.

Rich Tucker echoed an earlier comment by Norm Ingram, noting that most manufacturers change materials because of the products with which the meter will be used. When a manufacturer finds through experience that a particular change creates problems, manufacturers make adjustments accordingly to ensure continued performance. Rich even noted there were instances when NTEP passed a material in an evaluation and that material later proved to be problematic. The majority of the time materials issues will resolve themselves and most of the testing requirements imposed by the Product Families Table are going to address any question about materials.

The Sector also discussed numerous examples of specific materials and their effect on metering of different product types; however, these discussions provided no insight on how to best address the materials issue. Steve Patoray reminded the Sector that its purpose is to advise the NTEP administrator, and Publication 14 will only be changed if the NTEP Committee agrees with the Sector's recommendations.

Will Wotthlie (Maryland) commented that the laboratories are putting their reputation on the line by issuing a CC and saying that it covers everything listed on the CC; the laboratories want to have confidence that the devices will work and field officials are, in turn, relying on that assurance. Will also questioned why NTEP is needed if the feeling is that everything in the field will take care of itself. Mike Keilty noted that a balance needs to be achieved between a system that can be practically executed and one that will still provide confidence; manufacturers are concerned about expanding testing beyond what is economically feasible.

Will Wotthlie suggested that an alternative is for the labs to simply list what is tested on the CC under the testing conditions section; however, some manufacturers indicated they want to continue to list materials of construction on the CC under the "Standard Features and Options" section. Jim Truex noted that a CC is not meant to be a marketing tool. Tina Butcher commented that, in its early days, NTEP decided that only metrologically significant things should be listed on the CC. If this position is to be maintained, then the Sector needs to decide whether or not to include the metals on the CC if all options are covered. If the Sector concludes that the material is not significant, then perhaps a statement needs to be included in Publication 14 to that effect. She also reminded the Sector that the laboratories are not only trying to assess whether or not a new variation in material can be covered on the CC, but also how to determine which of two meters to select for testing when they are made of different materials.

Some members, including NTEP laboratory representatives as well as manufacturers, stated that if the materials feature or attribute is not metrologically significant, it doesn't belong on the CC; the information can be listed in the test conditions, but not on the front of the CC under the "Standard Features and Options." Dmitri Karimov questioned why the information would be listed in the test conditions if it isn't metrologically significant. Others noted that this record may eliminate the need for additional testing should policies change at a later date. Jim Truex also pointed out that if the information is to be listed on the front of the CC, it will be necessary for the laboratory to determine the "worst case" scenario with regard to materials.

At present there is a great variation among existing CCs with regard to how materials are referenced. Steve Patoray noted that there are differences in how manufacturers request this information be reflected on their CCs; some want various model numbers listed, including different materials. Some believe that the only thing that should be listed on the CC is the product application for which the meter is approved, not the materials. Jerry Butler questioned why the manufacturers want to list all of these different products on the CC, commenting that it is up to the manufacturer and the customer to make sure the meter is right for the application. He further noted it would be helpful to have materials construction identified through the model designation.

Questions were raised by the manufacturers and laboratories about how CCs will be handled until the Sector can reach an agreement with regard to testing requirements for materials variations. Jim Truex reiterated that the purpose of a CC is not a marketing tool. Jim indicated that, as NTEP Director, he is not comfortable with listing all these different features unless the laboratory has tested them. Without taking a position on whether or not "materials" are considered a metrologically significant feature, Jim indicated that, for consistency purposes, NTEP will not list materials in the standard features and options; however, the information will be listed in the test conditions for the meter(s) tested during the NTEP evaluation(s). He noted this will be an administrative decision to ensure consistency. In response to a question about whether eliminating the reference to materials of construction in the "standard features and options" section would affect existing CCs that presently list this information, Jim stated that no changes would be made until the CC is being revised for other reasons.

After extensive debate on the first day of the meeting without resolution, the Sector returned to the discussion the following day with little additional progress. At that point, Mike Keilty noted that there are manufacturers who have product materials listed on their CCs and those who do not have the materials listed. He commented that, in establishing guidelines, the Sector has tended to draw a broad brush across metering technologies and, in many instances, treated them as the same even though people know they are not made the same way. Manufacturers generally make the materials of the meter to be compatible with the product to be measured and manufacturers may

take different approaches in ensuring this compatibility. Andre Noel (Neptune) pointed out that some meters are made of different materials for different product applications, and the change in product necessitates an additional evaluation. Andre noted that a manufacturer can't make a meter out of bronze, for example, and use it to meter a caustic material because it will fail. Manufacturers take the product application and other application details into account when designing and choosing a meter for a given application base and will relay this information to the customer with regard to where the meter can be used. Andre further noted that this becomes a question of liability for the manufacturer since the customer will hold the manufacturer accountable. Some members also made note that the materials may be more significant for some meter technologies than for others.

The NTEP laboratories are asking for guidance to ensure consistency, but the Sector seems to be at an impasse with regard to how to provide that guidance. The Sector was not able to agree upon any general guidance that would assist the laboratories in understanding material construction and its impact on device performance. The laboratories need to be comfortable that the testing they have conducted supports the variations listed on the CC. Dennis Beattie (Measurement Canada) observed that the issue seems to focus on the question of how the materials affect the definition of what constitutes a "family" of devices. He also pointed out, in response to an example of a manufacturer choosing a lighter material for a vehicle-mounted than a stationary application, that some materials such as aluminum respond differently to changes in temperature.

Conclusion: The Sector had extensive discussion on both the first and second days of the meeting over specific examples of meter sizes, product applications, and component materials. There were clearly divided opinions regarding how these combinations should be addressed. Manufacturers generally seemed to feel that component materials relative to the intended meter application are a design issue and should be left to the manufacturer to address, particularly since they will ultimately be responsible for ensuring that the meters work accurately and their customers are satisfied. Some NTEP laboratory representatives were comfortable with the idea of allowing the marketplace to take care of this issue, whereas others were not, particularly citing their feeling of responsibility in attesting to the accuracy of what is listed on a CC. However, it was clear that all laboratories felt the need for additional guidance in how to handle variations with regard to the amount of testing required and on how to handle listing materials information on the CC to ensure consistency among all of the laboratories.

The Sector was unable to reach any consensus on this issue; however, the Sector acknowledged that the issue is not going to be eliminated from the Sector's agenda. Criteria (whatever that may be) regarding how to address materials must be included in Publication 14, and guidance needs to be given to the NTEP laboratories to ensure this issue is consistently addressed for all evaluations.

4. Add Testing Criteria to NTEP Policy U "Evaluating Electronic Indicators Submitted Separately from a Measuring Element"

Source: California NTEP Lab

Background: At its 2007 meeting, the Measuring Sector heard that Section U. of the NTEP Policy in NCWM Publication 14 allows for testing an indicator separately from a measuring element. However, specific test criteria had not been developed for this section. The Sector heard a recommendation to develop and add specific criteria for testing an indicator separately from a measuring element for this section. The California NTEP laboratory recommended using Canada's test criteria as a guideline to develop the tests outlined in that meeting agenda's Appendices A, B, and C.

The Sector agreed the California NTEP laboratory should lead a WG to develop a specific test procedure for review at the next Sector meeting. Members of the WG selected at the 2007 meeting are Dave Rajala (Veeder-Root Company), Rich Miller (FMC Technologies), Maurice Forkert (Tuthill Transfer Systems), Dmitri Karimov (Liqid Controls), Rodney Cooper (Actaris Neptune), and Ralph Richter (NIST WMD).

Recommendation: The Sector will hear an update on the progress of this work from the Work Group.

Discussion: Manufacturers want to be able to submit an indicating device separately and, while there is a checklist for meters in Publication 14, there are currently no similar provisions for electronic indicators. Currently, Publication 14 only includes criteria for addressing mechanical indicators.

Dan Reiswig reported that he has developed an initial draft of criteria for separate indicators. He emphasized that indicator manufacturers and people in the work group have provided a lot of help on the development of test criteria for these indicators thus far, particularly Rich Miller and Dmitri Karimov. Dan reported that the work group has also been fortunate to be able to consult with Canada's type evaluation laboratory staff, noting that the Canadian document for evaluating these devices is written more for people who regularly work in the lab and continually work with electronics.

Dan encountered some challenges in addressing variations with regard to amending CCs for previously approved indicators. One example given was how to address an indicator that has been approved for use with a positive displacement meter, but is to be used at a later point for mass flow applications. The "modularization" that has been done in the past has typically been done with the same technology, thus, Dan has expressed some uncertainty about how to handle such variations, noting the need for the criteria to address different technologies. Dan noted that the entire process is very complex, as he has learned from Measurement Canada's experiences.

An additional area that has posed some challenges is in addressing features such as multi-point calibration capability and how to define "approved and compatible" for an indicator with specific features. Dan raised the general question of whether or not we should be developing testing criteria for indicators alone and how extensive associated laboratory testing should be. He commented that putting an indicator on a meter and testing it in a field environment may not provide the best indication of the indicator's capabilities. The Sector must determine whether a laboratory and a field test are both needed or if one alone is sufficient.

Dan explained that the overarching goal of developing these criteria is to help ensure that the manufacturers and laboratories are all looking at the evaluation of indicators and their corresponding coverage on CCs from the same perspective. Rich Miller also noted the goal of establishing criteria that would allow modifications to be made to indicating elements, but not require unnecessary re-evaluations in the field for every modification.

He has distributed the checklist to some members of the work group, but has not received a response. General comments on the checklist from the Sector members at the meeting were favorable, with most, including Dan, noting that more work is needed with regard to test procedures and test equipment. The Sector had some limited discussion of specific aspects of possible test criteria before concluding that this conversation was best left to the work group to develop an initial proposal.

Steve Patoray noted that the material developed thus far has addressed technical policy issues related to the evaluation of separate indicators and also includes an initial start on a checklist; the next step is to develop detailed procedures regarding what the laboratories need to do to conduct a test on these components and what test equipment is required.

Dan reported including generic material from the General Code in the draft, but noted that these references need review from interested parties to ensure that the material is appropriate for these components. With regard to this point Steve Patoray noted that consideration needs to be given to the organization of the LMD checklist since the intent was to group General Code requirements together rather than repeating them to help ensure consistency in updating the criteria.

On the general issue of addressing separate components, Dennis Beattie suggested that, if the NCWM ultimately adopts criteria for temperature-compensated retail motor-fuel dispensers the Sector should consider addressing the automatic temperature compensation components separately. He noted that Measurement Canada was inundated with ATC kits and had to determine how to best address them in the type evaluation process.

Dan Reiswig commented that it is important to ensure a good cross section of the industry is represented in the work group, noting that this may not be the case with the current work group and encouraging participation from other

segments of the industry, particularly from other device technologies such as mass flow meters and magnetic flow meters.

Dennis Beattie suggested that the work group concentrate more on the technology of the indicator rather than on the meter with which the indicator will be interfaced. He noted that referencing these other technologies may add unnecessary complexity, and he further noted that indicators are just devices that receive pulses. He pointed out that Canada's requirements are actually different from the U.S. requirements in that Canada requires dual pulses whereas the U.S. does not. Thus, the evaluation procedures and associated equipment used in Canada are not necessary.

Mike Keilty asked for a renewed commitment from the people who have volunteered for the work group and asked if others are interested in participating. He asked if the work group could have something concrete by the beginning of January so that the members of the work group who happen to be at the Interim Meeting can go through it, recognizing that not all members may be able to attend, but at least those who are there (and are perhaps at the Annual Meeting) can use the opportunity to continue the work. He also noted that the Meter Manufacturers' Association has met fairly regularly with each NCWM meeting and part of their allotted meeting time might be used to review the group's progress.

Conclusion: The work group will meet briefly at the conclusion of the 2008 Sector meeting and will begin working via e-mail and telephone calls. The work group established a goal of having an updated draft by the beginning of January 2009. Work group members who are able to attend the NCWM Interim Meeting and the Annual Meeting can meet to work further on the draft.

Dennis Beattie and Mike Keilty volunteered to join the work group. Sector technical advisor Tina Butcher asked to be copied on any correspondence so that she is kept abreast of the status of the work.

New Items

5. Recommendations to Update to NCWM Publication 14 to Reflect Changes to NIST Handbook 44

Source: NIST/WMD

Background: The 93rd National Conference on Weights and Measures (NCWM) adopted the following item that will be reflected in the 2009 Edition of NIST Handbook 44 and NCWM Publication 14. This item is part of the agenda to inform the Measuring Sector of the NCWM actions and recommend changes to NCWM Publication 14.

Recommendation: The Sector was asked to review and, if acceptable, recommend to the NTEP Committee adoption of the following changes to Publication 14 based on changes to NIST Handbook 44:

A. Checklist for Specific Criteria for Vehicle-Tank Meters, Section 28. Marking Requirements, Code Reference S.5.7. (LMD-49)

Add the following new code reference to Section 28. Marking Requirements:

Code Reference: S.5.7. Meter Size

28.5. Except for milk meters, if the meter model identifier does not provide a link to the meter size (in terms of pipe diameter) on an NTEP Certificate of Conformance, the meter shall be marked to show meter size. Yes No N/A

Discussion: The Sector recognized that the decision to add paragraph S.5.7. to NIST Handbook 44 has already been made; however, there was some discussion regarding the technical aspects of the requirement during the meeting. Mike Keilty commented that, in a discussion of this item just prior to the Sector meeting, the manufacturers acknowledged that the markings are required only if other conditions are not met. Many companies correlate meter

models to the size, and this relationship is explained in the CC for the meter. For those who choose not to make this link, the marking requirement would apply.

Will Wotthlie pointed out that historically many people have associated a given meter size with a general flow range. He gave the example of a 2-inch meter being associated with a minimum and maximum flow range of 20 gpm and 100 gpm, noting that the flow rate is what is of most significance when considering the product depletion test. This was echoed by several other Sector members. The Sector also discussed the variations that may exist among manufacturers in designating meter size and corresponding flow rates as well as the use of flanges and how this might impact the designation of meter size.

Tina Butcher noted that NEWMA has indicated it plans to develop a proposal to further modify Handbook 44 to base the tolerance on meter flow rate rather than on meter size, an approach supported by NIST WMD; however, no proposal has been developed to this point. Some members also commented on concerns that have been raised about inspectors having regular access to CCs.

The Sector briefly discussed the idea of developing a proposal that might be submitted to the SWMA for recommending revisions to the code to base the tolerance ranges on flow rates. However, while the Sector would support further development of a proposal by NEWMA, the Sector was not interested in taking on this task. Some members also noted that they would like to see any such proposal circulated among the regions and reviewed at a subsequent Sector meeting prior to it being presented for a vote.

There was some discussion about the merits of using meter size versus flow rate. Dennis Beattie noted that Measurement Canada bases their requirements on meter size and that the current tolerance based on size was patterned after Canada's criteria. He also noted that the break points also correlate to when a different size prover is needed for a test.

Conclusion: The Sector agreed to recommend to the NTEP Committee that the proposed language be included in Publication 14.

6. G-S.8.1. Access to Calibration and Configuration Adjustments, Proposed Changes to Language

Source: Marc Buttler, Emerson Process Management

Background: In the 2008 NCWM Publication 16, the NCWM S&T Committee considered a new paragraph G-S.8.1. as shown below.

Original Proposed Language for G-S.8.1. from 2008 NCWM Publication 16:

G-S.8.1. Access To Calibration and Configuration Adjustments. – A device shall be so designed that access to calibration and configuration modes, including external and remote access, are only permitted when:

- (a) The application of the physical security seal shall ensure that the access to the calibration and configuration modes is disabled, or**
- (b) The calibration and configuration adjustments are protected by an approved category 1, 2, or 3 audit trail, and the device shall clearly and continuously indicate and print, if equipped with a printer, that the calibration and configuration adjustment modes are enabled.**

(Nonretroactive as of January 1, 2009)

(Added 2008)

In the addendum sheets published by the NCWM S&T Committee at the 2008 Annual Meeting, changes were made to the proposed revisions to G-S.8. Provision for Sealing Electronic Adjustable Components, G-S.8.1. Access to Calibration and Configuration Adjustments. The submitter expressed concern that the revised paragraph would

create a new requirement such that any device that does not automatically disable calibration and configuration mode when the physical security seal is applied must be a category 3 sealing device by requiring the device to have an approved audit trail. He further noted that there are currently approved devices, which are not category 3, but that continuously indicate configuration mode is active or do not function, when the device is in configuration and calibration mode, preventing the accidental sealing of the device while still in configuration and calibration mode. These devices would no longer be allowed under the new wording.

At the 2008 NCWM Annual Meeting, the S&T Committee revised the proposed change to G-S.8.1. in its addendum sheets as follows (see the S&T Committee’s addendum sheets for a complete summary of related changes to G-S.8.):

<p><u>G-S.8.1. Access To Calibration and Configuration Adjustments. – A device shall be so designed that:</u></p> <p>(a) <i>The application of the physical security seal automatically disables the access, including external and remote access, to the calibration and configuration mode, or</i></p> <p>(b) <u>The calibration and configuration adjustments, including external and remote access, are protected by an approved audit trail, and in addition:</u></p> <ul style="list-style-type: none">- <u>The device shall not provide metrological indications that can be interpreted, or transmitted into memory, or printed while it is in the calibration and/or configuration adjustment mode as a correct measurement value, or</u>- <u>The device shall clearly and continuously indicate that it is in the calibration and/or configuration adjustment mode and record such message if capable of printing in this mode.</u> <p><u>(Nonretroactive as of January 1, 2009)</u></p> <p><u>(Added 2008)</u></p>
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Recommendation: The Sector was asked to consider submitting a proposal to request that the S&T Committee reinstate the previous wording from the original item in Pub 16 (2008) that also allows category 1 and 2 devices as long as they continuously and clearly indicate that the device is in calibration and configuration mode or do not provide a measurement value.

The S&T Committee, by their comments on this item in the addendum sheets, seemed to be trying to eliminate references to sealing categories of the device. If the purpose of this was to reduce language, the references could still be removed as long as the additional reference to an approved audit trail is also removed, because this reference is specifically requiring a category 3 sealing device, whether intentional or not.

Discussion: The Sector discussed some of the questions that had been posed about the current language in G-S.8. by various members of the weights and measures community. Steve Patoray described (from his perspective as past NTEP Director) the scenario which prompted questions to be raised about this paragraph among the NTEP laboratories, noting that he believes this issue is really a weighing issue. He stated that some weighing devices are equipped with a jumper located inside the case; the jumper is engaged and the calibration mode can then be entered via use of a password. The manual to the device would specify that you should disengage the jumper before putting the case back on the device. If the technician neglects to disengage the jumper, a physical security seal could be affixed to the device without putting the jumper in the “on” position.

Rich Miller commented that this method of operation is different from how his company’s devices work, noting that the device could not be used in normal operation without first taking it out of the calibration mode. Others echoed Rich’s comments regarding how other measuring devices work and some commented that the method of operation described by Steve Patoray should never have been approved.

Will Wothlie noted that the NTEP measuring laboratories have historically applied the criteria to require the method of operation that Rich Miller described, commenting also that the labs also considered requirements for “facilitation of fraud” in their assessments. While this interpretation is consistent with the existing language in G-S.8., he doesn’t believe that this is strictly a concern for the weighing laboratories. Will noted that, if the weighing laboratories are interpreting the criteria differently, manufacturers for new measuring applications may question those interpretations. Dan Reiswig noted that Publication 14 supports Will’s statements.

Tina Butcher noted that the NIST Weights and Measures division believes that the existing language is clear and the interpretation used by the measuring laboratories is correct; however, there are people who are interpreting it differently. She pointed out that the current language states that a security seal must be broken before any metrologically significant change can be made. Tina further commented that the S&T Committee has struggled to find language that does not change the intent of the requirement. She and others noted that the NTEP laboratories have also had extensive discussions about this language and the labs and the S&T Committee would appreciate additional input from the Sector on a proposed approach.

The Sector returned to the more immediate issue before the Measuring Sector, which is the proposal to recommend that the S&T Committee reinstate the language originally printed in the 2008 Edition of NCWM Publication 16. Steve Patoray noted that the S&T Committee had pulled the item back from a Voting status at the 2008 NCWM Annual Meeting because of questions regarding the proposed wording, noting that the key issue is really how to address the application of the physical seal relative to the device being in the adjustment mode. He further stated that, for some weighing devices, the application of the physical seal does not do anything except give a visual indication of whether or not there is access to calibration. Marc Buttler noted that his concern regarding the implication that the device be able to sense that it has been left in the adjustment mode and the potential impact on existing devices. He noted that there are also many devices that simply won’t function normally if left in the calibration mode. Dave Rajala and Rich Miller echoed this comment and suggested that the recommendation state that the device must not provide a measurement value while in the adjustment mode. Rodney Cooper also noted that his company’s devices are designed such that it is necessary to exit the calibration mode before using it in normal operation. Dave supports maintaining the current language, noting that his company’s equipment complies with it and suggesting that, if weighing applications have not been interpreting it this way, these applications should be fixed. However, he further noted that he would support the proposed language with the removal of the word “automatic.”

The Sector also discussed the definition of an “audit trail” and the differences among various methods of sealing. Tina Butcher noted that the S&T Committee removed the reference to specific categories of audit trails because not all specific device codes use these same numerical references. She suggested that an alternative approach would be to say “an electronic means of sealing.” She also directed the Sector to the audit trail criteria that was originally developed by Claude Bertrand and others at Measurement Canada and Henry Oppermann at NIST WMD and ultimately incorporated into NCWM Publication 14. Marc Buttler stated that this information helps to clarify the language used in G-S.8., and some members of the Sector observed that field inspectors may benefit from additional information regarding the criteria for an “approved” audit trail. Marc further suggested that perhaps the Sector should consider proposing amendments to bullet (b) in the proposal.

Multiple different options for modifying G-S.8.1. were considered, including replacing the text in the proposed (a) with the following and modifying (b) to include a generic reference to different device categories:

G-S.8.1. Access To Calibration and Configuration Adjustments. – A device shall be so designed that:

- (a) Before the application of the physical security seal, means shall be taken to disable the access, including external and remote access to the calibration and configuration mode. (Rich Miller)***

OR

Before the application of the physical security seal, the access, including external and remote access, to the calibration and configuration mode shall be disabled, or (Dmitri Karimov)

OR

The access, including external and remote access, to the calibration and configuration mode must be disabled before the application of a physical security seal, or (Maurice Forkert)

(b) The calibration and configuration adjustments, including external and remote access, are protected by an approved audit trail for the category of device, and in addition:

- The device shall not provide metrological indications that can be interpreted, or transmitted into memory, or printed while it is in the calibration and/or configuration adjustment mode as a correct measurement value, or
- The device shall clearly and continuously indicate that it is in the calibration and/or configuration adjustment mode and record such message if capable of printing in this mode.

(Nonretroactive as of January 1, 2009)

(Added 2008)

After extensive discussion by the Sector regarding possible alternatives, Judy Cardin (Wisconsin), NTEP Committee Chair, suggested that the Sector just communicate its concerns over the use of the word “automatically.” Mike Keilty concurred, noting that many different alternatives could be written, but since the basic concern seems to stem from the use of the word “automatically,” just noting the Sector’s concern might be helpful to the S&T Committee in assessing alternatives.

Conclusion: The Sector is concerned that the term “automatically” may be misinterpreted. The Sector did not agree upon specific language to suggest, but encourages the S&T to find alternative language for this term.

7. Product Families for Meters Table, Categorization of Liquid CO₂

Source: Marc Buttler, Emerson Process Management

Background: Liquid carbon dioxide is not clearly addressed in the Product Families for Meters Table in NCWM Publication 14 (see Technical Policy, Section C, LMD-3). Clarification is required regarding the correct product family for liquid CO₂ in order to guide correct certification for liquid CO₂. Categorizing liquid CO₂ in the family of cryogenic products was considered, but the typical temperature of liquid CO₂ is above the defined maximum temperature for cryogenic fluids of 120 Kelvin as defined in NIST Handbook 44.

Recommendation: The Sector was asked to consider including liquid CO₂ as a compressed liquid and to increase the maximum density for compressed liquids to 1.1 to include the typical density of liquid CO₂.

Discussion: Marc Buttler summarized the history of the issue, noting that there is currently nothing in the Product Families Table to address CO₂. Marc also noted that he had checked with Dick Suiter (who was the Sector’s technical advisor prior to his retirement in 2008) regarding categorization of CO₂ and Dick had suggested that it be addressed as a compressed liquid. Marc noted that CO₂ exists at temperatures well above the threshold specified in NIST Handbook 44 for “cryogenics,” citing typical temperature ranges of –50 °C to –30 °C. The Sector discussed typical temperature and pressure ranges for liquid CO₂ and generally concurred that it does not fall into the category of a cryogenic based upon the definition referenced above.

The California laboratory has the most experience testing CO₂ meters; however, Dan Reiswig noted California’s experience is primarily limited to tests of turbine meters rather than mass flow meters. With regard to categories currently included in the table, Norm Ingram expressed the opinion that CO₂ belongs in the compressed liquids category; however, he noted that there is no specific gravity listed for either compressed gases or cryogenic liquids and the specific gravity for carbon dioxide is not within the range currently listed in the compressed liquids category.

The Sector discussed the relative tolerances specified in NIST Handbook 44 for cryogenic liquids, mass flow meters, and LPG and NH₃ and considered how this might impact the inclusion of CO₂ in an existing product family. If CO₂ is included in a family which is subject to different tolerances, the Sector will need to assess how to apply tolerances in testing. For example, would the most stringent tolerance be used to cover all products in the family? The Sector also discussed the fact that Section 3.34. in the Cryogenics Code does not apply to meters dispensing liquefied natural gas.

The Sector also discussed the question of what testing would need to be done to get the products listed under the family. Test D is specified for both the compressed liquids family and cryogenic liquids family. Mike Frailer noted that if you test with one product from the family, Test D would require testing with only one product from the family. This needs to be considered in conjunction with the issue of tolerances to be applied. Dan Reiswig noted that historically tests conducted by the California laboratory of turbine meters included separate tests for cryogenics and CO₂. Will Wotthlie pointed out that CO₂ has not previously been included in the Product Families Table and suggested an alternative might be to create a separate category for CO₂ with a Test D specified.

Related to the issue of the test specified in the Product Families Table is the question of specific test procedures. Because product is transferred through these meters via gravity discharge, Will Wotthlie noted that the testing is more complex; one must take great care to ensure that pressures are consistent and other parameters are monitored. The uncertainty in the testing process is one reason that a larger tolerance is allowed. While expressing a desire to avoid more testing than is absolutely necessary, Dan Reiswig and others laboratories noted that experience testing meters using gravity discharge in NTEP is rather limited. Dan expressed concern about including CO₂ in an existing product family category and, thereby, “grandfathering” it into an existing CC because of this limited experience and the lack of data to support doing so.

Jim Truex asked if Measurement Canada had experience with these meters and Dennis Beattie indicated they do not have any data to share. Marc Buttler reported that no tests have yet been conducted in the field, which led to the conclusion that more data is needed. Marc reported having a customer waiting for a resolution of this issue, and Dan Reiswig offered to work with Marc to look at a device near the California laboratory for the purposes of collecting additional data. Since limited or no data seems to be available, Jim Truex, noted that a test case is needed in order to collect data that will enable the Sector to assess what changes to the table can be supported. Marc suggested the Sector table the issue until additional data is collected and examined. The Sector agreed that additional data is needed to make an assessment of any proposed changes to the table with respect to CO₂.

Conclusion: The Sector agreed to table the issue until more data is available to suggest the best approach to use for including CO₂ in the Product Families Table and for defining the test criteria.

8. Product Families for Meters Table, Inclusion of Milk and Dairy Products

Background: The product family for milk is not clearly identified in the Product Table in Pub 14. HB 44 and Pub 14 have specific sections regarding milk meters, but it is unclear what the product family and test requirements are for milk.

The following points were offered for the Sector to consider in its discussion of this issue:

- The “Mass Flow Meters” category in the current table does not include any additional guidance regarding “milk and dairy products” or any other food-grade products.
- Milk and dairy products would presumably fall under the test requirements category of “Normal Liquids” for mass flow meters since the remaining categories of “Heated Products,” “Compressed Liquids,” “Compressed Gases,” and “Cryogenic Liquids and LNG” would clearly not include milk and dairy products.
- The majority of mass flow meters with NTEP CCs for dairy applications were tested with milk.
- Past Sector summaries and discussions do not appear to have any reference to discussions of how milk and

other dairy products would fit into the Product Families Table for MFMs or for any other meter technologies. Milk does not appear to be discussed in any recent discussions (in the past few years) on the Product Families Table categories for MFMs.

- There is reference to various food-grade oils and there are subcategories for Magnetic Flow, PD, and Turbine meters that include reference to “industrial and food-grade liquid oils.” However, no other reference is made in the table to other types of food products.
- The LMD Checklist is very sketchy on evaluation criteria for milk metering applications in general. So, a related Sector issue may be the need to strengthen the checklist criteria on milk meters. This point could be addressed with this agenda item or as part of a separate effort.
- A related issue (more for HB 44 than for NTEP) is that the MFM Code in HB 44 includes few references to milk meter applications. The MFM Code may need to be reviewed to determine if any additional requirements for milk meter applications from the NIST Handbook 44 Milk Meters Code might need to be proposed for inclusion in the MFM Code. It is questionable if this was done when the MFM Code was added to HB 44.
- Where does a food product such as high fructose corn syrup (which may sometimes be heated) fit in the existing table? There is a category for liquid feeds such as molasses, but not for corn syrup.

Recommendation: Identify clearly which product family milk falls into for each metering technology. Alternatively, the Sector might consider creating a separate product family just for milk and dairy products.

Discussion: Dmitri Karimov reported that one reference to milk that he observed on the internet cites an approximate 87.7 % water content. Thus, milk is most appropriately included in the “water” product category. For reference, Rich Miller also noted that R 117 has a section that addresses beer and other foaming liquids (which includes milk) under a single category for liquid foods.

Will Wotthlie agreed with Dmitri’s assessment, noting that he is also speaking for Ross Andersen (New York) who asked Will to relay his point of view. Will went on to comment, that with regard to test liquid, he believes that testing done in the laboratory with water is adequate to cover applications for either water or milk. Additionally, a test with water in a field application is appropriate to cover either water or milk applications on the CC. Will also commented that, because of the need to test complete systems, including any peripheral equipment typically associated with milk meters, if a manufacturer selects a field site that is normally used to meter milk, then milk must be used as the test liquid for the evaluation.

The Sector generally agreed that testing in a laboratory with water is adequate to cover both milk and water applications. Dennis Beattie noted that even if milk was brought into a lab, problems would likely arise because of product foaming. Dennis also commented that Measurement Canada doesn’t approve a meter alone, rather they approve systems, which includes an evaluation of the control components of the system. The Sector acknowledged that milk metering systems include peripheral equipment that is essential to ensuring accurate metering and that testing in a laboratory environment with water may not include testing with this peripheral equipment. However, several members made the point that initial and subsequent verification tests in the field will be conducted with all peripheral equipment that is necessary to ensure accurate measurement and further commented that milk must be used for the test liquid in such tests. The Sector also briefly discussed how CCs reflect associated peripheral equipment in milk metering systems, with some comments that there may be some inconsistency in previously issued CCs.

The Sector then went on to discuss the merits of NTEP testing with water versus milk in field applications. Echoing Will’s comments, the Sector agreed that NTEP tests in field applications can be conducted with either water or milk to cover both applications. However, when the field site selected is an application that is normally used to meter milk (for example an installation at a farm site), then the Sector believes that, whether the test is an NTEP test or an initial or subsequent verification, the test liquid must be milk and all associated peripheral equipment must be included for the test.

There was some additional discussion regarding whether or not milk should be included in the category with water for all metering technologies. The Sector agreed that milk can be included in the same category as water for all technologies; however, because of the issue of conductivity, the Sector agreed that, for magnetic flow meters, milk should be included in the category with tap water rather than deionized water.

Conclusion: The Sector agreed on the following points:

- Add milk to the “water” product categories in the table. However, because of the issue of conductivity, for magnetic flow meters where there are two categories for water, add milk to the “tap water” category.
- A manufacturer can select a field site for either a water meter application or a milk meter application and have both products covered on the certificate. If the site selected is a site intended to meter milk, then milk must be used for the test liquid.

9. Next Meeting

Recommendation: The Sector was asked to develop a proposed date and location for the next meeting.

Discussion: The Sector discussed several options for the 2009 and future meetings, including options of holding Sector meetings in conjunction with the SWMA, the WWMA, and the CWMA Interim Meetings as well as holding Sector meetings separately. Because more NTEP measuring laboratory personnel routinely attend the SWMA, holding the meetings in conjunction with the SWMA would be more cost effective to those laboratories. Thus, the Sector agreed that the Sector meetings should continue to be held in conjunction with the SWMA as a general practice.

Conclusion: The Sector agreed to recommend that the next meeting be held in conjunction with the SWMA in 2009.

Additional Items as Time Allows

10. Temperature Compensation for Liquid Measuring Devices Code

Source: NCWM S&T Committee

Background and Recommendation: The NCWM S&T Committee is considering a proposal to modify Section 3.30. Liquid-Measuring Devices (LMD) Code by modifying paragraphs S.2.6., S.2.7.1., S.2.7.3., N.4.1.1.(a) and (b), N.5., UR.3.6.1.1., and UR.3.6.1.2., to add new paragraphs S.1.6.8., S.2.7.2., S.4.3., UR.3.6.1.3., and UR.3.6.4., and to renumber other existing paragraphs as appropriate to recognize temperature compensation for retail devices. The Sector was asked to provide input to the S&T Committee on these proposed changes if time permitted. The proposed changes were included in the Sector’s 2008 agenda and can be found in the NCWM S&T Committee’s 2009 Interim agenda and 2009 Interim Report under Item 330-1.

Conclusion: Time did not permit the Sector to discuss the proposed changes. Consequently, the Sector took no position on these proposals.

11. Water Meters – S.1.1.3. Value of the Smallest Unit

Source: Western Weights and Measures Association (WWMA)

Background and Recommendation: The NCWM S&T Committee is being asked to consider a proposal from the WWMA to modify paragraph S.1.1.3. Value of the Smallest Unit in Section 3.36. Water Meters in NIST Handbook 44 to harmonize with American Water Works Association (AWWA) standards. The Sector was asked to provide input to the S&T Committee on these proposed changes if time permitted. The proposed changes were included in the Sector’s 2008 agenda and can be found in the NCWM S&T Committee’s 2009 Interim agenda and 2009 Interim Report under Item 336-1.

Conclusion: Time did not permit the Sector to discuss the proposed changes. Consequently, the Sector took no position on these proposals.

12. Water Meters – N.4.1.1. Repeatability Tests and T.1. Tolerance Values

Source: Southern Weights and Measures Association (SWMA)

Background and Recommendation: The Southern Weights and Measures Association is developing a proposal to change requirements for test draft sizes specified in NIST Handbook 44 Section 3.36. Water Meters. The proposal recommends modifications to paragraph N.3., Tables N.4.1. and N.4.2., and paragraph T.1.1.; as well as the addition of several new tables in the Notes and Tolerances sections specifying separate requirements for utility and non-utility meters.

The Sector was asked to provide input to the S&T Committee on these proposed changes if time permitted. The proposed changes were included in the Sector's 2008 agenda and can be found in the NCWM S&T Committee's 2009 Interim agenda on the Developing Items Agenda and in the 2009 Interim Report under Item 336-3.

Conclusion: Time did not permit the Sector to discuss the proposed changes. Consequently, the Sector took no position on these proposals.

13. Water Meters T.1.1. Repeatability, Tables T.1.1. and T.1.2.

Source: Western Weights and Measures Association (WWMA)

Background and Recommendation: The WWMA submitted a proposal to amend T.1.1. Repeatability and add new Tables T.1.1. and T.1.2. in NIST Handbook 44 Section 3.36. to specify test draft sizes for tests of water meters. A copy of the proposal was included in the Sector's agenda with the request that the Sector review the proposal and provide any comments and recommended changes to the NCWM S&T Committee.

Conclusion: Time did not permit the Sector to discuss the proposed changes. Consequently, the Sector took no position on these proposals.

[**Technical Advisor's Note:** This proposal can be found in the 2009 Interim agenda of the S&T Committee under Item 336-2. This item was subsequently withdrawn by the S&T Committee as reflected in its 2009 Interim Report, with the recommendation that the WWMA address the issue in conjunction with the WWMA's continued work on a related S&T Committee Developing item, Part 4, Item 1.]

14. Draft Code Section 3.3X. Hydrogen Gas-Measuring Devices

Source: NCWM S&T Committee

Background: The NCWM S&T Committee's agenda added a new item to its Developing Items to recognize work being done to develop a code for commercial hydrogen gas-measuring devices by the U.S. National Work Group for the Development of Commercial Hydrogen Measurement Standards. The work group, which presently includes weights and measures officials, manufacturers and users of hydrogen measuring devices, and federal agency representatives, is looking for input and participation from the weights and measures community in the development of the code and associated test procedures. The most current version of the draft code can be found on NIST WMD's home page at <http://ts.nist.gov/WeightsAndMeasures/Developing-Commercial-Hydrogen-Measurement-Standards.cfm>.

This web page will be the U.S. weights and measures and hydrogen communities' source for the latest information and status of ongoing work to develop uniform and appropriate legal metrology standards for commercial hydrogen measurements.

Conclusion: The Sector took no action on this item. This item was included on the Sector's agenda to make the Sector aware of the work and to encourage input and participation from Sector members.

Appendix 1 – Attachment #1 from 2008 Measuring Sector Agenda

Proposed Product Families and Typical Product Characteristics

Table X.X.X. Product Families and Typical Product Characteristics			
Product Group	Liquid Name	Viscosity (60 °F) Centipoises/Centistokes	Specific Gravity (60 °F)
Normal Liquids			
Fuels, Lubricants, Industrial and Food-Grade Liquid Oils	Diesel Fuel	10 cps	0.72
	Distillate		
	Gasoline	0.28 cps	0.72
	Fuel Oil (#1, #2, #3, #4)	8 to 88 cPs.	0.9
	Kerosene	1.94 cps	0.75
	Light Oil	13.47 cps	0.86
	Spindle Oil		
	Lubricating Oils	20 to 1000 cPs.	0.80 to 0.90
	SAE Grades	192 to 3626 cps	0.9
	Bunker Oil	11 200 cps	0.99
	6 Oil (#5, #6)	66 to 13 000 cPs.	0.9
	Crude Oil	3 to 1783 cps	0.79 to 0.97
	Asphalt	100 to 5000 cPs	
	Vegetable Oil	133 cps	0.92
	Biodiesel above B20	10.12 cps	0.86
	Avgas	1.5 to 6 cPs.	
	Jet A	1.5 to 6 cPs.	
	Jet A-1	1.36 cps	0.76
	Jet B	1.5 to 6 cPs.	
	JP4	1.02 cps	0.76
	JP5	1.94 cps	0.76
	JP7	1.82 cps	0.76
	JP8		
	Cooking Oils	9.93 cps	0.92
	Sunflower Oil	90.1 cps	0.93
	Soy Oil	90.6 cps	0.93
Peanut Oil	11 cPs. to 110 cPs	0.9 to 1.0	
Olive Oil	116.8 cps	0.92	
Corn Oil	4.0 cps	0.91	
Normal Liquids			
Solvents General	Acetates	0.44 cps	0.93
	Acetone	0.34 cps	0.8
	Esters		
	Ethylacetate	1.36 cps	0.96
	Hexane	0.34 cps	0.66
	MEK	0.45 cps	0.81
	Toluene	0.62 cps	0.87
	Xylene	0.86 cps	0.89
Normal Liquids			
Solvents Chlorinated	Carbon Tetra-Chloride	0.99 cps	1.6
	Methylene-Chloride	0.46 cps	1.34
	Perchloro-Ethylene	1	1.6
	Trichloro-Ethylene	0.6 cps	1.47

Table X.XX. Product Families and Typical Product Characteristics				
Product Group	Liquid Name	Viscosity (60 °F) Centipoises/Centistokes	Specific Gravity (60 °F)	
Normal Liquids				
Alcohols, Glycols & Water Mixes Thereof	Ethanol	1.29 cps	0.79	
	Methanol	0.64 cps	0.80	
	Butanol	3.34 cps	0.81	
	Isopropyl	2.78 cps	0.79	
	Isobutyl	4.54 cps	0.81	
	Ethylene glycol	25.5 cps	1.19	
	Propylene glycol	54 cps	1.04	
Normal Liquids				
Water	Tap Water	1.0 cPs	1.0	
	Deionized	1.0 cPs	1.0	
	Demineralized	1.0 cPs	1.0	
	Potable	1.0 cPs	1.0	
	Nonpotable	1.0 cPs	1.0	
Normal Liquids				
Clear Liquid Fertilizers	Nitrogen Solution 28 %, 30 % or 32 % 20 % Aqua-Ammonia			
	Urea	1.0 cps	1.89	
	Ammonia Nitrate	11.22 cps	1.16 to 1.37	
	N-P-K solutions 10-34-0	48 cps	1.39	
	9-18-9		1.32	
	Normal Liquids			
	Crop Chemicals	Herbicides		
Round-up		1.0	1.01	
Touchdown			1.4	
Banvel			1.19	
Treflan			1.12	
Paraquat			1.12	
Prowl			1.06	
Normal Liquids				
Crop Chemicals	Fungicides			
	Insecticides			
	Adjuvants			
	Fumigants			
	Dual		1.11	
	Bicep		1.11	
	Marksman		1.16	
	Broadstrike		1.12	
	Doubleplay			
	Topnotch	140 to 400 cps	1.16	
	Guardman		1.12	
	Harness		1.11	

Table X.X.X. Product Families and Typical Product Characteristics			
Product Group	Liquid Name	Viscosity (60 °F) Centipoises/Centistokes	Specific Gravity (60 °F)
Normal Liquids			
Crop Chemicals	Fungicides		
Normal Liquids			
Crop Chemicals	Micronutrients		
Normal Liquids			
Suspension Fertilizers	3-10-30		
	4-4-27		
Normal Liquids			
Liquid Feeds	Liquid Molasses	8640 cps	1.25
	Molasses plus Phos Acid and/or Urea (Treacle)	2882 cps	1.1 to 1.3
Normal Liquids			
Chemicals	Sulfuric Acid	1.49 cps	1.83
	Hydrochloric Acid	1.0 to 0.80 cps	1.1
	Phosphoric Acid	161 cps	1.87
Heated Products			
	Bunker C	11 200 cps	1.99
	Asphalt	100 to 5000 cPs	
Compressed Liquids			
Fuels and Refrigerants	LPG		
	Propane	0.098 cps	0.504
	Butane	0.19 cps	0.595
	Ethane		
	Freon 11	0.313 cps	1.49
	Freon 12	0.359 cps	1.33
	Freon 22	1.99 cps	1.37
Compressed Liquids			
NH ₃	Anhydrous Ammonia	0.188 cps	0.61
Compressed Gases			
	Compressed Natural Gas (CNG)		0.6 to 0.8 (1=Air)
Cryogenic Liquids and Liquefied Natural Gas			
	Liquefied Oxygen	0.038 cps	0.66
	Nitrogen	1.07 cps	0.31
	Liquefied Natural Gas		

Appendix 2 – Attachment #2 from 2008 Measuring Sector Agenda

Test Requirements for Product Families

Table X.X.X. Test Requirements for Product Families	
<u>Product Family</u>	<u>Flowmeter Test Requirements</u>
<u>Normal Liquids</u>	<p><u>Magnetic Flowmeters – Use Test F for Fuels, Lubricants, Industrial and Food-Grade Liquid Oils, Solvents General, Solvents Chlorinated, Pure Alcohols & Glycols, Water (De-mineralized & De-ionized), Heated Products (above 50 °C);</u></p> <p><u>Magnetic Flowmeters – Use Test D for Water (Tap, Potable & Non-potable), Water Mixes of Alcohols & Glycols, Juices, Beverages, Clear Liquid Fertilizers, Crop Chemicals, Suspensions Fertilizers, Liquid Feeds, Chemicals</u></p> <p style="text-align: center;"><u>Mass Flowmeters – Use Test B</u></p> <p style="text-align: center;"><u>Positive Displacement Flowmeters – Use Test C</u></p> <p style="text-align: center;"><u>Turbine Flowmeters – Use Test E</u></p> <p style="text-align: center;"><u>Other Flowmeter Types – Use Test A</u></p>
<u>Heated Products (above 50 °C)</u>	<p style="text-align: center;"><u>Magnetic Flowmeters – Use Test F</u></p> <p style="text-align: center;"><u>Mass Flowmeters – Use Test D</u></p> <p style="text-align: center;"><u>Positive Displacement Flowmeters – Use Test D</u></p> <p style="text-align: center;"><u>Other Flowmeter Types – Use Test A</u></p>
<u>Compressed Liquids</u>	<p style="text-align: center;"><u>Mass Flowmeters – Use Test D</u></p> <p style="text-align: center;"><u>Positive Displacement Flowmeters – Use Test D</u></p> <p style="text-align: center;"><u>Turbine flowmeters – Use Test E</u></p> <p style="text-align: center;"><u>Other Flowmeter Types – Use Test A</u></p>
<u>Cryogenic Liquids and Liquefied Natural Gas</u>	<p style="text-align: center;"><u>Mass Flowmeters – Use Test D</u></p> <p style="text-align: center;"><u>Turbine flowmeters – Use Test D</u></p> <p style="text-align: center;"><u>Other Flowmeter Types – Use Test A</u></p>
<u>Compressed Gases</u>	<p style="text-align: center;"><u>Mass Flowmeters – Use Test D</u></p> <p style="text-align: center;"><u>Other Flowmeter Types – Use Test A</u></p>
<u>Note: CNG is only included in Section 3.37. Mass Flow Meters of Handbook 44.</u>	

Tests to be Conducted:

Test A Products must be individually tested and noted on the Certificate of Conformance.

Test B To obtain coverage for a range of products within a family: Test with one product having a low specific gravity; test with a second product having a high specific gravity. The Certificate of Conformance will cover all products in the family within the specific gravity range tested.

Test C To obtain coverage for a range of products within a family: Test with one product having a low viscosity; test with a second product having a high viscosity. The Certificate of Conformance will cover all products in the family within the viscosity range tested.

Test D To obtain coverage for a product family: Test with one product in the product family. The Certificate of Conformance will cover all products in the family.

Test E To obtain coverage for a range of products within a family: Test with one product having a low kinematic viscosity; test with a second product having a high kinematic viscosity. The Certificate of Conformance will cover all products in the family within the kinematic viscosity range tested.

Test F To obtain coverage for a range of products within a family: Test with one product having a specified conductivity. The Certificate of Conformance will cover all products in the family with conductivity equal to or above the conductivity of the tested liquid.

Appendix 3 – Attachment #3 from 2008 Measuring Sector Agenda

Revisions to NCWM Publication 14 LMD Checklist Technical Policy Part C – Product Families for Meters Discussed by the Sector at its October 2008 Meeting

C. Product Families for Meters

When submitting a meter for evaluation, the manufacturer must specify the product family and critical parameters for which the meter is being submitted.

The product family and the specific product subgroup covered by the Certificate are to be identified on page 1 of the Certificate of Conformance. More detailed information, including the typical product types found in the subgroup, is to be included in the application section of the Certificate.

Tests are to be conducted as described in Table C.1. Tests to Be Conducted. **Testing must be completed for each product family in order for that product family to be covered on the Certificate.** Table C.2¹. Product Families Table identifies which of these tests apply to various metering technologies and product families. ~~For meter technologies not already specified in Table C.2., use “Test A.”~~ **Tests are to be conducted as described in Table C.2. Tests to Be Conducted. For meter technologies not already specified in Table C.2., use Test A.** Table C.3. Typical Product Family Characteristics gives viscosity and specific gravity values for typical products in each product family.

The “Application” section of the Certificate of Conformance will identify product families or specific products covered under the Certificate.

Table C.1. Product Families and Test Requirements			
Mass Flow Meters Product Family & Test Requirements (Test B unless otherwise noted)	Magnetic Flow Meters Product Family & Test Requirements (Test D unless otherwise noted)	Positive Displacement Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Meters Product Family & Test Requirements (Test A unless otherwise noted)
<p style="text-align: center;">Test B <u>Normal Liquids</u> Includes the following for Mass Flow Meters:</p> <p style="text-align: center;"><u>Fuels, Lubricants,</u> <u>Industrial and Food-Grade</u> <u>Liquid Oils,</u></p> <p style="text-align: center;"><u>Solvents</u> <u>General,</u></p> <p style="text-align: center;"><u>Solvents</u> <u>Chlorinated,</u></p> <p style="text-align: center;"><u>Alcohols, Glycols, and</u> <u>Water Mixes Thereof,</u></p> <p style="text-align: center;"><u>Water,</u></p>	<p style="text-align: center;">Test F-permitted Fuels, Lubricants, Industrial and Food-Grade Liquid Oils, Solvents General, Solvents Chlorinated, Pure Alcohols & Glycols, Water (De-mineralized & de-ionized), Heated Products (above 50 °C)*</p>	<p style="text-align: center;">Test C Fuels, Lubricants, Industrial and Food-Grade Liquid Oils</p>	<p style="text-align: center;">Test E-permitted Fuels, Lubricants, Industrial and Food-Grade Liquid Oils</p>
	<p style="text-align: center;">Test D Water (Tap, Potable & Nonpotable), Water Mixes of Alcohols & Glycols;</p>	<p style="text-align: center;">Test C Solvents General</p>	<p style="text-align: center;">Test E-permitted Solvents General</p>
	<p style="text-align: center;">Test C Solvents Chlorinated</p>	<p style="text-align: center;">Test A Solvents Chlorinated</p>	
	<p style="text-align: center;">Test C Alcohols, Glycols, & Water Mixes Thereof</p>	<p style="text-align: center;">Test E permitted Alcohols, Glycols, & Water Mixes Thereof</p>	
	<p style="text-align: center;">Test D-permitted Water</p>	<p style="text-align: center;">Test D-permitted Water</p>	

Table C.1. Product Families and Test Requirements

Mass Flow Meters Product Family & Test Requirements (Test B unless otherwise noted)	Magnetic Flow Meters Product Family & Test Requirements (Test D unless otherwise noted)	Positive Displacement Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Meters Product Family & Test Requirements (Test A unless otherwise noted)
(continued)	(continued)	Test C Clear Liquid Fertilizers	Test A Clear Liquid Fertilizers
Juices, Beverages, Clear Liquid Fertilizers, Crop Chemicals, Flowables Suspensions Fertilizers, Liquid Feeds, Chemicals	Glycols, and Water Mixes Thereof, Juices, Beverages, Clear Liquid Fertilizers, Crop Chemicals, Suspensions Fertilizers, Liquid Feeds, Chemicals	Test C Crop Chemicals <u>1</u>	Test A Crop Chemicals <u>1</u>
		Test C Crop Chemicals <u>2</u>	Test A Crop Chemicals <u>2</u>
		Test C Flowables	Test A Flowables
		Test C Crop Chemicals <u>3</u>	Test A Crop Chemicals <u>3</u>
		Test C Crop Chemicals <u>4</u>	Test A Crop Chemicals <u>4</u>
		Test C Suspensions Fertilizers	Test A Suspensions Fertilizers
		Test C Liquid Feeds	Test A Liquid Feeds
		Test C Chemicals	Test A Chemicals
Test B Heated Products (above 50 °C)	*See above (for heated products above 50 °C)	Test C Heated Products (above 50 °C)	Test A Heated Products (above 50 °C)
Test D Compressed Liquids, Fuels and Refrigerants, NH ₃	Not Applicable (conductivity too low)	Test C Compressed Liquids, Fuels and Refrigerants	Test E Compressed Liquids, Fuels and Refrigerants
		Test C NH ₃ Anhydrous Ammonia <u>Note: If a meter is certified for anhydrous ammonia the same meter type may also be certified for LPG without further testing.</u>	Test A NH ₃ Anhydrous Ammonia <u>Note: If a meter is certified for anhydrous ammonia the same meter type may also be certified for LPG without further testing.</u>
Test D Compressed Gases	Note: CNG is only included in Section 3.37. Mass Flow Meters of Handbook 44. CNG		

Table C.1. Product Families and Test Requirements

Mass Flow Meters Product Family & Test Requirements (Test B unless otherwise noted)	Magnetic Flow Meters Product Family & Test Requirements (Test D unless otherwise noted)	Positive Displacement Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Meters Product Family & Test Requirements (Test A unless otherwise noted)
Test D Cryogenic Liquids and Liquefied Natural Gas	Not Applicable (conductivity too low)	Test A Cryogenic Liquids and Liquefied Natural Gas	Test D-permitted Cryogenic Liquids and Liquefied Natural Gas

¹ Note: The Typical Products listed in this table are not limiting or all-inclusive; there may be other products and product trade names, which fall into a product family. Water and a product such as stoddard solvent or mineral spirits may be used as test products in the fuels, lubricants, industrial, and food-grade liquid oils product family.

² The specific gravity of a liquid is the ratio of its density to that of water at standard conditions, usually 4 °C (or 40 °F) and 1 atm. The density of water at standard conditions is approximately 1000 kg/m³ (or 998 kg/m³)

³ Diesel fuel blends (biodiesel) with up to 20 % vegetable or animal fat/oil.

⁴ Gasoline includes oxygenated fuel blends with up to 15 % oxygenate.

$$\text{Centistokes} = \frac{\text{Centipoise}}{\text{Specific Gravity}}$$

⁵ Kinematic viscosity is measured in centistokes (cSt).

Source for some of the viscosity value information is in the Industry Canada – Measurement Canada “Liquid Products Group, Bulletin V-16-E (rev. 1), August 3, 1999.”

Table C.2. Tests to be Conducted

Test A – Products must be individually tested and noted on the Certificate of Conformance.
Test B – To obtain coverage for a range of products within a family: Test with one product having a low specific gravity; test with a second product having a high specific gravity. The Certificate of Conformance will cover all products in the product family within the specific gravity range tested.
Test C – To obtain coverage for a range of products within a family: Test with one product having a low viscosity; test with a second product having a high viscosity. The Certificate of Conformance will cover all products in the product family within the viscosity range tested.
Test D – To obtain coverage for a product family: Test with one product in the product family. The Certificate of Conformance will cover all products in the family.
Test E – To obtain coverage for a range of products within a family: Test with one product having a low kinematic viscosity; test with a second product having a high kinematic viscosity. The Certificate of Conformance will note coverage for all products in the family within the kinematic viscosity range tested.
Test F – To obtain coverage for a range of products within a family: Test with one product having a specified conductivity. The Certificate of Conformance will note coverage for all products in both of the families with conductivity equal to or above the conductivity of the tested liquid.

Table C.3. Typical Product Family Characteristics			
Product Families	Typical Products	Reference Viscosity* (60 _F) Centipoise/Centistokes (cP)	Reference Specific Gravity* (60 _F) (1 = water, except where noted)
Normal Liquids, Fuels, Lubricants, Industrial and Food-Grade Liquid Oils	Diesel Fuel	10 <u>cPeps</u>	0.72
	Distillate		
	Gasoline	0.28 <u>cPeps</u>	0.72
	Fuel Oil (#1, #2, #3, #4)	8 to 88 <u>cPeps</u> .	0.9
	Kerosene	1.94 <u>cPeps</u>	0.75
	Light Oil	13.47 <u>cPeps</u>	0.86
	Spindle Oil		
	Lubricating Oils	20 to 1000 <u>cPeps</u> .	0.80 to 0.90
	SAE Grades	192 to 3626 <u>cPeps</u>	0.9
	Bunker Oil	11 200 <u>cPeps</u>	0.99
	6 Oil (#5, #6)	66 to 13 000 <u>cPeps</u> .	0.9
	Crude Oil	3 to 1783 <u>cPeps</u>	0.79 to 0.97
	Asphalt	100 to 5000 <u>cPeps</u>	
	Vegetable Oil	133 <u>cPeps</u>	0.92
	Biodiesel above B20	10.12 <u>cPeps</u>	0.86
	Avgas	1.5 to 6 <u>cPeps</u> .	
	Jet A	1.5 to 6 <u>cPeps</u> .	
	Jet A-1	1.36 <u>cPeps</u>	0.76
	Jet B	1.5 to 6 <u>cPeps</u> .	
	JP4	1.02 <u>cPeps</u>	0.76
	JP5	1.94 <u>cPeps</u>	0.76
	JP7	1.82 <u>cPeps</u>	0.76
	JP8		
	Cooking Oils	9.93 <u>cPeps</u>	0.92
	Sunflower Oil	90.1 <u>cPeps</u>	0.93
	Soy Oil	90.6 <u>cPeps</u>	0.93
	Peanut Oil	11 <u>cPeps</u> . to 110 <u>cPeps</u>	0.9 to 1.0
Olive Oil	116.8 <u>cPeps</u>	0.92	
Corn Oil	4.0 <u>cPeps</u>	0.91	
Normal Liquids, Solvents General	Acetates	0.44 <u>cPeps</u>	0.93
	Acetone	0.34 <u>cPeps</u>	0.8
	Esters		
	Ethylacetate	1.36 <u>cPeps</u>	0.96
	Hexane	0.34 <u>cPeps</u>	0.66
	MEK	0.45 <u>cPeps</u>	0.81
	Toluene	0.62 <u>cPeps</u>	0.87
	Xylene	0.86 <u>cPeps</u>	0.89

Table C.3. Typical Product Family Characteristics			
Product Families	Typical Products	Reference Viscosity* (60_F) Centipoise/Centistokes (cP)	Reference Specific Gravity* (60_F)(1 = water, except where noted)
Normal Liquids, Solvents Chlorinated	Carbon Tetra-Chloride	0.99 cPeps	1.6
	Methylene-Chloride	0.46 cPeps	1.34
	Perchloro-Ethylene	1.0	1.6
	Trichloro-Ethylene	0.6 cPeps	1.47
Normal Liquids, Pure Alcohols, Alcohols, Glycols & Water Mixes Thereof	Ethanol	1.29 cPeps	0.79
	Methanol	0.64 cPeps	0.80
	Butanol	3.34 cPeps	0.81
	Isopropyl	2.78 cPeps	0.79
	Isobutyl	4.54 cPeps	0.81
	Ethylene glycol	25.5 cPeps	1.19
Normal Liquids, Water	Propylene glycol	54 cPeps	1.04
	Tap Water	1.0 cPeps	1.0
	Deionized	1.0 cPeps	1.0
	Demineralized	1.0 cPeps	1.0
	Potable	1.0 cPeps	1.0
Normal Liquids, Clear Liquid Fertilizers	Nonpotable	1.0 cPeps	1.0
	Nitrogen Solution 28 %, 30 % or 32 %		
	20 % Aqua-Ammonia		
	Urea	1.0 cPeps	1.89
	Ammonia Nitrate	11.22 cPeps	1.16 to 1.37
	N-P-K solutions		
	10-34-0	48 cPeps	1.39
9-18-9		1.32	
Normal Liquids, Crop Chemicals 1	Herbicides		
	Round-up	1.0 cP	1.01
	Touchdown		1.4
	Banvel		1.19
	Treflan		1.12
	Paraquat		1.12
	Prowl		1.06
Normal Liquids, Crop Chemicals 2	Fungicides		
	Insecticides		
	Adjuvants		
	Fumigants		
Normal Liquids, Crop Chemicals 3	Fungicides		
Normal Liquids, Crop Chemicals 4	Micronutrients		
Normal Liquids, Flowables	Dual		1.11
	Bicep		1.11
	Marksman		1.16
	Broadstrike		1.12
	Doubleplay		
	Topnotch	140 to 400 cPeps	1.16
	Guardsman		1.12
	Harness		1.11

Table C.3. Typical Product Family Characteristics			
Product Families	Typical Products	Reference Viscosity* (60_F) Centipoise/Centistokes (cP)	Reference Specific Gravity* (60_F) (1 = water, except where noted)
Normal Liquids Crop Chemicals	Fungicides		
Normal Liquids Crop Chemicals	Micronutrients		
Normal Liquids, Suspension Fertilizers	3-10-30 4-4-27		
Normal Liquids, Liquid Feeds	Liquid Molasses	8640 cPeps	1.25
	Molasses plus Phos Acid and/or Urea (Treacle)	2882 cPeps	1.1 to 1.3
Normal Liquids, Chemicals	Sulfuric Acid	1.49 cPeps	1.83
	Hydrochloric Acid	1.0 to 0.80 cPeps	1.1
	Phosphoric Acid	161 cPeps	1.87
	Asphalt	100 to 5000 cPeps	
Compressed Liquids, Fuels and Refrigerants, NH ₃	LPG		
	Propane	0.098 cPeps	0.504
	Butane	0.19 cPeps	0.595
	Ethane		
	Freon 11	0.313 cPeps	1.49
	Freon 12	0.359 cPeps	1.33
	Freon 22	1.99 cPeps	1.37
	Anhydrous Ammonia	0.188 cPeps	0.61
Compressed Gases	Compressed Natural Gas (CNG)		0.6 to 0.8 (1 = Air)
Cryogenic Liquids and Liquefied Natural Gas	Liquefied Oxygen	0.038 cPeps	0.66
	Liquefied Nitrogen	1.07 cPeps	0.31
	Liquefied Natural Gas		

*Reference Fluid properties are not all inclusive and are representative examples only.

Summary of Key Changes:

- The original table in Pub 14 includes a viscosity range for fungicides; however, there is no value listed in the new table for fungicides. In the meantime identify these as crop chemicals 1, 2, 3, and 4.
- “Flowables” is missing from the table.
- Suggest putting crop chemicals after water and other changes to make the table flow better.
- The order of the tables originally numbered C.1. and C.2. was reversed for better flow.
- The note for a single test to cover NH₃ and LPG should also apply to turbine meters. The original table did not specify that the note applied to PD meters only. (*Note: This was a point of contention that was not resolved during the meeting, as referenced earlier.*)
- Terms in Table C.2. and Table C.3. (original numbers) should match for the various product families.
- The term for centipoise needs to be consistent.
- The term centistokes was deleted from the headers.
- The footnotes from the original Product Families Table were pulled back into Table C.2. (original number).

Maintenance Issues:

- Start to combine the “crop chemicals” into a single category.
- For magnetic flow meters we talk about beverages. However, we don’t talk about it for other technologies.
- There is no reference to heated products below 50 °C.

- If you list the items in order from lowest to highest viscosity, it would make the table easier to follow. By viscosity? By Specific gravity? Alphabetically by name?
- Need to include references to the footnotes included in Table C.1.

Appendix 4 – 2008 Measuring Sector Meeting Attendees



'08 Measuring Sector Meeting Attendees

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Appendix C

National Type Evaluation Technical Committee Weighing Sector

September 23 - 25, 2008 – St. Louis, Missouri
Meeting Summary

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Table B
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Table C
Glossary of Acronyms

AWS	Automatic Weighing Systems	NTEP	National Type Evaluation Program
CC	NTEP Certificate of Conformance	NTETC	National Type Evaluation Technical Committee
CIM	Coupled-in-Motion (Railway Track Scales)	OIML	International Organization of Legal Metrology
CLC	Concentrated Load Capacity	S&T	NCWM Specifications and Tolerances Committee
DUT	Device Under Test	SWMA	Southern Weights and Measures Association
EPO	Examination Procedure Outline	W/LRE	Weighing/Load-receiving Element
GIPSA	Grain Inspection Packers and Stockyards Administration	WG	Work Group
NCWM	National Conference on Weights and Measures	WMD	NIST Weights and Measures Division
NIST	National Institute of Standards and Technology	WWMA	Western Weights and Measures Association

Unless otherwise stated:

- “Handbook 44” (HB 44) means the 2008 Edition of NIST Handbook 44 “Specifications Tolerances, and Other Technical Requirements for Weighing and Measuring Devices.”
- “Handbook 130” (HB 130) means the 2009 Edition of NIST Handbook 130 “Uniform Laws and Regulations in the areas of legal metrology and fuel quality.”
- “Publication 14” (Pub 14) means the 2008 Edition of NCWM Publication 14 – Weighing Devices – Technical Policy • Checklists • Test Procedures.
- “Sector” means the NTETC Weighing Sector.

Note: NIST does not imply that these acronyms are used solely to identify these organizations or technical topics.

Details of all Items
(In order by Reference Key Number)

Load Cell Items

1. Publication 14 Force Transducer (Load Cell) Family and Selection Criteria

Background: See the NTETC Weighing Sector 2007 Meeting Summary – Agenda Item 5 for additional background information and the reasons that the OIML Mutual Acceptance Arrangement (MAA) prompted the proposed changes to the selection criteria.

Discussion: The NTEP Director provided the Sector with an update to the status of this item. The main issue was to develop a policy for amendments to existing load cell Certificates of Conformance (CC). The policy would determine which load cell needs to be submitted to expand the CC based upon what has already been tested and what is being proposed for the selections criteria. The Sector discussed a suggestion from Stephen Langford that cut-off dates be established where an existing CC could no longer use the current selection criteria and that until then, an applicant be given a choice between the proposed and existing criteria to amend an existing CC. It was also stated that either selection criteria should be included with the test conditions of the CC. Kevin Fruchte stated that there should only be one selection criteria since having multiple selection criteria makes it difficult to design load cells based on the desires of the marketplace. The Sector responded favorably to a suggestion to just add a simple statement to indicate that a cell submitted under the MAA would follow the selection criteria of R 60.

Tom Bartel of the NIST force group reminded the Sector that the NIST and California NTEP laboratory testing capabilities do not cover test loads from 250 kg to 1000 kg and that that has to be kept in mind when selecting the load cell to be submitted for test. It was also noted that the Netherlands (NMI) has a similar gap in testing capabilities but at higher capacities. In both situations, alternate capacities of load cells were submitted based upon agreements by the applicants with either the NTEP Director for NTEP evaluation and the Netherland laboratory authorities or R 60 evaluations. Darrell Flocken suggested that adding language to Publication 14 to recognize that the deviations to the selection criteria are unavoidable due to test capability and manufacturing product line.

Discussion/Conclusion: The Sector agreed to recommend that Publication 14 Force Transducers Section D be amended to state that:

1. The selection criteria and family characteristics in R 60 will be used for any load cell submitted under the MAA including load cell test data used for subsequent applications to amend the CC.
2. The criteria (NTEP or OIML) will be listed on all future CCs and amendments.
3. The selection criteria will be based on the original load cell manufacturer's CC for load cell CCs issued under a private label CC.
4. A statement will be added to Publication 14 stating that the deviations to the selection criteria may be unavoidable due to test capability and manufacturing product line and that any such deviations may be approved by NTEP after consulting with the applicant.

Note: See Appendix A, Agenda Item 1 for the specific recommendation to amend Publication 14 Force Transducers Section D.

2. Load Cell Creep and Creep Tests and (Pub 14)

2.(a) Pub 14 Force Transducers Table 5. Loading Times, Reduction Factors, and Force Transducers Section II, Item 5

Source: Stephen Patoray, NTEP Director

Background: At the 2008 NCWM Annual Meeting, several industry members asked the S&T Committee to consider a priority item that relates to Section T.N.4.6 and T.N.4.7 of NIST Handbook 44 Section 2.20. Scales. They also mentioned related sections of NCWM Publication 14, load cells. The argument presented was that the items in the handbook failed to harmonize with international standards (OIML R 60) since the information in the handbook did not include instructions on the process or timing for the creep and creep return tests indicated in these two sections. It was further stated that the timing for the creep test in Pub 14, was not consistent with the international Recommendation R 60.

The three items that are currently different between the OIML Recommendation R 60 and Publication 14 Force Transducers requirements are loading times, reduction factors, and differences between the Pub 14 Section 5. test procedure and HB 44. I have only highlighted the differences between the two documents. (**Note:** Differences with Class III L in HB 44 or Pub 14 and OIML R 60 have not been included with this item.)

Item 2.(a), Part 1 – Loading Times

The issue was the load/unload plus stabilization time differences between OIML and Pub 14 was the focus of the request for a priority item at the 2008 Annual Meeting. OIML R 60 Section 5.2.3. states clearly that during the conduct of the tests, the initial reading shall be taken at a time interval after the initiation of loading or unloading, whichever is applicable, as specified in Table 6. In Section 5.3.2.1., the loading or unloading times shall be approximately half the time specified. The remaining time shall be utilized for stabilization. OIML R 60 does go on further in Section 5.2.3.2. *Loading/unloading times impracticable* and indicates if this timing cannot be achieved that some consideration must be made in the specification. (This is currently limited to the unloading time in Subsection a.). It is not clear what to do if loading times cannot be achieved, other than record the actual times. The NIST FG performs the NTEP testing for load cells and reports that load and unload times are nearly instant, or less than 1 second, then they wait 20 seconds as per the written instruction in Pub 14 above. Currently the times in Pub 14 Table 5 are not used.

The submitter of this item requested that sector to consider:

1. Amend Table 5 in Pub 14 to match the capacity ranges and times in OIML R 60 Table 6,
2. Amend the wording regarding the timing for load and unload in Pub 14 to match the wording in R 60, and
3. Add the exception found in OIML R 60 for loading times that are impractical to Pub 14.

Discussion: This discussion of this part of the agenda was combined with agenda Item 2.(b) since they both address the same issues.

Item 2.(a), Part 2 – Reduction Factors for Creep (at load) tolerance (Class III only)

Currently **OIML R 60** has a requirement that Creep is $0.7 \times mpe$ and mpe is defined as $p_{lc} \times 1.5 v$ (at 90 to 100 % capacity). Further p_{lc} for creep is defined as 0.7. Therefore, the tolerance for creep is $(1.5 v) \times (0.7) \times (0.7) = 0.735 v$. However, Publication 14 has a tolerance value which uses either a reduction factor of 1.0 (for multiple) or 0.7 (for single) $\times 1.5 v$. Therefore the tolerance for creep is $1.5 \times 1.0 = 1.5 v$, or $1.5 \times 0.7 = 1.05 v$.

Discussion: This was presented as an information item and no further action is needed by the Sector at this time.

Item 2.(a), Part 3 – Differences Between Pub 14 Section 5. Test Procedures and HB 44:

Currently the procedure for conducting the minimum dead load output return (MDLOR) in OIML R 60 is different from the procedure for creep return in Pub 14. Also it appears that the method in Pub 14 is not consistent and may be in conflict with the information in NIST Handbook 44 T.N.4.7.

Discussion/Conclusion (Item 2.(a), Part 3): The Sector discussed this item and agreed to recommend that Publication 14 Force Transducers Section be amended to delete the last sentence in Section L, II, paragraph 5a as shown in Appendix A, Agenda Item 2.

2.(b) Pub 14 Force Transducers Section II, Item 3 and Table 5. Loading Times

Source: Stephen Langford, Cardinal/Detecto

Background: Publication 14, in its current form does not address times allowed for unloading and stabilization for conducting creep and creep recovery tests. Only Table 5 is included in Publication 14 and that table deals only with loading times. In order to more closely harmonize NTEP evaluation tests of force transducers with those tests performed under OIML R 60, additional information regarding these times for load application and removal need to be added to Publication 14.

Discussion/Conclusion: The discussion of this item was combined with the first part of agenda Item 2.(a)-1 “Loading Times” submitted by Stephen Patoray since it addressed the same issue. After lengthy discussions and reviewing both proposals to add OIML Table 6 and applicable OIML language, the Sector developed a third proposal that seemed to be a suitable alternative to provide an exception for tests where the test load is removed too fast. Kevin Fruechte, Steven Cook, Tom Bartel, Kevin Chestnutwood, and Stephen Patoray agreed to develop a ballot item for consideration by the Sector on a conference call October 1, 2008. Additionally, the load cell manufacturers were requested to review their recent load cell test data for creep recovery to determine if the proposed variation to the tolerance is acceptable. Upon agreement on a suitable variation to the tolerance, the Sector requested that its recommendation be considered by the NTEP Committee as soon as possible due to the importance of this item to load cell manufacturers.

The result of the ballot was: Seven members voted in favor of the proposal, five members opposed the proposal and three members voted to abstain. In summary, the comments indicated that two public sector members (NTEP labs) supported the intent of the proposal, but voted negative since they had concerns regarding the clarity of the proposal. Two other members, who initially supported the recommendation during the Sector meeting, changed their position and voted negative on the ballot language. Those members (NIST and 1 private) stated that they believed that the intent of the proposal was to apply a “correction factor” to the creep recovery tolerance in HB 44 (and R 60) since the NIST test equipment loaded and unloaded weights faster than the procedures prescribed in OIML R 60. However, they became aware of additional information and test data after the Sector meeting that seemed to indicate that a few other international labs use similar equipment with similar loading and unloading characteristics and did not apply any correction factors. As a result of this information, those members believed that the proposed “correction factor” could be interpreted as a tolerance value, which conflicts with the creep recovery tolerance value in HB 44 and is different from the equivalent tolerance recommended in OIML R 60. A third private sector member voted negative and provided additional background information about the development of the R 60 requirements and test procedures and noted that the loading/unloading and stabilization times in R 60 were established to take into account existing test equipment without requiring significant modifications or replacement.

The result of the ballot and summary of all submitted comments were forwarded to the NTEP Committee. At its fall 2008 meeting, the NTEP Committee considered the ballot results and comments and decided not to accept the recommendation from the Sector. A copy of the proposed ballot language, voting results and comments can be found in Appendix B, Agenda Item 2.

In January 2009, a revised proposal was developed by the small work group that addressed the concern that the proposed correction factor could be interpreted as a tolerance that was not supported in HB 44. The originally proposed correction factor was replaced by the tolerances in the 2009 Edition of HB 44 Scales Code paragraph T.N.4.7. The revised proposal was sent to the Sector as a revised ballot item. The result of the ballot and

summary of all submitted comments (*12 affirmative, 0 negative and 1 abstain*) were forwarded to the NTEP Committee. The NTEP Committee considered the ballot results and comments during its meeting at the 2009 NCWM Interim Meeting and agreed to accept the recommendation. The recommended changes to Publication 14 and the revised ballot have been added to the previous recommendation in Appendix A, Agenda Item 2.

Carryover Items

3. In-Motion Railway Track Scale

Source: 2007 NTETC Weighing Sector Meeting Summary – Agenda Item 2

Background: During the 2007 Sector discussion of agenda Item 2 regarding the performance and permanence requirements for in-motion railway track scales, the Sector asked the NIST technical advisor to develop a Publication 14 definition of the term “in-motion” weighing device. The NIST technical advisor was to investigate the possibility of making the definition broad enough to include controllers for other “in-motion” weighing devices such as dynamic monorail scales. The proposed language will be voted on by the Sector in a letter ballot prior to the 2008 NCWM Interim Meeting.

The technical advisor did not have sufficient time to develop a proposed definition for “in-motion” weighing devices in time for consideration by the Sector prior to the 2008 NCWM Interim Meeting.

Discussion: The Sector reviewed the following proposed definition for “in-motion weighing device” developed by the technical advisor which is based on an international definition founding OIML R 51 for automatic weighing instruments.

In-motion weighing device: A complete weighing system, separable indicating element, or controller that follows a predetermined program of automatic processes for objects while in motion without the intervention of an operator on the load-receptor of a complete weighing device or separable weighing/load-receiving element.

Mettler Toledo submitted the following alternate definition:

In-motion weighing device: An instrument capable of weighing objects in motion without the intervention of an operator and follow a predetermined program of automatic process characteristics of the instrument. The instrument can be a complete weighing system, a separable controller or a separable weighing/load-receiving element.

Conclusion: The Sector recommended that the both versions be presented to the representative of the railroad weighing industry attending the fall meeting of AREMA Committee 34 and the SMA and that this item be placed on the Sector’s 2009 agenda.

The members of AREMA Committee 34 reviewed the proposed definitions for Publication 14 and stated no preference for either recommendation. This item was also discussed by the SMA at their fall 2008 meeting where Darrell Flocken reported on discussions at the NTETC Weighing Sector meeting and that feedback on the In-Motion Railway Track Scales item is being requested. Any comments should be submitted to Darrell Flocken or Steve Cook by August 2009.

4. Recommended Changes to Publication 14 Based on Actions at the 2008 NCWM Annual Meeting

The NIST Technical Advisor, Steve Cook, has provided the Sector with specific recommendations for incorporating test procedures and checklist language based upon actions of the 2008 Annual Meeting of the 93rd NCWM. The Sector was asked to briefly discuss each item and, if appropriate, provide general input on the technical aspects of the issues.

4.(a) G-A.1. and Appendix D – Definition of Equipment

Source: See the Annual Report of the 2008 NCWM S&T Committee agenda Items 310-4 for additional background information to amend HB 44 General Code paragraph G-A.1. Commercial and Law Enforcement Equipment and definition of Equipment and the adopted language. During the Annual Meeting, the NCWM agreed to add a new definition of equipment and amend General Code paragraph G-A.

Discussion/Conclusion: The Sector reviewed the language adopted by the NCWM and agreed with the NIST technical advisor recommendation that no further action by the Sector is required since the revised paragraph and new definition is intended to provide clarification of commercial devices and does not impact type evaluation procedures and technical policies in NCWM Publication 14.

4.(b) Scales Code S.1.1.1.(b) Digital Indicating Elements

Background: See the Annual Report of the 2008 NCWM S&T Committee Agenda Items 320-1 for additional background information and the language adopted to amend S.1.1.1.(b) Digital Indicating Elements to clarify that the requirements for the operation of a center-of-zero indication applies to the gross and net load indication of zero.

Discussion/Conclusion: This item was submitted to the NCWM by the Sector to provide a HB 44 reference for Publication 14 DES Section 41. The Sector reviewed the language adopted by the NCWM and agreed with the NIST technical advisor recommendation that no additional action is required by the Sector.

4.(c) Scales Code S.1.2.1., S.2.3., T.N.2.1., and AWS Code S.1.1.1.

Background: See the Annual Report of the 2008 NCWM S&T Committee Agenda Items 320-2 and 324-1 for additional background information to amend HB 44 by:

1. Adding a note clarifying that the requirement that a net weight division on multiple range and multi-interval scales is not required to be expressed as 1, 2, or 5, or a decimal multiple or submultiples of 1, 2, or 5, where the scale division of the tare weight is different from the scale division of the gross weight,
2. Adding a similar exception to paragraph S.2.3., and
3. Adding language that clarifies that scale tolerances apply to net weight using any tare load.

Discussion/Conclusion: This item was submitted to the NCWM by the Sector to provide a HB 44 reference for Publication 14 DES Section 41. The Sector reviewed the language adopted by the NCWM and agreed with the NIST technical advisor recommendation to amend Publication 14 DES Sections 1.11., 31., and 32. This recommendation can be found in Appendix A, Agenda Item 4.(c).

The Sector also recommended that the NIST technical advisor develop similar amendments for Publication 14 for Automatic Weighing Systems, ballot the AWS work group on the proposed changes, and report the ballot results to the NTEP Committee.

4.(d) Scales Code S.2.1.5. Initial Zero-Setting Mechanism

Background: See the Annual Report of the 2008 NCWM S&T Committee agenda Items 320-4 for additional background information to amend S.2.1.5. to clarify IZSM for separable indicating elements.

Discussion/Conclusion: This item was submitted to the NCWM by the Sector to clarify HB 44 language as a result of amending Publication 14 DES Section 41.2. for the verification of IZSM requirements on separable electronic indicating elements in 2007. The Sector reviewed the language adopted by the NCWM and agreed with the NIST technical advisor recommendation that no additional action is required by the Sector.

4.(e) Scales Code S.2.4. Level-Indicating Means and S.2.4.1. Vehicle On-Board Weighing Systems

Background: See the Annual Report of the 2008 NCWM S&T Committee agenda Items 320-5 for additional background information and the specific language to amend S.2.4. and S.2.4.1. to clarify the requirements for level indication means.

Discussion/Conclusion: The Sector reviewed the language adopted by the NCWM and agreed with the NIST technical advisor recommendation to amend Publication 14 DES Sections 55. and 56. as shown in Appendix A, Agenda Item 4.(e).

5. Add New and Amended Tare Definitions and Tare Requirements

Source: NTEP Participating Laboratories (Carryover Item)

Background: See the Annual Report of the 2008 NCWM S&T Committee agenda Items 320-6 for additional background information.

During its 2008 Annual Meeting, the NCWM agreed with the comments that this item needed additional time for review and analysis and that the item be given “information” status. The NIST technical advisor will develop a one to two hour technical presentation on the proposed tare requirements that will be available to the regional weights and measures associations, and posted on the WMD website.

Discussion/Conclusion: The NIST technical advisor provided the Sector with an update on the status of the technical presentations and reported that this item is now on the NCWM agenda. Additionally, he reported that he has developed a one-hour presentation on this item and has written a series of articles for the WMD quarterly newsletter.

The Sector agreed with comments from the regional weights and measures association and recommended that the S&T Committee technical advisor split the agent item into three sub-proposals. The Sector offered that the item could be separated into the following three subjects:

1. Tare weighing/balancing with applicable definitions,
2. Tare requirements for multi-interval and multiple range scales, and
3. Preset tare with applicable definitions.

6. Minimum Size of Weight and Units Indications

Source: 2007 Weighing Sector Item 7 (Carryover Item)

Background: See the 2008 NCWM Specifications and Tolerance Committee Annual Report Developing Item Part 2, Item 1 “S.1.4.6. Height., Definition of Minimum Reading Distance, UR.2.10. Primary Indicating Elements Provided by the User and Definition of Primary Indications,” and the 2006 Weighing Sector Summary Item 6 for additional background information.

At the 2008 NTEP Participating Laboratory Meeting in Ottawa Canada, the weighing laboratories discussed this item and recommended that the Sector consider amending the proposal as follows by deleting the proposed 2 mm minimum height for all units and descriptors in S.1.4.6.(e) and proposed user requirement paragraph UR.2.10. as follows since the labs believe that General Code paragraph G-UR. 3.3. Position of Equipment addresses the position of a device so that its indications can be accurately read.

Discussion: The Sector discussed the NTEP labs' recommended changes to the proposal along with the labs' recommendation to move forward with this proposal as a voting item for the S&T Committee. Darrell Flocken noted that the numbering of the proposed specification should be changed from S.1.4.6. since it appears that all of the S.1.4. paragraphs are applicable to mechanical indicators and that the proposed language is applicable to electronic scales with digital indication. It was also noted that the CWMA and WWMA recommended that the proposal be withdrawn unless it received additional support from the industry. Measurement Canada added that they do not have the 9.5 mm requirement in their laws and regulations.

Conclusion: During the discussions, a vote was held on whether to forward the NTEP labs' proposal to the S&T Committee. Seven members voted in favor and nine members voted against forwarding the NTEP lab alternate proposal to the S&T Committee. The results of the vote indicated that there is no consensus between the NTEP labs and device manufacturers. The Sector also recommended that the discussion and conclusion be forwarded to the WWMA and NCWM S&T Committees.

7. Hopper Scale Design Parameters – Technical Policy

Source: 2007 Weighing Sector (WS) Agenda Item 10 (Carryover Item)

Background: See the 2007 NTETC Weighing Sector Meeting Summary for additional background information. During the 2007 Weighing Sector meeting, the Sector could not come to a consensus on the questions raised on this item and suggested that a hopper scale work group be established to:

- (1) Define a type, and
- (2) Determine selection of device(s) to be submitted for evaluation, modifications that can be made to the type, and whether or not multiple types can be listed on a CC.

Stephen Patoray and Don Onwiler volunteered to develop a specific proposal to be considered by the Sector during the 2008 NTETC Weighing Sector Annual Meeting.

This item was further discussed during the 2008 NTEP Participating Laboratory meeting, including reviewing that the following definition of type is from the NCWM Publication 14 Administrative Policy definition section as it applies to hopper scales and other device types (A.19. Type).

There seems to be agreement among the labs on what constitutes type. However, variations to the type that might be considered as sub-types or OIML families have been put on the same CC. The weighing labs reviewed the OIML term and examples of types and families. The OIML R 76 terminology and definitions (T.3.4. Type and T.3.5. Family) tends to make sure that the type and families (sub-types) are sufficiently defined on the certificate.

Discussions included evaluating new features to be added on older electronic devices and whether the entire evaluation checklist should be reviewed when an amendment is requested to add or change a feature. Two NTEP lab sector members stated that they go through the entire checklist (except for influence factor testing) to verify that the change does not impact an unrelated feature, e.g., adding a lb/kg switch impacted the overcapacity blanking and accuracy in one of the units. MC is also concerned about older (10 year) certificates on electronic devices.

The labs also support the concept of adding multiple types on a single CC provided the content and clarity of the types are suitably defined on the CC. There are distinct models and tests for the different designs (hanging vs. compression).

At the end of the discussion:

- Ron Rigdon agreed to develop a template CC for hopper scales to be submitted to the Weighing Sector.
- Steve Patoray agreed to submit a recommendation to the NTEP Committee to amend the title of Pub 14 Admin Policy Section L. **What Constitutes a “Different” Type** since the subject of the title does not agree with the content of the subsections.
- Steve Cook and Steve Patoray will update the Weighing Sector on the position of the labs regarding the Weighing Sector carryover item on hopper scales.
- The NTEP participating laboratories will verify that a device submitted for evaluation to add a new feature or variation complies with the **entire** checklist. The exception to the evaluation would be influence factor and permanence testing unless requested by the applicant or required by NTEP (e.g., modifications to the load-sensing element, A/D converters, mechanical design changes to the load-receiving element, etc.).

After the lab meeting, Steve Cook noted the following list of device metrologically relevant features and functions in OIML R 76 that the Weighing Sector and NTEP may consider in making a determination of tests to be performed to update a CC.

- housings;
- temperature and humidity ranges;
- indications;
- n_{max} ;
- lowest input signal, $\mu V/e$ (analog strain gauge load cells);
- temperature ranges;
- maximum size of load receptor, if significant;
- maximum number of indications;
- maximum number of implemented digital devices;
- several load receptors, if connectable to the indicator;
- load receptors;
- instrument functions;
- highest number of verification scale intervals,
- verification scale interval, e_{min} ;
- accuracy classes;
- single range, multiple range or multi-interval instrument;
- maximum number of instrument functions;
- maximum number of peripheral devices connected;
- maximum number of analog and digital interfaces;
- different types of power supply (mains and/or batteries);
- etc.

Discussion/Conclusion: The Sector reviewed the background information. The NTEP Director reported that there has been little agreement on what constitutes a different type or can be considered as a variation of the design and how many certificates are required.

The Sector recommended that this item be carried over for the 2009 NTEP lab and NTETC Weighing Sector meetings to allow for additional work and development of a proposal.

8. Method of Sealing – Setup and Verification of Calibration/Configuration Access

Source: NTEP Director

Background: The Sector was requested to review the report of the NTETC Weighing Sector Annual Meeting September 11 - 13, 2003 Fresno, California, FINAL Summary, Item 18. Physical Security Seals on Scales with External Calibration Capability regarding previous interpretations of HB 44 General Code paragraphs G-S.2. Facilitation of Fraud, G-S.8. Provision for Sealing Adjustable Components, and Scale Code paragraph S.1.11. Provision for Sealing.

It was reported that there is still disagreement among the NTEP labs on this topic. It was also noted that changes were made to the Publication 14 in 2004 in the anticipation of changes to HB 44; however, the changes to HB 44 did not happen and that there may be a problem with Pub 14 since the current procedures and type evaluation requirements are not fully supported by HB 44.

The discussion in 2003 was to address a specific deficiency that was found in several devices at that time. At least one device manufacturer attempted to address this deficiency with changes to the device function. This device was evaluated, and based on the input from the NTEP lab, the NTEP Committee Chair and the NTEP Director, it was determined that this device did meet the requirements. That is, the device would (upon command) display or print the external calibration status that was configured in the setup mode, (e.g., “not sealed,” “not legal for trade,” “HB 44,” etc.). Currently several NTEP labs do not believe that this “fix” is acceptable.

The NTEP Director provided additional observations based on a series of e-mail exchanges on this item.

1. Such discussions are healthy for NTEP, as long as they are kept positive and productive and focus on objective facts.
2. Acknowledged the contributions from Andrea Buie in providing background information.
3. Restated that Publication 14 is not a standard or a regulation; it is a checklist to determine if a device is capable of meeting the applicable requirements of HB 44. It is also not design-based, it is performance-based.
4. In this particular case, Publication 14 was changed (with good intentions) in anticipation of similar changes being made to HB 44. In hindsight that was an error on the part of the Sector to recommend such a change. Currently Pub 14 is not in line with HB 44. Or, it is not being interpreted in line with HB 44.

Discussion/Conclusion: Darrell Flocken suggested that DES Section 10.12.9. should be deleted since it was not supported by HB 44. The Sector also discussed amending DES Section 10.12.4. to provide guidance to the evaluator to make sure that adjustments can not be made to sealable parameters. However the Sector could not come up with a consensus to amending DES Section 10.12.4.

The Sector agreed to recommend that DES Section 10.12.9. be removed from Publication 14 since the language is not supported by requirements in HB 44 as shown in Appendix A, Agenda Item 8. The Sector also recognized that additional language may need to be added at a later date pending action of the NCWM on a proposal to add new language to G-S.8.

9. S.1.1.(c) Zero Indication (Sleep/Screen Saver/Power Save Modes)

Source: Weighing Sector Carryover Agenda Item 4.(d)

Background: See the 2007 NTETC Weighing Sector Meeting Summary for additional background information. The NIST technical advisor revised the ballot proposal and submitted it to the NTEP Participating laboratories during the 2008 Annual Meeting. The labs agreed with the revised language. The NIST technical advisor developed a table for review by the Sector that compared the original and revised versions of the ballot language.

Discussion/Conclusion: The Sector reviewed the revised ballot language and agreed to recommend that Publication 14 be amended to clarify the evaluation procedures for verifying that “sleep/screen saver/power save” features comply with paragraph S.1.1.(c) and do not conflict with other HB 44 requirements. The recommended language can be viewed in Appendix A, Agenda Item 9.

10. Vehicle and Railway Track Scales

Source: 2007 Weighing Sector Carryover Agenda Item 3

Background: During the 2007 meeting of the Weighing Sector, the Sector agreed there is a loophole in the existing policies for RR track scales with a capacity greater than 200 000 lb. The SMA and AREMA Committee 34 volunteered to work on the testing requirements for vehicle and railway track scales with capacities greater than 200 000 lb and provide to the NTEP Director and NIST technical advisor an update on developing a proposal for consideration by the Weighing Sector prior to the 2008 NCWM Interim Meeting.

AREMA Committee 34 Adhoc Subcommittee submitted proposed changes to Publication 69 as shown below. However, the SMA was not able to address this item during their November meeting and therefore this item will be carried over to the 2008 meeting of the Weighing Sector.

Discussion/Conclusion: During the discussion on this item, the NTEP labs noted a couple of places where clarification may be needed regarding the terms used in the railroad industry. The labs believed that the referenced sections of the AAR handbook should be included in Publication 14 (with proper citation).

The Sector recommended that this item be carried over until the 2009 meeting of the Sector to await final approval by AREMA Committee 34.

At their October 2008 fall meeting, the Chairman of Committee 34 stated that Committee 34 could not further develop this item without specific input from the Weighing Sector. Additionally, permission to reprint sections of the AAR Handbook is possible by submitting a request in writing to Raphael Jimenez requesting the specific definitions and other language to be reprinted in Publication 14.

Edited by AREMA Committee 34 Adhoc Subcommittee on 11/27/07

69. Performance and Permanence Tests for Railway Track Scales Used to Weigh Statically

(NOTE: For combination vehicle/railway track scales, see also additional test considerations under “Test Considerations for Other Scales” in the application.)

It is desirable, but not required that a new installation should be calibrated by a railroad test car after a representative of the railroad has inspected the installation for compliance with railroad design and construction specifications.

The Performance Test (69.1 thru 69.6) is conducted to determine compliance with the tolerances and, in the case of nonautomatic indicating scales, the sensitivity requirements specified in NIST Handbook 44. The tests described here apply primarily to the weighing/load-receiving element. It is assumed that the indicating element used during the test has already been examined and found to comply with applicable requirements. If the design and performance of the indicating element is to be determined during the same test, the applicable requirements for weighbeams, poses, dials, electronic digital indications, etc., must also be referenced. A 100 000 lb field standard weight cart, or a combination of field standard weights **safely** added to a field standard weight cart in 10 000 lb increments for a total of 100 000 lb will be used to conduct the Performance test.

The Permanence Test (69.7) shall not be conducted sooner than thirty (30) days after the Performance Test. If a 100 000 lb field standard weight cart, or a combination of field standard weights **safely** added to a field standard weight cart for a total of 100 000 lb, is not available for the Permanence Test a 100 000 lb Test Weight Railcar may be used.

***NOTE:** A field standard Test Weight Railcar and Test Weight Railcart shall have a footprint no greater than 7'. The Association of American Railroads, AAR Scale Handbook Section 1.5 “Specifications for Railway Track Scale Test Weight Loads” defines the requirements for test weight loads including Test Weight Railcars and Test Weight Railcarts. A standard railcar, as described in AAR Scale Handbook Section 1.5.7, is not suitable for use during NTEP evaluations.*

The following definitions from the AAR Safety and Operations Scale Handbook ©2009 Edition Section 1.5 Specifications for Railway Track Scale Test Weigh Cars and have been reprinted with the permission of the AAR.

1.5.5. TEST WEIGHT RAILCAR

Test weight load designed as a certified mass standard supported by two-axle trucks, built for AAR interchange service, with the following design characteristics:

- a. All metal construction except ballast. Ballast material must be stable.
- b. Loading points must not exceed 7ft (2.2 m) and have uniform load distribution.
- c. No unnecessary equipment.
- d. A minimum of ledges, cavities, or projections that hold dirt, water, or other foreign matter.
- e. The calibration cavities, capable of holding at least 1,000 lb (500 kg), must be waterproof and sealable.
- f. Operational controls functional from both sides of the railcar.
- g. Drive system, when used, shall be adequate to propel the railcar on a 3% grade.
- h. Smooth and sloped top to ensure drainage.
- i. Accessibility of all parts for inspection.
- j. Ruggedness and durability in order to minimize repairs.
- k. Overall truck centers shall not exceed 50 ft (15 m).
- l. Side-mounted hand brake accessible from the ground.
- m. Fuel tank, when used, must be attached and not exceed 16 lb (7 kg) capacity or 2 gal (8 L).
- n. Lifting system must be adequate to lift all wheels a minimum of 2 in. (5 cm) above the rail.
- o. Hydraulic oil tank, when used, must be equipped with a sight gauge or other means to indicate proper amount of oil to

maintain calibration.

1.5.6. TEST WEIGHT RAILCART

Test weight load designed as a certified mass standard supported by two-axes on steel wheels, with the following design characteristics:

- a. All metal construction.
- b. Loading points must not exceed 7ft (2.2 m) and have uniform load distribution.
- c. No unnecessary equipment.
- d. A minimum of ledges, cavities, or projections that hold dirt, water, or other foreign matter.
- e. The calibration cavities, capable of holding at least 1,000 lb (500 kg), must be waterproof and sealable.
- f. Minimum surface area with smooth and sloped top to ensure drainage.
- g. Accessibility of all parts for inspection.
- h. Ruggedness and durability in order to minimize repairs,
- i. Fuel tank, when used, must be attached and not exceed 16 lb (7 kg) capacity or 2 gal (8 L).
- j. Hydraulic oil tank, when used, must be equipped with a sight gauge or other means to indicate the proper amount of oil to maintain calibration.
- k. The weight cart, as well as the separable weights, must be traceable.

1.5.7. STANDARD RAIL CAR

Standard rail car converted to a certified mass standard supported by 2-axle trucks, built for AAR interchange service, with the following design characteristics.

- a. All metal construction except ballast. Ballast material must be stable.
- b. Load uniformly distributed over trucks.
- c. No unnecessary equipment.
- d. A minimum of ledges, cavities, or projections that hold dirt, water, or other foreign matter.
- e. The calibration cavity must be waterproof and sealable.
- f. Smooth and sloped top to ensure drainage.
- g. Accessibility of all parts for inspection.
- h. Ruggedness and durability in order to minimize repairs.

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69.1. Influence Factors

If tests are necessary to determine compliance with influence factors, individual main elements and components tests must be conducted according to NTEP Policy that is outlined in NCWM Publication 14, Section B.1. Influence Factor Requirements.

69.2. Test Standards

A 100 000 lb field standard weight cart or a 100 000 lb combination of field standard weights safely added to a field standard weight cart shall be used for the Performance test. Weights must be incremented by 10 000 lb from 30 000 lb to 100 000 lb. A test weight railcar shall not be used for the Performance Test.

69.3. Sensitivity and Discrimination Tests

69.3.1. Weighbeams

The sensitivity test is conducted at zero load and at maximum load for mechanical railway track scales with non-automatic indicating elements. The sensitivity test is conducted by determining the actual test weight value necessary to bring the beam from a rest point at the center of the trig loop to rest points at the top and bottom of the trig loop. The maximum load at which the sensitivity test is conducted need not be comprised of known test weight.

69.3.2. Automatic Digital Indicating Elements

The discrimination test is conducted at zero load and at maximum load for railway track scales with indicating elements (e.g., electronic digital indicating elements, mechanical dials). See also DES Section 54 regarding the specific procedures for the discrimination test. (Technical Advisor Note: The above language is recommended to match the title of DES Section 69.3.)

69.4. Digital Indications

Width-of-zero, zone of uncertainty and, if so equipped, automatic-zero-setting mechanism tests shall be conducted as specified in other sections of NCWM Publication 14.

69.5. Increasing Load/Shift Tests

69.5.1. Conduct increasing load tests in 10 000 lb load increments up to 100 000 lb. Conduct shift tests over each section at 50 000 lb and 100 000 lb, testing all sections and midspans between sections in both directions with each load. The scale shall be capable of returning to a no-load indication within prescribed limits [3 d per 5 °C change in temperature]and within 15 minutes after increasing or shift test load is removed. Zero balance change is limited to acceptance tolerance (1/2 d). The indication may be re-zeroed before the start of any increasing load or shift test, but not during any sequence.

- (a) Begin increasing-load test by placing 30 000 lb on one end section. Record error
- (b) Remove test load and record balance change. Do not reset zero.
- (c) Increase to 40 000 lb on end section and record error.
- (d) Remove test load and record balance change. Do not reset zero.
- (e) Repeat this process, incrementing to 50 000 lb.
- (f) After 50 000 lb is removed and balance change is recorded, reset zero.
- (g) Begin the shift test by loading one end section with 50 000 lb and record the error.
- (h) Move the test load to the midspan and to the left and right of each section so that one set of the test cart wheels are spotted over the load cell or lever bearing points. Record errors at each test position. .
- (i) Remove load from opposite end of scale. Record balance change and reset zero.
- (j) Repeat shift test in opposite direction according to steps (g) through (i).
- (k) Continue with increasing load test following the procedures in steps (a) through (e) for test loads from 60 000 lb to 100 000 lb.
- (l) After 100 000 lb is removed and balance change is recorded, reset zero.
- (m) Conduct shift test in each direction using 100 000 lb following the procedures in steps (g) through (j).

69.5.2. Results shall be within acceptance tolerance as specified in Handbook 44, Section 2.20. Scales Code, T.N.4.4.

69.6. Strain Load Tests

69.6.1 The minimum test for a strain load test for single-load receiving element scales greater than 35 feet and for multiple load receiving element scale systems designed to weigh railroad cars in a single draft is 200 000 lb, or if practicable, at least 80% of scale capacity.

- (a) Load one end of the scale with a strain load.
- (b) Record the “reference point” for the start of the strain load test.
- (c) Add 100 000 lb of test weight to the opposite end of the scale. The target strain load is the sum of the unknown weight and the test weights.
- (d) Record the indicated strain-load value after the maximum amount of test weights have been added and calculate the strain load test error. The scale shall perform within prescribed tolerances based upon tolerance for the known test weights.
- (e) Remove the test weights from the end of the scale without conducting a decreasing load test.
- (f) If a higher strain load value is desired, increase the strain load at this time before proceeding with next step.
- (g) Record the new strain load reference value and reapply the test weights.
- (h) Record the indicated strain load value and calculate the strain load test error. The scale shall perform within prescribed tolerances based upon the known test weights.

- (i) Evaluate repeatability of results in test weight values obtained in step (d) and step (g) to agree within the absolute value of maintenance tolerances.
- (j) Remove the strain load (railcar or material of unknown weight) from the scale, decreasing to 100 000 lb of known test weights.
- (k) Record error based on a decreasing load test to 100 000 lb.
- (l) Remove weights from scale.
- (m) Record zero balance change.

69.6.2. The results of all observations shall be within acceptance tolerance.

69.7. Permanence Test

69.7.1. Minimum Use Requirements for the Field Permanence Test

69.7.1.1. There must be at least 300 weighing operations executed over the scale prior to conducting the type evaluation Permanence Test. The entire NTEP evaluation should be performed at a customer location to facilitate “normal” use during the permanence period.

69.7.1.2. There must be at least 30 days between the Performance Test and the Permanence Test. If the prescribed weighments have not been completed, the time between tests shall be extended. Acceptance tolerances apply regardless of the time between Performance Test and the Permanence Test.

69.7.1.3. Only loads, which reflect “normal” use, will be counted during the permanence-testing period.

- 100 percent of the loads must be above 20 percent of scale capacity; and
- 50 percent of the loads must be above 50 percent of scale capacity.

The scale may be used to weigh other loads, but only the loads specified above are counted as part of the Permanence Test.

69.7.2. Subsequent Type Evaluation (Field) Permanence Test

69.7.2.1. It is recommended that the Performance Test procedure as described above be repeated for the Permanence Test. However, if the original test equipment is not available, the test may be conducted to the extent possible with a Test Weight Railcar with at least a 100 000 lb capacity and a suitable and current calibration report.

69.7.2.2. Repeat width-of-zero, zone of uncertainty, sensitivity, and discrimination tests near zero (outside the range of the AZSM) and at or near capacity on the subsequent tests.

The results of these tests must be within acceptance tolerance. If the device does not meet these tolerance limits the scale will be rejected and the entire test must be repeated, including successful performance testing and a subsequent test after a minimum of 30 days.

New Items

11.(a) Publication 14 Clarification on Section 66.(c) Permanence Tests

Submitted by: Ed Luthy

Background: Current wording in Publication 14 Section 66.(c) is unclear as to whether “Subsequent Type Evaluation (Field) Permanence Tests” are required. It was understood at the time that the language was written that subsequent testing would be required and there has been at least one “double wide” feature added to an existing CC that included a subsequent test. However, the language that was added to Publication 14 did not clearly state that. As a result, manufacturer representatives and Sector members may not recall the specific discussions at the 2001

meeting of the Weighing Sector. Additionally, other applicants and new Sector members will have trouble concluding that a subsequent test is required since the language does not clearly state that the test needs to be repeated to add this option/feature to an existing CC. The NIST Technical Advisor recommends that the language be amended and clarified as shown in the following recommendation.

Discussion/Conclusion: The Sector reviewed the item in the agenda and agreed with the proposed changes to Publication 14 DES Section 66.(c) to clarify that subsequent permanence tests are required and suggested other editorial amendments and shown in Appendix A, Agenda Item 11.(a).

11.(b) Publication 14 Clarification on Section 66.(c) Waiving of Permanence Tests

Submitted by: Ed Luthy

Recommendation: During the 2008 meeting of the NTETC Weighing Sector, Ed Luthy requested that DES Section 66.(c) be deleted from Publication 14. He stated that in these applications individual weighing/load-receiving elements have already passed all applicable tests in order for the NTEP CC to be issued and that the added costs to repeat test for side-by-side applications is not justified.

Discussion: There was a lengthy discussion on this item. Section 66.(c) was originally added to Publication 14 in 2002 to address the concerns of the NTEP labs who stated that the original testing for a vehicle scale weighing/load-receiving element did not anticipate scales being used in side-by-side applications where the wheels of the vehicles would travel longitudinally down the center of the scales. The NTEP lab stated that they believed that many scales are not designed to accurately determine weight with heavy loads concentrated in the center portion of the scale. These concerns were repeated at this meeting. The Ohio NTEP laboratory related past failures of three different evaluations where the scales failed being tested with test loads applied down the middle of the scale or the scales failed the stain-load tests.

Several manufacturers supported deleting the permanence tests for side-by-side applications if the permanence test was conducted on the single weighing/load-receiving element. Another manufacturer stated that they have several extra wide and side side-by-side vehicle scale CCs and they have never questioned permanence test on a “new design.” In the case of the side-by-side with a CC, this manufacturer believes that the permanence test should not be required. This manufacturer added that they question the value of permanence testing on anything and that permanence is part of the quality of the scale.

Stephen Patoray noted that Publication 14 allows for some judgment in other areas of the publication. However, Section DES 66.(c) allows no variances. He suggested that the permanence test be waived depending upon the performance of the scale on the initial test. If, during the initial test, the scale demonstrated good repeatability and accuracy, then the permanence test should be waived. If it barely passes the initial test then the permanence test will be performed. In the past, the evaluator has consulted with the NTEP Director to confirm waiving the permanence test.

The Sector considered an example of such language in DES Section 63. Performance and Permanence Tests for Platform Scales with Less than Four Load Supports (63.7).

“The results of all increasing-load, decreasing-load, and shift tests conducted during the initial tests must be within acceptance tolerances. If scale repeatability is very good, (e.g., 0.5 d) the fourth test may be waived.”

The Sector also considered the following example in Publication 14 LMD Section F. where variations to the evaluation may be permitted:

“If the product being added is from a family of products that has been previously subjected to the permanence test, then the requirement for a permanence test may be waived provided the initial test of the product being added meets following conditions:

- a) the results of the initial test were not questionable; and
- b) multi-point calibration may not be used to add the new product.”

Conclusion: The Sector supports adding the following note to DES Section 66.(c)4. to allow discretion if the initial test results are well within tolerance as shown in Appendix A, Agenda Item 11.(b).

12. Correction to Scale Tickets

Source: Maryland NTEP Lab

Background: At its 2008 NTEP Participating Laboratory meeting, the NTEP labs discussed a proposal from the Maryland NTEP lab to amend Section 35. which is for weigh in/out applications.

The proposal recommended amending DES Section 35. to specify the requirements for devices that print scale tickets with corrected weight information. Several of the labs believed that the subject may be more appropriate for Section 13. Recorded Representations and limited to indirect sale applications. Steve Cook was able to verify that HB 130 Weighmaster Regulations do not address correcting erroneous tickets similar to California Weighmaster Regulations.

After the meeting, Steve Cook reviewed the California Business and Professions Code, Weighmaster Law to investigate those requirements for voided and duplicate tickets in its weighmaster program. The California Law (B&P Code Section 12716.5) does not specify additional requirements for a correction or duplicate certificate.

Discussion/Conclusion: The Sector reviewed the item that was submitted to the NTEP labs. There were concerns that the proposal is intended to address the application described in Scales Code UR.3.9. However, other members of the Sector supported the intent for weigh-in/weigh-out vehicle scales applications. The Sector agrees that clarification of erroneous tickets is needed; however it could not come to a conclusion since the Sector did not have a developed recommendation to review. There were also discussions about the appropriate location for the requirements. For example, Section 35. applied to weigh-in/weigh-out applications where the publication states that manual weight entries are not permitted.

The Sector recommends that a specific recommendation be developed for this item and carried over until the 2009 meeting of the Weighing Sector.

13. Stored Tare for “Weigh-in/Weigh-out” Applications

Source: Ohio NTEP Lab

Background: At its 2008 NTEP Participating Laboratory meeting, the NTEP labs discussed another proposal to amend Section 35. for weigh-in/out applications and storing in lieu of printing the first weight in weigh-in/out application. The labs agreed that the scale first weight stored in a “temporary memory” that is automatically deleted from memory after the net weight is determined is not considered as a stored tare and suggested that DES Section 35. be further developed and submitted this to the Sector for additional discussion and recommendations.

Discussion/Conclusion: The Sector believes that the language from the NTEP lab meeting did not need additional development (except to change the word “tare” to “weightment” to address a potential conflict if the tare proposals are adopted by the NCWM) and recommends that DES Section 35. be amended as shown in Appendix A, Agenda Item 13.

14. Money Values in Other Than 1-Cent Intervals

Source: NTEP Participating Laboratories

Background: At its 2008 NTEP Participating Laboratory meeting, WMD stated that they received a phone inquiry from an inspector who came across a computing scale with total price indications with \$0.05 increments. The inspector stated that the scale owner configured that scale this way in order not to deal with pennies. The inspector had no problem getting the owner to re-configure the scale to \$0.01 increments according to General Code G-S.5.5. Money Values, Mathematical Agreement. (Note that exceptions are permitted for scales and retail motor fuel devices with analog indications.)

The labs discussed a proposal from Steve Cook to add “minimum value of currency” to the list of sealable parameters to all Pub 14 checklists since the feature could facilitate fraud if the minimum money value can be changed without an obvious indication to the customer. The labs recommended that Steve submit an item to the Weighing Sector to amend the table of sealable parameters by adding check boxes to the individual features to make it less likely to overlook a specific sealable parameter.

The labs agreed with WMD and agreed to submit a proposal to amend Publication 14 to the Sector.

Discussion/Conclusion: The Sector agreed with the proposed changes to Publication 14 DES Section 10.1. from the NIST technical advisor as shown in Appendix A, Agenda Item 14.

15. Suitability of Pressure Sensitive Security Seals

Source: Ohio Participating Laboratory

Background: At its 2008 NTEP Participating Laboratory meeting, the weighing labs reviewed a proposal to amend Publication 14 DES Section 10. The lab reported that the current evaluation procedures in Publication 14 Section 10.12.1. Physical Seals appears to be written only for wire lock security seals and not pressure sensitive seals. Pressure sensitive seals are acceptable under certain conditions. If they cover a hole (e.g., through which a “calibration enable” switch would be activated), that hole must be covered with a suitable rigid plug. Additionally;

1. The pressure sensitive seal must not bridge so as to leave cavities or air pockets under the seal,
2. Pressure sensitive seals are not to be used in an adverse environment (seal is destroyed by rain, cold, washdown etc.), and
3. Pressure sensitive seals must be durable (difficult to remove at all temperatures, and if tampered with must show void or be self destructive.

The labs reviewed the HB 44 definition of security seals and discussed the applications where pressure sensitive, self-destructive would and would not be suitable to seal weighing and measuring devices.

The labs agreed to forward this discussion and recommendation to amend Publication 14 Section 10.12. Physical seals to add new evaluation criteria and checkboxes specifically for pressure sensitive self-destructive security seals.

Discussion: The Sector reviewed and discussed the proposal to amend Publication 14 and whether or not these proposed requirements are needed. There was little support for the item for the following reasons:

- HB 44 only requires that provision be made to apply a security seal; the definition only defines a seal as being “sufficiently permanent.”
- The proposed evaluation criteria would require that the states have to obtain different types of pressure sensitive seals that are suitable for different types of environments.
- A “NEMA 4 enclosure” was the only type of enclosure addressed in the proposal and is rarely used. Additionally, there are numerous types of other enclosures designed for different types of environments.

- The proposed evaluation criteria would create an additional test for devices evaluated under the U.S./Canada Mutual Recognition Agreement since Measurement Canada stated that they only request that the manufacturer provide samples demonstrating compliance with G-S.8.
- Standards for security seals would have to be established and test methods developed (or referenced if already developed by another standards development organization).
- Some states still do not accept pressure sensitive seals as a method of sealing.

The manufacturers do not agree with the proposal for the reasons listed in the discussion and stated that they are able to demonstrate that pressure sensitive seals are available that meet the durability requirements due to adverse environments. Additionally, the manufacturers have no control over the requirements the states and service agencies use in procuring these seals.

Conclusion: The Sector agreed with the concerns listed above from the manufactures and recommends that no action be taken on this item.

16. Identification of ECRS

Source: NTEP Participating Laboratories

Background: At its 2008 NTEP Participating Laboratory meeting discussion on marking requirements for self checkout ECRS systems, the Maryland NTEP lab stated that inconsistencies in marking requirements were found between the description of modular markings and the pictures of examples (page ECRS 4 and 8). Steve Cook and Stephen Patoray agreed to develop a Weighing Sector item addressing the differences and provide a proposal to clarify the differences.

Discussion/Conclusion: No revised proposal to amend the evaluation criteria for ECRS was received for the Sector to consider. The Sector recommends no further action be taken on this item until a specific proposal has been submitted to the Sector.

17. Automatic Zero-Tracking vs. Automatic Zero-Setting

Source: Stephen Patoray, NTEP Director

Background: This item relates to changes to NIST Handbook 44 in 2005. The agenda item is Item 320-4 from the 2005 NCWM Annual Report and is included below as reference.

Currently, HB 44 Scales Code and OIML R 76 for Nonautomatic Weighing Instruments (NAWI) are not harmonized regarding automatic zero-tracking mechanism and setting mechanisms.

- OIML R 76 uses the term zero-tracking **device**; HB 44 uses **automatic** zero-tracking **mechanism**.
- OIML R 76 uses the term automatic zero-setting device; there is no equivalent to this term in either HB 44 or NCWM Publication 14.

It has been reported that the operation of an automatic zero-setting device may be functional on a device installed in the United States since many devices are built for the global marketplace. Currently, NIST HB 44 does not define this function and NCWM Pub 14 has no test to determine if the device under test (DUT) has such a function, or if it is sealable.

In the past, several of the NTEP labs have stated that they have not accepted the automatic zero-setting mechanism because its operation is similar to an automatic zero-tracking mechanism and thus does not comply with the requirements specified in HB 44 paragraph S.2.1.1. Automatic Zero-Tracking Mechanism.

HB 44 does not clearly state that this function is not allowed and Scale Code paragraphs S.1.1.(c) and S.1.1.1.(b) could be interpreted to allow the automatic zero-setting device as described in OIML R 76. That may not be a universal interpretation.

Also (a minor point), Section 43. in NCWM Publication 14 Weighing Devices, Digital Electronic Scales needs its title corrected by replacing the word “setting” with the word “tracking.”

Stephen Patoray recommends that the Sector review the information regarding automatic zero-tracking and automatic zero-setting. The items to be addressed in order are:

- (a) Consensus that there is a problem that needs to be solved based on the current information or lack of information in NIST Handbook 44.
- (b) Determine if there are or are not technical reasons why the feature automatic zero-setting as described in OIML R 76 should or should not be included in NIST Handbook 44.

In either case, language will need to be developed for NCWM Publication 14 to either test for the correct function of automatic zero-setting or test to determine that the device does not have automatic zero-setting and it is a sealable parameter.

Discussion: The Sector discussed the comments that an increasing number of scales submitted for NTEP evaluations include an “**automatic zero-setting**” feature, which is not addressed in HB 44. It has been noted that many devices are built for a global marketplace and that the operation of this **automatic zero-setting** device may be functional on the device when installed in the United States. Currently, HB 44 does not define this function. NCWM Pub 14 has no test to determine if the device submitted for evaluation has such a function, or if it is sealable. The automatic zero-setting mechanism on a scanner/scale submitted to NTEP could be enabled and disabled by means of a bar code read by the scanner.

In the past, several of the NTEP labs, when asked about this “feature,” have indicated that since it does not meet the definition of **automatic zero-tracking** mechanism, it is not allowed. Additionally, the Sector agreed that HB 44 does not clearly state that this function is not allowed which may lead to inconsistent interpretations of Section 2.20. Scale paragraphs S.1.1.(c) (Zero Indication – “. . . return to a continuous zero indication”) and S.1.1.1.(b) (Digital Indicating Elements – “*a device shall either automatically maintain a “center-of-zero” condition. . .*”) could be interpreted to allow the automatic zero-setting device as described in OIML R 76. That may not be a universal interpretation.

The Sector concluded that:

- (a) There is a problem that needs to be solved, based on the current information or lack of information in HB 44.
- (b) There are no technical reasons why the automatic zero-setting feature, as described in OIML R 76, should not be included in NIST Handbook 44.
- (c) The feature may not be suitable for all applications (e.g., balancing off a stable partial load) if the feature can function with both positive and negative weight indications.
- (d) Language will need to be developed for NCWM Publication 14 to either test for the correct function of automatic zero-setting or test to determine that the device does not have **automatic zero-setting** and it is a sealable parameter.

The Sector established a small work group (Scott Davidson, Scott Henry, Steve Cook, and Stephen Patoray) to develop language to be submitted the NCWM S&T Committee and make a recommendation addressing the suitability of scales with the capability to automatically set a positive weight indication to zero. Additionally, the Sector agreed to review the language developed by the work group to confirm its support of the proposed language. (Todd Lucas and Jim Truex also contributed to the discussions and subsequent proposal.)

In the process of developing the proposal, the WG considered the following points:

1. Making the proposal to add automatic zero-setting “retroactive” since the group is aware that the feature has been included on several scales for nearly 20 years and may not have been activated. The WG considered alternate retroactive dates, but felt that the proposed requirements for the feature should be applicable to all scales incorporating this feature. Additionally, NCWM Publication 14 NTEP technical

policies state that only the standard features and options that have been evaluated will be included on the CC. As a result, an NTEP applicant will have to submit an application to NTEP in order to have the automatic zero-setting feature listed on an existing CC.

2. The automatic zero-setting mechanism shall be limited to operating only when the scale indication is below zero. The group discussed allowing the feature to operate in both directions. Although there may be valid reasons for allowing it in the positive direction, the group felt that legitimate objects on a scale could be inadvertently (or intentionally) zeroed without an obvious indication to the customer or operator when the scale was indicating zero at the start of a transaction.
3. The automatic zero-setting mechanism should be considered as a “sealable parameter” since there are applications where it is required to be disabled, and if the time, stability, and capacity parameters can be adjusted beyond the limitations in the proposal.
4. Publication 14 evaluation and field examination procedures should be amended to verify that the automatic zero-setting mechanism cannot set the scale to a zero indication in less than five seconds and that it can only operate if it complies with motion detection requirements and its effect is no larger than 4 % on the nominal scale capacity.
5. The automatic zero-setting mechanism is permitted for devices covered by Section 2.24. Automatic Weighing Systems.
6. The automatic zero-setting mechanism is prohibited for automatic bulk-weighing systems for the same reasons that zero-tracking is prohibited (unintentional and unobserved zeroing or tracking off material that may be retained in a hopper resulting in incorrect weight determinations).
7. The automatic zero-setting mechanism should be capable of being disabled for testing purposes for the same reasons that zero-tracking is capable of being disabled for Scales Code Class III L devices.
8. The group believes that the current definition for initial zero-setting mechanism is a type of zero-setting mechanism and should be included with the definition on zero-setting mechanism as shown in the recommendation.
9. The Sector should consider recommending changing the term “automatic zero-tracking” to “zero-tracking” throughout the weighing codes in order to reduce the confusion with the term “automatic zero-setting.” The word “automatic” is redundant for zero-tracking since it is included in the definition of “automatic zero-tracking.”

The WG did not have sufficient time to both develop the proposal and ballot the Sector prior to the November 1, 2008, cutoff date for submitting new items to the Committee. Therefore, the group agreed to submit the proposal to the Committee and ballot the Sector members. (Note: The ballot will also ask the Sector if it agrees with submitting a recommendation to the NTEP Committee that an existing CC may be amended upon a successful review on an application and documentation.) The results of the ballot and all comments will be summarized and forwarded to the Committee prior to the 2009 NCWM Interim Meeting.

Conclusion: Eight Sector members responded to the ballot of which six voted in favor of the proposed language. It should be noted that two of the affirmative votes stated that their vote was provisional provided the reference to the 4 % of scale capacity limitation is removed from the proposal. Two members opposed that item stating that the language should not be rushed through the S&T Committee and that the feature should operate with either negative or positive weight indications.

The NIST technical advisor has forwarded the ballot results and comments to the S&T Committee for its consideration at the 2009 NCWM Interim Meeting. A copy of the ballot summary can be viewed in Appendix C, attachment to agenda Item 17.

18. Capacity – Markings and Display

Source: Stephen Patoray, NTEP Director

Background: There has been a question asked by a current NTEP CC holder regarding marking of the capacity x division statement. This CC holder wished to use a dot matrix display on their device. This happens to be a Class II non-computing scale with prescription counting capabilities, but the question could apply to just about any type of indicating element or scale display.

This CC holder wants to mark the capacity by division using the dot matrix display. They stated that the device could display different units of weight (lb, kg, etc). They stated that only one capacity by division would be displayed, based on the unit that was selected. It would be clear from this marking what the unit of measure was and what the capacity by division was set to.

They also stated that since this device had the prescription counting feature, they request that the requirements for marking in NIST HB 44 2.20. Scales, S.6.6. Counting Feature, Minimum Piece Weight (MPW) and Minimum Sample Size (MSS) be allowed on the dot matrix display, whenever the device is in the counting mode.

When the four NTEP brick and mortar labs were polled on this question, two of the labs indicated that they would not allow the marking of the capacity by division, or the markings for counting on a scale display. One lab indicated that this would be an acceptable method since the language in NCWM Publication 14, Weighing Devices, Digital Electronic Scales, Section K. Subsection 1. Item 1.14. is significant in that it mentions a “video terminal.” One lab did not respond. The Weighing Sector needs to discuss this issue and 1) clarify this issue for the NTEP labs, or 2) recommend a clarification in HB 44, so that labs can consistently interpret the information found in both HB 44 and NCWM Publication 14.

In 1992, the S&T Committee took on this topic and an Item (320-6) that was adopted by the NCWM. At that time, the Committee recommended that Tables S.6.3.a. and S.6.3.b. (note 3) be interpreted to permit the **required capacity and scale division markings** to be presented as part of the **scale display (e.g., displayed on a video terminal or in a liquid crystal display)**, rather than be physically marked on the device. As part of the current language in the tables and this interpretation, the capacity by division statement must be adjacent to the weight display and continuously displayed when in the weighing mode. However, if the weighing mode of the scale permits different menus for selecting operations to be displayed, the weight information and capacity by d continuously displayed if this display is the customer’s only display. These requirements apply to all of the weighing modes that may be selected for commercial transactions. The statement does not have to be displayed when the indicating element operates in modes other than the weighing mode. This does not require a change to Handbook 44. This interpretation will be included in NCWM Publication 14 and NCWM Publication.

It should be noted that there is a difference in the language of the S&T agenda item and that of Pub 14. The Final S&T Report uses “**scale display**” with video terminal as an example; however, Pub 14 uses “**video terminal**” with no example. While this may seem trivial, the information in Pub 14 is what the two labs were basing their decisions on and did not consider a video terminal the same thing as a dot matrix scale display. The language in Pub 14 should reflect the position of the S&T Committee and to not limit the type of technology used for a scale display.

Part 1 – Capacity x Division, Multiple Units of Measure

With this information from 1992, the ability to display capacity by division on a dot matrix scale display should be allowed by this interpretation.

The next question is whether the capacity by division can change in relationship to the current unit of weight that the scale is using (instead of displaying all of the various capacity by divisions all at one time, (like on a sticker) no matter what unit of weight was in use).

It is submitter’s position that the only useful information is that of the “unit of weight” that is in use at the time of the weighing, and that the other information for other units could add to confusion for everyone. The capacity by division statement is of no value and need not be displayed if the scale is in some other mode of operation (e.g. not a weighing mode).

Discussion/Conclusion (Part 1): The Sector supported the recommendation and agreed that NCWM Publication 14 DES Section 1.14. be clarified so that it is acceptable to display the capacity by division information for only the unit of weight that is currently in use and is only necessary for the capacity by division information to be displayed when the device is in the weighing mode as follows:

- 1.14. If the capacity by division statement is displayed **as part of the scale display (e.g., displayed on a video terminal or in a liquid crystal display)**~~on a video terminal~~ with the weigh values, then the capacity by

division statement must be indicated in a clear and conspicuous manner and be readily apparent when viewing the reading face of the scale indicator unless already apparent by the design of the device and displayed whenever the system is in the weighing mode.

Part 2 – Minimum Piece Weight and Sample Size

The marking requirements for prescription counting were added to HB 44 in 2003, long after the clarification of capacity by division on a scale display in 1992 by the S&T.

In the 2003 NCWM Annual Report, the S&T Committee in part stated in agenda Item 320-2 (which was adopted) that the Committee agreed that the proposal should clarify when special application marking requirements are not required on scales equipped with the counting feature.

Based on the previous information in *Part 1* regarding capacity by division that was clarified in 1992 by the S&T, and the statement in S.6.6. that the device has an operational counting feature, the Sector considered a proposal to allow the required markings of MSS and MPW to be displayed on the scale display, only when the device is in prescription counting mode.

Discussion/Conclusion (Part 2): The Sector discussed the proposal to clarify NCWM Publication 14 to state that it is acceptable to display the HB 44 required marking for the Minimum Piece Weight (MPW) and the Minimum Sample Size (MSS) on the scale display, only when the device is in prescription counting mode. The Sector agrees that clarification in NCWM Publication 14 is needed and recommended that specific language needs to be developed by Steve Patoray and Steve Cook, and that the recommended language will be presented to the NTEP Committee prior to its January 2009 meeting.

Next Sector Meeting

Discussion/Conclusion: The Sector discussed several possible options for the date and location for its 2008 meeting. Suggestions included holding the meeting at NCWM headquarters in Lincoln, Nebraska, the Ohio NTEP laboratory, or to tie the Sector meeting with the 2009 Annual Technical Conference for the Western Weights and Measures Association in New Mexico.

The Sector made no recommendation for a date and location for its 2009 meeting.

Appendix A – Recommendations for Amendments to Publication 14¹

Agenda Item 1. Force Transducer (Load Cell) Family and Selection Criteria

Amend Publication 14 Force Transducers Section D. as follows:

D. Force Transducers (Load Cells) to be Submitted for Test¹

~~*Editor's Note: A modified Section D. is currently out for comment. This modification will attempt to align this section with OIML R 60 selection criteria. Additional work is needed by the Weighing Sector before this modification is completed.*~~

In 2006, NCWM signed the OIML Declaration of Mutual Confidence (DoMC) as a utilizing participant in R 60 Load Cells. As part of this agreement, NCWM will accept the Test Report and test data that is generated by the Issuing Participant and laboratory who have also signed the DoMC. The selection process for load cell samples will be that described in OIML R 60 2000 Section 7.3 Selection of Load Cells Within a Family. ~~No amendments to NTEP CCs will be allowed under the DoMC will be issued an NTEP CC.~~

- *The load cell(s) evaluated under the MAA will be issued a new NTEP CC.*
- *Subsequent applications to amend the MAA-generated CCs will also use the selection criteria and family characteristics in R 60.*
- *Amendments to NTEP CCs issued on or after XXXX XX, 2009, will use the family and selection criteria listed on the certificate.*
- *NTEP CCs issued earlier than XXXX XX, 2009, will use the Publication 14 family and selection criteria.*

Note: Use of either the NTEP or R 60 selection criteria will be listed in the CC test conditions. (Effective with CCs issues after XXXX XX 2009)

Force transducers (load cells) with essentially the same design will be considered to be part of the same family on a CC. If force transducers (load cells) within a family are made from different materials, such as aluminum, alloy steel, or stainless steel, than all material types must be submitted for evaluation. The policy applies to all applications for new or amended Certificates of Conformance received after January 31, 2002. This policy is non-retroactive for Certificates issued prior to February 1, 2002.

1. The manufacturer must provide the following information with a request for evaluation:

2. The actual number of force transducers (load cells) and force transducer (load cell) capacities to be tested will be decided by NTEP in discussions with the manufacturer. The data are evaluated strictly on a pass/fail basis with respect to the NTEP requirements. However, if the test data is marginal, then NTEP may require that additional force transducers (load cells) be tested before an NTEP Certificate is issued. **NTEP recognizes that deviations to the selection criteria may be unavoidable due to test capability and manufacturing product line and that any such deviations may be approved by NTEP after consulting with the applicant.**

¹ Holders of NTEP CCs that have private label agreements with the original load cell manufacturers (OEM) shall comply with Publication 14 Administrative Policy Section G.1. Private Label. (Editorial suggestion)

¹ Recommended changes to Publication 14 are indicated in shaded, ~~strike-out~~, and underlined text.

Agenda Item 2. Force Transducer

Amend Publication 14 Force Transducers Section L as follows:

L. Procedures

II. Determination of Creep and Creep Recovery, Test Procedure and Permissible Variations

1. - 3. (no change)

4. Test for Creep:

- a. Apply a load equal to 90 percent to 100 percent of the maximum capacity of the force transducer (load cell). ~~and record the indication 20 seconds after reaching the load.~~ The time to load test weights ~~and read the indicator~~ shall be as short as possible. ~~and shall not exceed the time specified in Table 5.~~ A portion of the time specified in Table 5 shall be used for loading. The remaining time specified in Table 5 shall be used for stabilization. The tests shall be conducted under constant conditions. Time shall be recorded in the test report in absolute (hh:mm:ss), not relative, units. The initial reading shall be taken at the applicable time indicated in Table 5. With the load remaining on the load cell, continue to record indications periodically, thereafter at time intervals over a 30 minute period. Be certain to obtain a reading at 20 minutes (8.b. below).

5. Test for Creep Recovery:

- a. Remove a load equal to 90 percent to 100 percent of the maximum capacity of the force transducer (load cell) that has been applied for 30 minutes. ~~Record the indication after 20 seconds.~~ The time to unload test weights ~~and read the indicator~~ shall be as short as possible. ~~and not exceed the time specified in Table 5.~~ A portion of the time specified in Table 5 shall be used for unloading. The remaining time specified in Table 5 shall be used for stabilization. The tests shall be conducted under constant conditions. Time shall be recorded in the test report in absolute (hh:mm:ss), not relative, units. The initial reading shall be taken at the applicable time indicated in Table 5. ~~Continue to record indications periodically thereafter at time intervals over a 30 minute period.~~

6. - 8. (no change)

9. Permissible Variations of Reading for Creep Recovery

a. (no change)

Table 5. Loading Initial Reading Times		
Load		Time
Greater than	To and including	
0 kg	10 kg	10 seconds
10 kg	100 kg	15 20 seconds
100 kg	1000 kg	20 30 seconds
1000 kg	10 000 kg	30 40 seconds
10 000 kg	100 000kg	50 seconds
100 000 kg	-----	60 seconds

Table T.N.4.6. (no changes)

Agenda Item 4.(c) Scales Code Paragraphs S.1.2.1., S.2.3., and T.N.2.1. and AWS Code Paragraph S.1.1.1.

Recommendation 1: Amend Publication 14 DES Section 1.11. as follows:

11.1. Except for batching scales, the value of the scale division in all available weight units for both indicating and recording elements must be in values of 1, 2, or 5 times 10k where k is an integer, e.g., 0.1, 0.2, or 0.5; 1, 2, or 5; 10, 20, or 50, etc.
 Yes No N/A
See additional exceptions in DES Sections 31. and 32. for multi-interval and multiple range scales.

Recommendation 2: Amend Publication 14 DES Section 31. as follows:

In applying these principles, it is acceptable to:

- round the indicated and printed tare values to the nearest appropriate net weight scale division,
- or display net weight values in scale divisions other than the scale division used in the display of gross weight, as when the gross and tare weights are in different ranges of the device. For example, a scale indicating in 2-lb divisions in the lower range and 5-lb divisions in the next higher range may result in net values ending in three or eight in the higher range. For example, a multi-interval scale may indicate and record tare weights in a lower weighing segment (WS) and net weights in the higher weighing segment as follows:

55 kg	Gross Weight (WS2 d = 5 kg)	10.05 lb	Gross Weight (WS2 d = 0.05 lb)
<u>- 4 kg</u>	Tare Weight (WSR1 d = 2 kg)	<u>- 0.06 lb</u>	Tare Weight (WS1 d = 0.02 lb)
= 51 kg	the Mathematically Correct Net Weight	= 9.99 lb	the Mathematically Correct Net Weight

In every case, it is required to maintain the mathematically correct equation:

$$\underline{\text{net} = \text{gross} - \text{tare}}$$

Recommendation 3: Amend Publication 14 DES Section 32. as follows:

Whenever gross and tare weights fall in different weighing ranges so that the scale divisions for the gross and tare weights differ, the net weight must agree mathematically with the gross and tare weights that are indicated or recorded (i.e., net = gross - tare).

A multiple range scale may indicate and record tare weights in a lower weighing range (WR) and net weights in the higher weighing range. ~~On a multiple range instrument, Alternatively,~~ a tare value may ~~only~~ be transferred from one weighing range to another one with a larger verification scale interval and shall then be rounded to the nearest scale division of the latter verification interval. ~~For example: when displayed and/or printed as follows: *~~

Capacity x d: WR1 = 0 - 4 kg x 2 g WR2 = 4 - 10 kg x 5 g WR3 = 10 - 20 kg x 10 g	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"></td> <td colspan="2" style="text-align: center;"><u>Displayed and/or Printed</u></td> </tr> <tr> <td></td> <td style="text-align: center;"><u>Preferred</u></td> <td style="text-align: center;"><u>Acceptable</u></td> </tr> <tr> <td style="text-align: right;"><u>Gross</u></td> <td style="text-align: center;"><u>13.380 kg</u></td> <td style="text-align: center;"><u>13.380 kg</u></td> </tr> <tr> <td style="text-align: right;"><u>Tare</u></td> <td style="text-align: center;"><u>-3.814 kg</u></td> <td style="text-align: center;"><u>-3.810* kg</u></td> </tr> <tr> <td style="text-align: right;"><u>Net</u></td> <td style="text-align: center;"><u>9.566 kg</u></td> <td style="text-align: center;"><u>9.570 kg</u></td> </tr> </table>		<u>Displayed and/or Printed</u>			<u>Preferred</u>	<u>Acceptable</u>	<u>Gross</u>	<u>13.380 kg</u>	<u>13.380 kg</u>	<u>Tare</u>	<u>-3.814 kg</u>	<u>-3.810* kg</u>	<u>Net</u>	<u>9.566 kg</u>	<u>9.570 kg</u>
	<u>Displayed and/or Printed</u>															
	<u>Preferred</u>	<u>Acceptable</u>														
<u>Gross</u>	<u>13.380 kg</u>	<u>13.380 kg</u>														
<u>Tare</u>	<u>-3.814 kg</u>	<u>-3.810* kg</u>														
<u>Net</u>	<u>9.566 kg</u>	<u>9.570 kg</u>														

* 3.814 tare in WR2 is rounded to the nearest scale division of WR3.

Recommendation 4: The NIST technical advisor recommends that the Sector consider developing equivalent amendments in the above recommendations to Publication 14 for AWS Sections 10., 19., and 20.

Agenda Item 4.(e) Amend Level-Indicating Means

Amend Publication 14 DES Sections 55. and 56. as follows:

55. Vehicle on-Board Weighing Systems

Code References: S.1.13., S.2.4.1., and N.1.3.7.

A vehicle on-board weighing system is defined as a weighing system designed as an integral part of or attached to the frame, chassis, lifting mechanism, or bed of a vehicle, trailer, industrial truck, industrial tractor, or forklift truck.

- 55.1. Verify that when the vehicle is in motion the on-board weighing system is either:
- 55.1.1. accurate or Yes No N/A
 - 55.1.2. the weighing operation is inhibited Yes No N/A
- 55.2. The on-board weighing system operates within tolerance for out-of-level conditions up to and including 5 percent*~~3 degrees~~. Yes No N/A
- 55.2.1. A sensor detects and inhibits weighing when an out-of-level condition exists that will exceed the accuracy limits of the scale. Weighing is inhibited for out of level conditions of _____ degrees Yes No N/A
 - 55.2.2. The system is accurate for the shift test when the vehicle is both level and out-of-level. Yes No N/A

**NOTE: 5 percent refers to 5 percent rise over run.~~slope/grade~~*

56. Level-Indicating Means – Portable Scales

Code Reference: S.2.4.

Portable wheel-load weighers and portable axle-load scales intended for law enforcement must weigh accurately when placed out-of-level by 5 percent*~~(approximately 3 degrees)~~.

A portable scale which is intended to be moved must either be equipped with a readily observable level-indicating means (typically a bubble level) or the scale must still weigh accurately when placed out-of-level by 5 percent*~~(approximately 3 degrees)~~. Weighing accurately means that the results must be within acceptance tolerance.

The level-indicating means shall be rigidly mounted, located where it will be protected from damage but still be easily read in normal use, mounted so that its reference point for level will not change when pressure is applied to the level-indicator, and sensitive enough to indicate an out-of-tolerance condition that might affect the accuracy of the scale. A bubble level mounted on a swing-out bracket is not adequate. Portable floor scales (generally with capacities of more than 500 lb) shall have the level-indicating means visible without removing any scale parts.

**NOTE: 5 percent refers to 5 percent rise over run.~~slope/grade~~*

- 56.1. Scales (other than wheel-load weighers and portable axle-load scales) must meet one of the following conditions:
- 56.1.1. The device is equipped with a level indicator as standard equipment, or? Yes No N/A
 - 56.1.2. the device complies with the provisions of S.2.4. The test procedure is given in “Performance Tests for Digital Counter (Bench) and Computing Scales”. Yes No N/A

56.2.	If the scale is equipped with a level-indicating means, it must be readily observable without mechanical disassembly that requires the use of tools. A bubble level placed under the scale platform of a portable floor scale mounted on wheels is not practical for the user of the scale.	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
56.3.	The level-indicating means is rigidly mounted, easily read, protected from damage, will not change its reference for level, and sufficiently sensitive.	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
56.4.	Wheel-load weighing and axle-load scales must weigh accurately when placed out-of-level by 5 percent* (approximately 3 degrees).	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

Agenda Item 8. Method of Sealing

Delete DES Section 10.12.9. as follows:

10.12.9. The scale shall clearly indicate it is in the set up (calibration or configuration) mode, such as indicators, error message, or other means of indication that can not be interpreted as legal weight values (Effective January 1, 2005).

Agenda Item 9. S.1.1.(c) Zero Indication (Sleep/Screen Saver/Power Save Modes)

Amend Publication 14 – Digital Electronic Scales (DES) as follows:

Scale Features and Parameters (in DES Section 10.)	
Typical Scale Features to be Sealed	Typical Scale Features and Parameters Not Required to be Sealed
• • • Screen Saver/Sleep and/or Power Save mode <i>not listed</i> on the CC (enabled/disabled)	• • • Screen Saver/Sleep and/or Power Save mode <i>listed</i> on the CC (enabled/disabled)
<p>NOTE: The above examples of adjustments, parameters, and features to be sealed are to be considered “typical” or “normal.” This list may not be all inclusive . . .</p>	

11.8.4.	Does the scale or indicating element have a:	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	<input type="checkbox"/> screen saver/sleep mode, or <input type="checkbox"/> power save mode?	
<p><u>Note for Editor: Proposal deletes existing Pub 14 language in the NOTE and Sections 11.8.4.1. and 11.8.4.2. to be replaced by the following:</u></p> <p>Manufacturers have been adding screen savers and sleep modes to scales for the purpose of prolonging the useful life of displays or provide promotional or other information on displays during periods of scale inactivity.</p> <p>Additionally, some scales have automatic shut-off, or power (battery) save modes. These features promote energy conservation or prolong battery life in battery-operated scales. This feature either automatically turns off the scale after a period of inactivity or only turns off the display. If the power or battery save mode only turns off the display to save power, the feature is considered to be a sleep mode and should be evaluated using the screen saver/sleep mode criteria.</p> <p>As used in Publication 14, the terms screen saver/sleep mode and power save mode are defined as follows:</p> <p><u>screen saver/sleep mode.</u> A function of a device that blanks the display or shows information other than weight indications after a defined period of non-use.</p> <p><u>power save mode.</u> A function of a device that automatically blanks indications and turns off or reduces power</p>		

to the electronics after a defined period of non-use in order to save line or battery power. Operator intervention is required to restore operation (e.g., return the scale to zero, turn on the scale, etc.).

Summary of Screen Saver/Sleep and Power Save Mode of Operation				
Mode	Display	Activated by	Exited by	Verified by
Screen Saver/Sleep	i.e., Scrolling or other non metrological information, blank, or annunciator	Period of time at gross load center of zero	Change in weight, i.e., no longer at gross load zero	<u>Accurate weights are displayed</u> under all the following conditions when: - weight is added to the LRE, - weight is removed from the LRE, and - the LRE is disturbed by hand.
		Period of time with a non changing load on the scale	Deliberate operator action (remove load off scale and rezero if necessary)	<u>No weights are displayed</u> under all the following conditions when: - weight is added to the LRE, - weight is removed from the LRE, and - the LRE is disturbed by hand.
Power Save	Off/Blank	Period of time with no activity on the LRE (loaded or unloaded)	<u>Return the scale to a zero-balance indication with the automatic zero tracking or semi-automatic zero-setting mechanisms, or other deliberate operator action (e.g., turn on the scale, etc.)</u>	<u>No weights are displayed</u> under all the following conditions when: - weight is added to the LRE, - weight is removed from the LRE, - the LRE is disturbed by hand, and - <u>power is restored to the scale with weight on the LRE.</u> <u>Accurate weights are displayed/indicated or recorded</u> according to Publication 14 Section 53. Values Displayed, Temperature Conditions (Warm-up) Test Procedure 1 or 2 <u>since power may have been turned off or reduced to the electronics and load cell while in the power save mode.</u>

11.8.4.1. If the scale can only enter a screen saver/sleep mode **with no load on the LRE**, perform the following steps to verify that automatic means are provided to inhibit a weighing operation unless the scale is at zero. **Yes** **No** **N/A**

1. Add a load plus 20 d to the LRE and rezero the scale.
2. Observe the scale while indicating zero and note the amount of time taken to enter the screen saver/sleep mode. _____
3. The scale shall exit the screen saver/sleep mode when the 20 d is removed from the scale.
Yes **No**
4. Observe the scale indication for the amount of time taken to enter the screen saver/sleep mode noted in Step 2. The scale complies if it does not reenter the screen saver/sleep mode.
Yes **No**
5. Rezero the scale and allow the scale to enter the screen saver/sleep mode.

6. The scale shall exit the screen saver/sleep mode when the 20 d is now added to the LRE.
Yes No

7. Rezero the scale by removing the 20 d from the LRE to allow the scale to enter the screen saver/sleep mode.

8. The scale shall exit the screen saver/sleep mode when the LRE is momentarily disturbed by hand.
Yes No

11.8.4.2. If the scale can enter a screen saver/sleep mode **with a load on the LRE**, verify that automatic means are provided to inhibit a weighing operation when the scale is in an out-of-balance condition. Yes No N/A

While in the screen saver/sleep mode and with a load on the LRE, the scale **shall not indicate a weight** under all the following conditions when:

- an additional load is added to the LRE,
- a partial load is removed from the LRE, and
- the LRE is disturbed by hand.

The scale is permitted to return to a zero indication when the entire load is removed from the LRE (unloaded condition) or the operator is required to zero the scale.

11.8.4.3. Does the scale have a power save mode feature? Yes No N/A
Yes No

If yes, attempt to initiate a weighing transaction while the scale display is off or blank when:

- an additional load is added to the LRE,
- a partial load is removed from the LRE, ~~and~~
- a load on the LRE is disturbed by hand, ~~and~~
- power is restored to the scale with weight on the scale.**

Perform the tests described in Pub 14 Section 53. Values Displayed, Temperature Conditions (Warm-up) Test Procedure 1 or 2 as appropriate to verify the accuracy of the scale after its power has been lowered or turned off.

11.8.4.3. Verify that recording and printing functions are inhibited when the device is in screen saver/sleep or power save mode. Yes No N/A

Publication 14 – Electronic Cash Registers Interfaced with Scales (ECRS) as follows:

1. Zero Indication

Code Reference: S.1.1., S.1.1.1., S.1.6.3., G-S.5.1.

A digital electronic scale must be capable of defining a zero-balance condition within 0.5 scale division (d) for all weight units and may be defined within ± 0.25 d. In ~~If~~ a point-of-sale system automatically monitors its zero balance condition ~~and inhibits scale operation when an out of zero balance condition is detected~~, a continuous

digital zero balance indication is not required provided that automatic means is provided to inhibit a weighing operation or to return to a continuous digital indication when the scale is in an out-of-balance condition.

Manufacturers of scales and point-of-sale systems have been adding screen savers and sleep modes to scales for the purpose of prolonging the useful life of displays or provide promotional or other information on displays during periods of scale inactivity.

Additionally, some scales and point-of-sale systems have automatic shut-off, or power (battery) save modes. These features promote energy conservation or prolong battery life in battery-operated scales. This feature either automatically turns off the scale after a period of inactivity or only turns off the display. If the power or battery save mode only turns off the display to save power, the feature is considered to be a sleep mode and should be evaluated using the screen saver/sleep mode criteria.

As used in Publication 14, the terms screen saver/sleep mode and power save mode are defined as follows:

screen saver/sleep mode. A function of a device that blanks the display or shows information other than weight indications after a defined period of non-use.

power save mode. A function of a device that automatically blanks indications and turns off or reduces power to the electronics after a defined period of non-use in order to save line or battery power. Operator intervention is required to restore operation (e.g., return the scale to zero, turn on the scale, etc.).

Summary of Screen Saver/Sleep and Power Save Mode of Operation

<u>Mode</u>	<u>Display</u>	<u>Activated by</u>	<u>Exited by</u>	<u>Verified by</u>
<u>Screen Saver/Sleep</u>	<u>i.e., Scrolling or other non metrological information blank, or annunciator</u>	<u>Period of time at gross load center of zero</u>	<u>Change in weight, i.e., no longer at gross load zero</u>	<u>Accurate weights are displayed under all the following conditions when: - weight is added to the LRE, - weight is removed from the LRE, and - the LRE is disturbed by hand.</u>
		<u>Period of time with a non changing load on the scale</u>	<u>Deliberate operator action (remove load off scale and rezero if necessary)</u>	<u>No weights are displayed under all the following conditions when: - weight is added to the LRE, - weight is removed from the LRE, and - the LRE is disturbed by hand.</u>
<u>Power Save</u>	<u>Off/Blank</u>	<u>Period of time with no activity on the LRE (loaded or unloaded)</u>	<u>Return the scale to a zero-balance indication with the automatic zero tracking or semi-automatic zero-setting mechanisms, or</u>	<u>No weights are displayed under all the following conditions when: - weight is added to the LRE, - weight is removed from the LRE, - the LRE is disturbed by hand, and - power is restored to the scale with weight on the LRE.</u>

			other deliberate operator action (e.g., turn on the scale, etc.)	<u>Accurate weights are displayed indicated or recorded</u> according to Publication 14 Section 53. Values Displayed, Temperature Conditions (Warm-up) Test Procedure 1 or 2 since power may have been turned off or reduced to the electronics and load cell while in the power save mode.
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For all other systems, when an ECR is interfaced with a weighing/load receiving element, a continuous display of weight values and the digital zero balance indication must be provided. The continuous weight display must be visible to both the customer and cash register operator. A single weight display suffices so long as both the customer and cash register operator can easily see it. The operator’s zero balance indication may be an annunciator on the cash register display that is illuminated when the scale is in a zero balance condition.

The weight display may be integrated into the scale, may be a remote weight display, or may be integral with the cash register. If the weight display is in the ECR, it must be separate from other displayed information.

- 1.1. (No change) Yes No N/A
- 1.2. (No change) Yes No N/A
- 1.3. If the point-of-sale system automatically monitors the zero-balance condition of the scale, the system shall automatically prohibit scale operation when an out-of-zero balance condition is detected, or return to a continuous digital indication when the POS scale is in an out-of-balance condition.

Does the scale or indicating element have a:
screen saver/sleep mode? Yes No
power save mode? Yes No

1.3.1. If the scale and point-of-sale system (POS) can only enter a screen saver/sleep mode **with no load on the LRE**, perform the following steps to verify that automatic means are provided to inhibit a weighing operation unless the scale is at zero. Yes No N/A

1. Add a load plus 20 d to the LRE and rezero the scale.
2. Observe the weight display while indicating zero and note the amount of time taken to enter the screen saver/sleep mode.

3. The scale or POS shall exit the screen saver/sleep mode when the 20 d is removed from the scale.
Yes No
4. Observe the weight indication for the amount of time taken to enter the screen saver/sleep mode noted in step 2. The scale complies if it does not reenter the screen saver/sleep mode.
Yes No
5. Rezero the scale and allow the scale to enter the screen saver/sleep mode.
6. The scale or POS shall exit the screen saver/sleep mode when the 20 d is now added to the LRE.

Yes No

7. Rezero the scale by removing the 20 d from the LRE to allow the scale to enter the screen saver/sleep mode.

8. The scale or POS shall exit the screen saver/sleep mode when the LRE is momentarily disturbed by hand.

Yes No

1.3.2. If the scale or POS can enter a screen saver/sleep mode **with a load on the LRE**, verify that automatic means are provided to inhibit a weighing operation when the scale is in an out-of-balance condition. Yes No N/A

While in the screen saver/sleep mode with a load on the LRE, the scale or POS **shall not indicate a weight** under all the following conditions when:

- an additional load is added to the LRE,
- a partial load is removed from the LRE, and
- the LRE is disturbed by hand.

The scale or POS is permitted to return to a zero indication when the entire load is removed from the LRE (unloaded condition) or the operator is required to zero the scale.

1.3.3. Does the scale or POS have a power save mode feature? Yes No N/A

Yes No

If yes, attempt to initiate a weighing transaction while the scale display is off or blank when:

- an additional load is added to the LRE,
- a partial load is removed from the LRE, **and**
- a load on the LRE is disturbed by hand, **and**
- power is restored to the scale with weight on the scale.**

Perform the tests described in Pub 14 DES Section 53. Values Displayed, Temperature Conditions (Warm-up) Test Procedure 1 or 2 as appropriate to verify the accuracy of the scale after its power has been lowered or turned off.

1.3.4. Verify that recording and printing functions are inhibited when the scale or POS is in screen saver/sleep or power save mode. Yes No N/A

Agenda Item 11.(a) Clarification on Section 66.(c) Performance and Permanence Tests

Amend Publication 14 – Digital Electronic Scales (DES) Section 66.(c) as follows (*Editor's Note: Jim Truex and Steve Cook need to resolve conflict with minimum weight for subsequent test in Sections 66.(c)4.1. and 66.(c)6.6.*):

Pub 14 Section 66.(c) (figures not included here)

Side-by-side scale vehicle applications are typically two 7- to 12-foot wide vehicle scales (**load-receiving elements**) placed side-by-side and may have a small area between each **load-receiving element (LRE)**. Unless the “side-by-side” scale has a single CLC rating for the complete scale, the section test-load shall not be greater CLC (for the single side) x 2 when both sides of the “side-by-side” scale are tested simultaneously.

If the **load-receiving elements (LRE)** used in the “side-by-side” application do not have a CC, then at least one of

the load-receiving elements **shall be tested as a “single” scale** according to Section 66.(a) in addition to the following tests (CLC test load at least 90 percent).

If the **LRE** used for the “side-by-side” application are already covered by a CC for “single” scale applications, then only the following test loads and patterns need to be performed **including strain-load and subsequent evaluation (field) permanence tests**. If the “single” scale is too narrow for legal highway vehicles, testing as a “single” (one of the sides) scale does not have to be performed and the weighing/load-receiving element will be limited to “side-by-side” applications.

Side-by-side applications using **LREs** narrower than 8 ft wide should not be able to provide weight information from the individual scale since legal highway vehicles would always straddle both **LREs** to obtain a weight.

Section tests on “side-by-side” scales can be conducted with at least 75 percent CLC test loads in Prescribed Test Patterns (PTPs). Care shall be taken not to overload a Prescribed Test Pattern (PTP) during the strain-load test. Position tests will be conducted with loads no greater than 50 % CLC in a test pattern approximately 4 ft (L) x 4 ft to 5 ft (W).

The evaluator is reminded to be aware of potential safety hazards prior to and during the evaluation. When test carts are not available, care should be taken when stacking 1000-lb weights on a scale platform. Extreme caution must be used when stacking 1000-lb weights higher than three levels. If a fourth level of test weight is required to reach the desired test load, weights should not be placed on the outer edge of the weight stack. The evaluator may request the assistance of the applicant, service agency, or device owner to help with the stacking of weights and to verify that the weights are safely stacked without the risk of falling and injuring people, and damaging property (General Code Section 1.10. G-UR.2.3. Accessibility for Inspection, Testing, and Sealing Purposes).

66.(c)1. Indicator Tests . . .

Agenda Item 11.(b) Clarification of Section 66.(c) Waiving of Permanence Tests

Add the following note to DES Section 66.(c)4. as follows:

66.c.4. Subsequent Type Evaluation (Field) Permanence Tests

Note: The subsequent permanence test may be waived if the scale passes the initial test without significant performance issues and the NTEP Administrator approves the waiver based upon the report of the NTEP evaluator.

Agenda Item 13. Stored Tare for “Weigh-in/Weigh-out” Applications

Amend DES Section 35. as follows:

35. Weigh-In/Weigh-Out Systems

A weigh-in/weigh-out system is typically **used in a-vehicle scale and other applications that involve two weight determinations, in which an in-bound truck is weighed either loaded or empty; the inbound weight is stored; the truck is then emptied or loaded.** The ~~outbound truck is weighed, and the~~ larger of the two weights (~~outbound or stored weight~~) is printed as the gross weight. The other **weight is** printed as the tare weight and the difference computed as the net weight. ~~In-bound~~ Weights, recalled weight values, and gross, tare, and net weights must be identified to clearly document the transaction. The storage, recalling, and printing actions are limited so they do not facilitate fraud.

- 35.1. Any **weigh-in-bound** weight values shall be recorded and automatically identified as such. If **weigh-in-bound** weights are not printed at the time the weigh-in operation is performed, then the **weigh-in-bound** weight information shall not be lost during a power interruption. Yes No N/A

35.8. Keyboard tare entries **or stored tare** shall not be accepted into weigh-in/weigh-out memory. **A weight retained in memory that is automatically deleted from memory after the net weight is determined is not considered as a stored weight.** Yes No N/A

Agenda Item 14. Money Values in Other Than 1-Cent Intervals

Amend DES Section 10.1. as follows:

- 10.1 **Verify that the following sealable parameters are secured by a Category method of sealing.**
- 10.1.1 Coarse zero Yes No N/A
 - 10.1.2 Initial Zero-Setting Mechanism (IZSM) on separable indicating elements with limits that that can be adjusted more than 20 % beyond the maximum capacity of the load-receiving element Yes No N/A
 - 10.1.3 Span Yes No N/A
 - 10.1.4 Linearity correction values Yes No N/A
 - 10.1.5 Motion detection (on/off) Yes No N/A
 - 10.1.6 Motion detection (number of divisions and speed of operation) Yes No N/A
 - 10.1.7 Number of samples averaged for weight readings Yes No N/A
 - 10.1.8 Averaging time for weight indications Yes No N/A
 - 10.1.9 Selection of measurement units (if internally switched and not automatically displayed on the indicator) Yes No N/A
 - 10.1.10 Division value, d Yes No N/A
 - 10.1.11 Number of scale divisions, n Yes No N/A
 - 10.1.12 **Minimum money value on electronic computing devices (\$ 0.01)** Yes No N/A
 - 10.1.13 Range of over capacity indications (if it can be set to extend beyond regulatory limits) Yes No N/A
 - 10.1.14 Automatic zero-tracking mechanism (on/off) for bulk-weighers hopper scales and all Class III L devices Yes No N/A
 - 10.1.15 Automatic zero-tracking mechanism (range of a single step) Yes No N/A
 - 10.1.16 ¼ and ½ lb pricing capability or multiplier keys Yes No N/A
 - 10.1.17 Weight Classifier mode (enabled/disabled) Yes No N/A
 - 10.1.18 Manual Gross Weight Entries (enabled/disabled) for applications where this feature is not permitted in Handbook 44 Yes No N/A

Other: Describe the parameter and provide justification according to the “Principles for Determining Features to be Sealed.”

10.21 (~~Renumber remaining sections~~)

Agenda Item 18. Capacity – Markings and Display: Part I (Clarification of Cap x d):

Amend DES Section 1.14. as follows:

1.14. If the capacity by division statement is displayed **as part of the scale display (e.g., displayed on a video terminal or in a liquid crystal display)** ~~on a video terminal~~ with the weigh values, then the capacity by division statement must be indicated in a clear and conspicuous manner and be readily apparent when viewing the reading face of the scale indicator unless already apparent by the design of the device and displayed whenever the system is in the weighing mode.

Agenda Item 18. Capacity – Markings and Display: *Part 2 (MSS and MPW):*

- 1.17. If a Class I or Class II prescription scale complies with paragraphs S.1.2.3., S.2.5.3., and S.6.6., it shall be:
- 1.17.1. marked, “Counting Feature for Prescription Filling Only” (see test procedure in Section 58.);
 - 1.17.2. marked with the minimum piece weight and minimum number of pieces used to establish an individual piece count.
 - 1.17.3. **If the minimum piece weight and/or minimum number of pieces is displayed with the count values on the counting display, then the minimum piece weight and minimum number of pieces must be indicated in a clear and conspicuous manner and be readily apparent when viewing the reading face of the counting indicator.**

Appendix B – Attachments

Attachment for Agenda Item 2

National Conference on Weights and Measures / National Type Evaluation Program

NTETC Weighing Sector Ballot Summary 94-01



INFORMATION AND INSTRUCTIONS

Item No.	Item	Affirm.	Negat.	Abst.
1	Approve the revised Publication 14 Force Transducers Section “II. Determination of Creep and Creep Recovery, Test Procedures and Permissible Variations” which replaces and amends the 2008 language with the amended language as shown in the <u>underlined</u> language on the following pages.	7	5	3
	Breakdown of votes →	6 private 1 public	2 private 3 public	3 private
Comments				
Two negative votes from NTEP participating labs had the same comments stating that they agreed with the intent of the proposal. However, the language in the proposal was confusing and difficult to follow.				
<p>Justification for Negative Response: WMD was initially in favor of this item until additional data and information was received after the distribution of the ballot proposal. After reviewing the data provided by the NIST Force Group and information from Stephen Langford and Stephen Patoray, WMD votes “negative” on this item. The proposal has become a significant deviation from R 60 tolerances when taking into account the different interpretations for (un)loading and stabilization times from the OIML testing labs and data submitted by Tom Bartel, NIST FG and are summarized as follows.</p> <p>Additionally, a scale’s ability to maintain zero in actual field applications will be improved since the 0.5 v creep recovery tolerance for load cells (1.5 v for Class III L) is no larger than the scale specification for zero-tracking (0.5 d or 3 d for Class III L).</p> <ol style="list-style-type: none"> Stephen Langford and Steve Patoray contacted four OIML laboratories that perform type verifications on load cells according to the requirements on OIML R 60. They asked for information about their combined (un)load and stabilization times of their test equipment, how closely they complied with the times specified in OIML Table 6 (proposed Pub 14 Table 5), and their interpretations of the stabilizations times specified in R 60. <p>Three of the four labs responded to the request and stated that their test equipment loads and unloads weights similar to the equipment used by the NIST FG. Therefore they stated that they use the full time allotted in R 60 Table 6 for (un)load and stabilization time before taking the initial reading.</p> <p>R 60 Table 6 indicates that the combination of (un)loading and stabilization is a certain time based on the change in the test load, for example 40 seconds for a load of 10 000 kg. So the described method in R 60 would allow for a loading time of 20 seconds. The stabilization time is then also 20 seconds. However, the labs responded that from the meaning of the test, the stabilization time would be the most important factor. In this case, they load in 2 seconds and then stabilize for 38 seconds to keep the combined time to 40 seconds. This also complies with R 60 clause 5.2.3.2.(b) by recording the actual times in the Test Report.</p> <p>The following is an overview of possible combinations at a combined (un)loading and stabilization time of 40 seconds:</p>				

(un)loading time	stabilization time
20 s	20 s
18 s	22 s
22 s	18 s
2 s	38 s
1 s	40 s

2. Tom Bartel, NIST Force Group provided a worksheet that summarizes the results of NIST creep recovery tests since October 1, 2007. According to Tom’s report, the summary includes tests conducted earlier this month. All tests were conducted with a recovery reading taken 20 seconds after unloading the creep load (which takes about one second). Since additional recovery readings are taken at 40 seconds and 60 seconds after unloading, these readings may be used to obtain the creep recovery at any other time (e.g., 30 seconds) – which correspond to appropriate lines in the new proposed Table 5 of unloading times for Pub 14. (The reading at 30 seconds must be estimated by averaging the readings at 20 and 40 seconds, and likewise for the reading at 50 seconds.)

The worksheet on the following page gives the recovery results obtained from NIST’s tests, for both a fixed “delay time after unloading” of 20 seconds (as has been specified in Pub 14 until now), and for other “delay times after unloading” as given in the new proposed Table 5. In addition, the percentage of entries that “pass” is given, for Class III using a fixed time of 20 seconds, for both the current tolerance (0.5 v) and the proposed increased tolerance of 0.75 v.

Tom reported “that while most load cells show a smaller recovery value for greater delay times, the difference is not enough to change the outcome of “pass” or “fail” for any of them. This is a bit surprising, but that is the way the numbers work out.”

Tom added that that occasionally a load cell shows a greater recovery value when using a longer delay time after unloading. This can occur if, for example, the creep recovery response curve makes an initial quick dip downward, then reverses sign and rises back toward its starting point. This behavior is not unusual. Tom has offered to show curves that illustrate this behavior if requested.

WMD has modified Tom Bartel’s worksheet to include the projected compliance rate of the submitted load cells if:

1. they were classified as Class III load cells, and
2. the compliance rate using the proposed exponential formula tolerance.

A copy of this table is located on the last page of this summary.

WMD has developed revised language based on the negative comments as a separate file to this summary.

From John Elengo (Consultant), October 28, 2008.

I have previously commented on the title in Table 5 of the proposal that is incorrect and the line that reads “Loading and Unloading Times” should be removed.

I believe the proposal is unacceptable in that it deviates significantly from R 60’s intent.

The proposal introduces a Tolerance Multiplier based upon a time constant relationship:

Where: $M = 1.65e^{-T}$

M = tolerance multiplier $T = \frac{\text{load time}}{\text{Table 5 time}}$

$e = 2.7182818 = \text{natural logarithm of } 1 (\ln 1)$

M is dependent on the independent variable, time in Table 5, and the dependent variable, the time a load testing machine can load/unload a test load (that should be 90 % to 100 % of capacity). The value 1.65 is chosen to force M = 1 when the load/unload time is half of that in Table 5. The result is as follows:

Test Load -->	0 kg to 10 kg	10 kg to 100 kg	100 kg to 1 000 kg	1 000 kg to 10 000 kg	10 000 kg to 100 000 kg	Over 100 000 kg
Table 5, seconds -->	10	20	30	40	50	60

Load/Unload Time, seconds	Tolerance Multiplier					
	Instantaneous	1.65	1.65	1.65	1.65	1.65
1	1.49	1.57	1.60	1.61	1.62	1.62
2	1.35	1.49	1.54	1.57	1.59	1.60
3	1.22	1.42	1.49	1.53	1.55	1.57
4	1.11	1.35	1.44	1.49	1.52	1.54
5	1.00	1.29	1.40	1.46	1.49	1.52
10	0.61	1.00	1.18	1.29	1.35	1.40
15	0.37	0.78	1.00	1.13	1.22	1.29
20	0.22	0.61	0.85	1.00	1.11	1.18
25	0.14	0.47	0.72	0.88	1.00	1.09
30	0.08	0.37	0.61	0.78	0.91	1.00
40	0.03	0.22	0.43	0.61	0.74	0.85
50	0.01	0.14	0.31	0.47	0.61	0.72
60		0.08	0.22	0.37	0.50	0.61
80		0.03	0.11	0.22	0.33	0.43
100		0.01	0.06	0.14	0.22	0.31
150			0.01	0.04	0.08	0.14
200				0.01	0.03	0.06
300						0.01

This relationship is analogous to the current versus time relationship when a voltage change is applied across a resistor and a capacitor that are connected in series. Specifically:

Where: $i = \frac{E}{R} e^{-\frac{t}{RC}}$

i = current E = voltage C = capacitance R = resistance t = time

RC = time constant e = 2.7182818 = natural logarithm of 1 (ln 1)

When a voltage is suddenly applied, the current will increase with time according to the above relationship until it reaches its final level. The rate at which the system responds is dependent on the time constant that a designer chooses by selection of appropriate resistance and capacitance values. The time constant is the amount of time that passes from the moment a step change in voltage is applied to the time transient component will have decayed to 36.8 % of its initial value.

Relating back to the proposal, the full time in Table 5 has been employed as the time constant. The factor 1.65 is employed to force the tolerance multiplier a value of 1.0 when the load/unload time is half that in Table 5. The interpretation that the tolerance should only be applicable at half the time in Table 5 has no basis. This was never discussed, nor intended, at the time the Table 5 values were established. Further, the tolerance was to apply when the load is changed relatively instantaneously. The times in Table 5 represent solely a consensus of lab machine capabilities at the time the table was developed. It was recognized that pragmatically one lab's capability might be more favorable to a device submitter than another lab's, but all would recognize the pass/fail result as sufficient. Further, the actual times are to be recorded in order to portray the basis for the conclusion.

While a time constant method of interpolation might be appropriate, the proposed equation is arbitrary; further, it

has shortcomings.

The weighing machine tolerance is based on that change in indication from the initial indication displayed once the load has been completely placed on the device or removed from it. There are no restrictions placed on the loading or unloading times and these times are set by the application conditions at the time of the device use.

The greatest change in indication with time occurs under the condition of a quick full step load change. If the load is changed in a more progressive manner, a lesser change in indication with time will occur from the time the load is fully applied. In the latter case, it might be appropriate to use a time constant relationship to reduce the allowable tolerance applied during a type evaluation, but in no case is an increase in tolerance justified.

Many scales are loaded or unloaded by directly placing or removing the load in one quick step. According to this proposal, a load cell that in turn is loaded or unloaded in one quick step during evaluation would be provided with a tolerance that is greater than the weighing machine's allowance and much greater than that applicable under the load cell's $p_{lc} = 0.7$ apportionment factor. Hence, this proposal is unacceptable.

I think the solution has to be a pragmatic one. We can't dictate that new testing machines be acquired nor old ones modified to achieve exact loading/unloading times. Besides the time probably cannot be exactly measured either and a few seconds one way or the other is likely "in the noise."

Again, it is ultimately the scale's response under the conditions of use that counts and a 30-minute test in the field is not that impractical and you can get a hint in five minutes whether or not to continue with a full 30-minute test.

A bit of history relative to Table 6 in R 60.

I clearly remember chairing the IWG discussion at which the table was born. We were facing an impasse because it was recognized that some labs needed more time than others to load a device than to simply place a full load on as a single dead weight of the proper value and that this could affect the measurement of creep. What to do?

In order to defuse the impasse, I went to the blackboard and canvassed the participants asking what times could they meet. As we went around it became evident that the times given were also dependent on the load capacities of their testers. I decided to see if these times might fit a scheme by categorizing them according to the load being applied.

I decided to use loads of 10 raised to the n^{th} power and wrote the columns 10, 100, 1000, 10 000, 100 000 kg on the board. I next organized the input received and the table began to take shape. We went around the room again and it fell into place and there was a comfortable feeling. We all recognized that a bit of "settling" time should be included before taking the initial reading so we decided on times in the table that were based on using half for loading and half for settling. It was clear that due to differing lab capabilities these times could not exactly be mandated, definitely a "should" and not "shall" basis, and that the competence of the evaluator should also be relied upon.

Comments from Stephen Patoray on Negative Vote: I originally supported this item as it was developed by the Weighing Sector in September 2008, however; there are six (6) main items that have made me change my mind and vote negative on this ballot.

1. Data was presented by the NIST Force Group after the Weighing Sector meeting which is not included with this ballot item. It shows clearly that the outcome (percentage of cells to pass) of the creep return test was NOT affected by increasing the time for the creep return value from 20 seconds to 40 seconds. All seventeen (17) load cells tested since October 1, 2007, were included in this analysis. Twenty-nine percent (29 %) passed at either 20 seconds or 40 seconds return. This is very strong evidence that the time at which this value is taken is not as critical as was originally believed (full data can be supplied if needed).
2. Responses from three OIML laboratories in Europe confirmed that they currently conduct tests for load cells with a nearly instant load/unload and they allow the remaining time in Table 6 of OIML R 60 for stabilization.

In addition, an OIML lab in the Pacific Rim also would allow data to be taken in this manner. Initially, it was thought that the additional stabilization time allowed by these labs would significantly affect the results of the evaluation. The information from NIST FG mentioned in item 1 above indicates that this is not apparently the case.

3. The addition of the proposed formula to NCWM Publication 14 would add significant complexity to the evaluation of data. It is not consistent or in harmony with other requirements of either HB 44 or Publication 14.
4. The proposed formula is not in harmony with the requirements of OIML R 60. While it is a less strict requirement, this would be moving in a direction away from harmonization, not toward it.
5. Currently NCWM is a signatory to the DoMC as a utilizing participant in the MAA for OIML R 60. While the addition of the proposed formula is not in conflict with the arrangement, it does not move NTEP closer to harmonization with OIML R 60.
6. Currently there have been several NTEP CCs issued with current requirements being met, in some cases with retesting taking place to get the device to meet the current requirements. This cost these companies both time and money. While a much looser tolerance of 0.80 v might be easier to meet, it would potentially be a disservice to the companies that have already passed the evaluation and received an NTEP CC.

I therefore do not support the proposed formula and additional language. It is my belief that the information in Table 6 of OIML R 60 be brought into NCWM Publication 14, and that it be clarified with examples that the load/unload times should be no more than approximately ½ the time listed in the table. If it is less than approximately ½ the time, then the remaining time is used for stabilization. This would align with the test methods currently in use by the OIML labs.

Load/unload	Stabilize	Table value
20	20	40
18	22	40
22	18	40
2	38	40
1	39	40

For times longer than those specified, OIML R 60 provides a special case. This could also be incorporated into Publication 14.

Additional Information and Comments from and Tom Bartel:

Sent October 22, 2008:

As requested, I have attached an Excel worksheet that summarizes the results of NIST creep recovery tests since October 1, 2007. It includes tests conducted earlier this month (*see table on the last page of this summary*). All tests were conducted with a recovery reading taken 20 seconds after unloading the creep load (which takes about one second). Since additional recovery readings are taken at 40 seconds and 60 seconds after unloading, these readings may be used to obtain the creep recovery at 30 seconds, 40 seconds, and 50 seconds – which correspond to appropriate lines in the new proposed Table 5 of unloading times for Pub 14. (The reading at 30 seconds may be estimated by averaging the readings at 20 and 40 seconds, and likewise for the reading at 50 seconds.)

The worksheet gives the recovery results obtained from NIST’s tests, for both a fixed “delay time after unloading” of 20 seconds (as has been specified in Pub 14 until now), and for other “delay times after unloading” as given in the new Table 5. In addition, the percentage of entries that “pass” is given, for Class III using a fixed time of 20 seconds, for both the current tolerance (0.5 v) and an increased tolerance of 0.75 v.

While most load cells show a smaller recovery value for greater delay times, the difference is not enough to change the outcome of “pass” or “fail” for any of them. This is a bit surprising, but that is the way the numbers work out.

Note that occasionally a load cell shows a greater recovery value when using a longer delay time after unloading. This can occur if, for example, the creep recovery response curve makes an initial quick dip downward, then reverses sign and rises back toward its starting point. This behavior is not unusual. I can show curves that illustrate it if you like.

Sent October 23, 2008:

I vote “yes” on the ballot; seeing as, technically, I am not a voting member, you can use this for “informational purposes”.

Let me make the following clarifications regarding the implementation of the language on the ballot.

1. The first sentence under II.4. reads “During the conduct of the tests, the initial reading shall be taken at a time interval after the initiation of loading or unloading, whichever is applicable, as specified in Table 5.” Since it takes us about one second to unload our creep test load, this sentence means that, after the unloading is finished, we will wait an additional 19 seconds before taking the first reading for capacities from 10 kg to 100 kg; 29 seconds for capacities from 100 kg to 1000 kg; 39 seconds for capacities from 1000 kg to 10 000 kg; and 49 seconds beyond that.

In other words, for a 2500 lb capacity load cell, our first reading would be 40 seconds after unloading begins, or, equivalently, 39 seconds after unloading is completed. For a 50 klb capacity load cell, we would wait 49 seconds after unloading is completed.

If, on the other hand, you intend to keep constant the time to be utilized for stabilization (half the time given in Table 5), regardless of a laboratory’s unloading time, then you would need to specify this in an explicit manner.

Note that we can accomplish the new requirements at the present time without making any changes to our instrumentation or machine controls.

2. For load cells that we test at NIST, the formula of 4.1.(a) will give a multiplier, M , of 1.57 for the lower end of our range (100 kg and below) and 1.62 for the upper end of our range (above 10 000 kg), which puts the creep recovery tolerance for Class III at 0.78 v to 0.81 v , depending on capacity.
3. While longer unloading times do not apply to NIST, for a laboratory that does, for example, require 50 % more time to unload than required in Table 5, the formula gives a multiplier, M , of 0.78. In other words, for a load cell capacity of 10 kg to 100 kg, Table 5 gives a (total) time of 20 seconds, of which 10 seconds should be used for actual unloading. If a laboratory requires 15 seconds to unload (i.e., 50 % more time than specified), the time ratio T in the formula is 0.75, giving $M = 0.78$, thus giving a reduction in the tolerance to 78 % of the nominal value.

Note that this is not nearly as severe as the requirement in OIML R 60, which states that “the time may be increased from 100 % to a limit of 150 % of the specified time provided that the permissible variation of the result is proportionally reduced from 100 % to 50 % of the allowable difference...”

4. The instructions in this ballot are applying the multiplier, M , to the creep tolerances as well as to the creep recovery tolerance. Note that, in OIML R 60, if the specified loading/unloading times cannot be achieved, an adjustment is made only to the tolerance for minimum dead load output return, not to the tolerances for creep. Since OIML’s language is not entirely consistent here, this may be an oversight on their part. In that case, we are correctly not making the same oversight here in Pub 14.
5. I do assume, however, that you have inadvertently left out of the ballot wording the paragraph giving the tolerance for creep between 20 minutes and 30 minutes (which is 0.15 times the tolerance for the allowed creep over 30 minutes).

None of the five points listed above constitute objections on my part. I am merely pointing them out so that you can make sure that what you intend agrees with what you say.

Tom Bartel, NIST Mass and Force Group

Creep Recovery History and Tolerance Scenario											
NIST Tests 10/1/2007 - 10/20/2008			Current Pub 14/NIST Method			Note 5	Current R 60 Method (inc. lab interpretations for stabilization times)			Note 6. Ballot Proposal	
NCWM Control No.	Capacity	Classification	Delay Time (seconds)	Measured Recovery (v)	5000 v Outcome for Tolerance of 0.50 v	3000 v Outcome for Tolerance of 0.50 v	Approximate Delay Time (seconds)	Measured Recovery (v)	Outcome for Tolerance of 0.50 v	Proposed Exponential Formula Tolerance	5000 v Outcome
	4 klb	III M 5000	20	1.19			40	1.09		0.8	
	4 klb	III M 5000	20	1.14			40	0.95		0.8	
	1000 kg	III M 5000	20	0.58		pass	30	0.51		0.8	pass
	1000 kg	III M 5000	20	0.83		pass	30	0.82		0.8	
	5 klb	III M 5000	20	1.55			40	1.56		0.8	
	5 klb	III M 5000	20	0.30	pass	pass	40	0.17	pass	0.8	pass
	2000 kg	III S 5000	20	0.26	pass	pass	40	0.39	pass	0.8	pass
	2000 kg	III S 5000	20	0.35	pass	pass	40	0.16	pass	0.8	pass
	5 klb	III S 5000	20	1.86			40	1.72		0.8	
	1000 kg	III S 5000	20	0.99			30	0.96		0.8	
	200 lb	III S 5000	20	1.51			20	1.51		0.8	
	1000 kg	III M 5000	20	0.53		pass	30	0.53		0.8	pass
	5 klb	III M 5000	20	0.77		pass	40	0.60		0.8	pass
	5 klb	III M 5000	20	0.48	pass	pass	40	0.39	pass	0.8	pass
	10 klb	III M 5000	20	0.86			40	0.66		0.8	pass
	4 klb	III M 5000	20	0.90			40	0.75		0.8	pass
	4.4 klb	III M 5000	20	0.48	pass	pass	40	0.42	pass	0.8	pass
			percent passing ==>		29 %	53 %	percent passing ==>		29 %		59 %
NCWM Control No.	Capacity	Classification	Delay Time (seconds)	Measured Recovery (v)	Outcome for Tolerance of 1.50 v		Delay Time (seconds)	Measured Recovery (v)	Outcome for Tolerance of 1.50 v		
	30 t	III L M 10000	20	0.56	pass		50	0.90	pass		
	30 t	III L M 10000	20	0.70	pass		50	0.80	pass		

Note 1: Actual time for NIST unloading is on the order of 1 second, regardless of capacity.
 Note 2: "Delay time" means the time between unloading and taking the first (reference) reading.
 Note 3: NIST sampling begins after a "delay time" of 20 seconds; subsequent readings are taken at 40 seconds and 60 seconds after unloading.
 Note 4: Recovery values for "delay times" of 30, 40, or 50 seconds are derived from the most appropriate readings.
 Note 5: Steve Cook added this column showing compliance if data were evaluated as a Class III (300 v) load cell.
 Note 6: Steve Cook added these columns that include the tolerances from the proposed formula and the proposed increase in the stabilization times for the NIST test equipment.

Attachment for Agenda Item 17

National Conference on Weights and Measures/National Type Evaluation Program				
NTETC Weighing Sector Ballot Summary 94-02				
Item No.	Item	Affirm	Negat	Abst
1A	Agree that the proposed language is sufficiently developed and recommend that this item move forward as a voting item on the NCWM S&T 2009 agenda.	4		
NO COMMENTS				
1B	Agree that the proposed language is not sufficiently developed and recommend that this item be given “Information” status on the NCWM S&T 2009 agenda.			
COMMENTS				
	1. Does not believe that the proposed change is fair to the buyer and seller. If the device can zero out a negative weight, then it must be allowed to zero out a positive weight as well. 2. This item should be given “ developmental ” status instead of “informational.” This feature appears on the surface to be OK in direct sale applications, but I would like to hear more discussion on the industrial/heavy capacity side. There is no need to rush this item into HB 44 and should be allowed additional time for the language to be further developed by the Weighing Sector.	2		
1C	Agree (if amended) that the proposed language is sufficiently developed and recommend this item move forward as a voting item on the NCWM S&T 2009 agenda. <i>Please include your recommended changes with your ballot response.</i>			
COMMENTS				
	1. The maximum effect of automatic zero-setting should not be limited to 4 % of the nominal capacity since there are no limits on other zero-setting mechanisms in HB 44. 2. Same as above comment on 1C.	2		
2	Forward a recommendation to the NTEP Committee that an existing CC may be amended upon a successful review on an application and documentation if the proposal is adopted by the NCWM.	4	3	1

National Conference on Weights and Measures/National Type Evaluation Program				
NTETC Weighing Sector Ballot Summary 94-02				
Item No.	Item	Affirm	Negat	Abst
COMMENTS				
	<p>1. The Weighing Sector should make the recommendation to the NTEP Committee after it has developed a consensus on the proposed requirements for automatic zero-setting.</p> <p>2. The requirement of Pub 14 to list any standard feature or option on an NTEP CC is clearly stated. It indicates that an NTEP lab must evaluate any feature or option before it can be listed on an NTEP CC. The commenter voted negative for the following reasons.</p> <ul style="list-style-type: none"> - There are metrological ramifications to how the automatic zero-setting mechanism must function. These metrological features MUST be evaluated by an NTEP lab to ensure the ASZM meets all the requirements. - Currently, there is no procedure developed in Pub 14 for evaluating AZSM. Therefore the NTEP Committee, the NTEP Committee chair, or the NTEP lab evaluators would not have uniform criteria to base their decision to amend an NTEP CC. - It is premature to begin amending NTEP CCs until all due process has run its course, and proper procedures have been developed and reviewed by the Weighing Sector and approved by the NTEP Committee. This is an item that will go before the NCWM S&T Committee. It may or may not be accepted, and, if accepted, may not resemble the original proposal. Additionally, it may or may not be approved by the NCWM representatives and delegates. 			
3	<p>Recommend including the following note to clarify the differences between automatic zero-tracking and automatic zero-setting in the definitions stating:</p> <p><u>Zero-tracking is functionally similar to automatic zero-setting. The differences are important in applying the applicable requirements to maintain and establish an accurate zero-balance condition.</u></p> <ul style="list-style-type: none"> - <u>Automatic zero-setting is activated by an event, such as after a programmed time interval or part of every weighing cycle in an automatic weighing system;</u> - <u>Automatic zero-tracking operates continuously (when the specified conditions are met) and is controlled by a rate of correction (e.g., 0.5 d/second) to prevent interaction with the normal weighing process.</u> 	5	3	0
COMMENTS				
	<p>1. This proposed note should be reviewed and recommended by the Weighing Sector since the item was only discussed by the small work group and not the entire Sector.</p> <p>2. It is not appropriate to include initial zero-setting mechanism under zero-setting mechanism. The feature is not intended to maintain the zero balance of a scale. It is intended to zero the scale upon power-up (of the device) with or without a load on the load-receiving element.</p> <p>3. The commenter supports a definition of zero-tracking and automatic zero-setting (if adopted). The commenter understands the differences, but believes that the proposed language can be improved since there is little difference in wording between the two definitions.</p>			

Appendix C – Attendees

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Appendix D

National Type Evaluation Technical Committee Software Sector

May 20 - 21, 2008 – Reynoldsburg, Ohio
Meeting Summary

Agenda Items

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Carryover Items

1.a. NTETC Software Sector Mission

Source: NCWM Board of Directors

Background: In 2005 the Board of Directors established a National Type Evaluation Technical Committee (NTETC) Software Sector. A mission statement for the Sector was developed at that time.

Mission of the Software Sector:

- Develop a clear understanding of the use of software in today's weighing and measuring instruments.
- Develop NIST Handbook 44, *Specifications, Tolerances, and other Technical Requirements for Weighing and Measuring Devices*, specifications and requirements, as needed, for software incorporated into weighing and measuring devices. This may include tools for field verification, security requirements, identification, etc.
- Develop NCWM Publication 14 checklist criteria, as needed, for the evaluation of software incorporated into weighing and measuring devices, including marking, security, metrologically significant functions, etc.
- Assist in the development of training guidelines for weights and measures officials in verifying software as compliant to applicable requirements and traceable to a NTEP Certificate. Training aids to educate manufacturers, designers, service technicians and end users may also be considered.

Recommendation: There should be an attempt to follow the four bullet items above in order from the top down when discussing agenda items. Focus should begin with any possible impact on NIST Handbook 44.

1.b. NCWM/NTEP Policies – Issuing Certificates of Conformances (CC) for Software

Source: NCWM Reports

Background: Excerpts of reports from the 1995 - 1998 Executive Committees were provided to NTETC Software Sector members at their April 2006 meeting. The chair asked the Sector to review the following NTEP policy decision adopted by the NCWM in 1998 relative to the issuance of a separate Certificate of Conformance (CC) for software.

The NCWM has struggled with software issues for many years. Prior to 1995, NTEP had evaluated stand-alone software (e.g., weigh-in/weigh-out, Point of Sale (POS), and batch controller software) and, in some cases, had issued CCs for stand-alone software. The Board established a software work group (WG) to study the issues and make recommendations.

The WG discussed many issues including: first indication of the final quantity, metrologically significant software, definitions, software marking, software checklist evaluation, a software Examination Procedure Outline (EPO) for the field inspector, user programmable software, and third party software. According to conference reports, it seems in 1997 some concerns were raised about the direction of the WG. In 1997 after the Annual Meeting, the NCWM chair appointed a new Software Work Group.

During the 1998 NCWM, the following recommendation was adopted as NTEP policy:

- Software, regardless of its form, shall not be subject to evaluation for the purpose of receiving a separate software CC from the National Type Evaluation Program.
- Remove all of the software categories from the index of NCWM Publication 5, NTEP Index of Device Evaluations.
- Reclassify all existing software CCs according to their applicable device categories.

The policy is still in effect today.

Also noteworthy is a statement in Section C of NCWM Publication 14, Administrative Policy. It states:

In general, type evaluations will be conducted on all equipment that affect the measurement process or the validity of the transaction (e.g., electronic cash registers interfaced with scales and service station consoles interfaced with retail fuel dispensers); and all equipment to the point of the first indicated or recorded representation of the final quantity on which the transaction will be based.

Discussion: The recommendation below was discussed. It was pointed out that this may be a technical policy that needs to be inserted into each different volume or chapter of NCWM Publication 14 or it may need to be placed in the Administrative Policy volume. The Sector agreed that overall there would be no change to what is currently being done by NTEP and the labs to certify devices; however, the device type or name of the device certified would be changed.

Recommendation from the Sector to the NTEP Committee: The Sector recommended the following language to be submitted to the NTEP Committee as a policy change. The Sector requests the NTEP Committee place this issue on their agenda.

Software Requiring a Separate CC: Software, which is implemented as an add-on to other NTEP Certified main elements to create a weighing or measuring system and its metrological functions, are significant in determining the first indication of the final quantity. Such software is considered a main element of the system requiring traceability to an NTEP CC.

NOTE: OEM software *may* be added to an existing CC or have a stand-alone CC with applicable applications (e.g., a manufacturer adding a software upgrade to their ECR or point-of-sale system, vehicle scale weigh-in/weigh-out software added as a feature to an indicating element, automatic-bulk weighing, liquid-measuring device loading racks, etc.) and minimum system requirements for “type P” devices (see proposed software definition below). It may be possible for a manufacturer to submit a single application for both hardware and software contained in the same device. A single CC would be issued.

In this instance, OEM refers to a third party. The request to add software could be made by the original CC holder on behalf of the third party. Alternatively, a new CC could be created that refers to the original CC and simply lists the new portions that were examined.

1.c. Definitions for Software Based Devices

Source: NTETC Software Sector

Background: Discussed was marking and G-S.1.1. Location of Marking Information for Not-Built-for-Purpose, Software-Based Devices. It was initially suggested that “not-built-for-purpose” be removed from the wording in NIST HB 44 G-S.1.1. However, after further discussion this may not be the correct or final decision. Handbook 44 does not have a definition for a not-built-for-purpose device. The current HB 44 definition for a built-for-purpose device reads:

Built-for-purpose device. Any main device or element, which was manufactured with the intent that it be used as, or part of, a weighing or measuring device or system. [1.10]
(Added 2003)

There was also the suggestion to use the definitions from the WELMEC document for Type P and Type U instruments. They were modified by the Sector. It was also suggested that a list of examples be provided.

Draft definitions for consideration:

Built-for-purpose weighing or measuring instrument (device) (type P): A weighing or *measuring instrument (device)* designed and built specially for the task in-hand. Accordingly, the embedded software is assumed to be designed for the specific task. It may contain many components also used in PCs, e.g., motherboard, memory card, etc.

A weighing or measuring instrument (device) using a universal computer (type U): A *weighing or measuring instrument (device)* that uses a general-purpose computer, usually a PC-based system, for performing metrologically significant functions.

Examples:

- Type U
- Weigh-in/Weigh-out
- Open Architecture

The Sector agreed to forward the recommendation to the S&T Committee.

Recommendation from the Sector to the S&T Committee:

The Sector recommended that the following definitions be submitted to the S&T Committee as an item and be considered for inclusion in NIST Handbook 44.

New Definition:

Electronic devices, software-based. Weighing and measuring devices or systems that use metrological software to facilitate compliance with Handbook 44. This includes:

- (a) **Embedded software devices (Type P), aka built-for-purpose.** A device or element with software used in a fixed hardware and software environment that cannot be modified or uploaded via any interface without breaking a security seal or other approved means for providing security, and will be called a “P”, or
- (b) **Programmable or loadable metrological software devices (Type U), aka not-built-for-purpose.** A personal computer or other device and/or element with PC components with programmable or loadable metrological software, and will be called “U.” A “U” is assumed if the conditions for embedded software devices are not met.

From NCWM Publication 16, 2008:

310-2 D Appendix D – Definition of Electronic Devices, Software-Based

Source: National Type Evaluation Technical Committee (NTETC) – Software Sector (This item was assigned developing status and moved to 360-2 Part 1, Item 2.)

Appendix A Part 1, Item 2 Appendix D – Definition of Electronic Devices, Software-Based

(This item first appeared on the 2008 S&T Committee Interim Agenda as Item 310-2)

Source: National Type Evaluation Technical Committee (NTETC) – Software Sector

Recommendation: Add a new definition and cross-reference term to Appendix D in HB 44 for “Electronic devices, software-based” as follows:

Electronic devices, software-based. Weighing and measuring devices or systems that use metrological software to facilitate compliance with Handbook 44. This includes:

(a) Embedded software devices (Type P), aka built-for-purpose. A device or element with software used in a fixed hardware and software environment that cannot be modified or uploaded via any interface without breaking a security seal or other approved means for providing security, and will be called a “P,” or

(b) Programmable or loadable metrological software devices (Type U), aka not-built-for-purpose. A personal computer or other device and/or element with PC components with programmable or loadable metrological software, and will be called “U.” A “U” is assumed if the conditions for embedded software devices are not met.

Software-based devices – See Electronic devices, software-based.

Background/Discussion: During the NTETC Software Sector discussion on marking requirements and G-S.1.1. Location of Identification Information, it was initially suggested that the term “not-built-for-purpose” be removed from the wording in NIST HB 44 paragraph G-S.1.1. since there is no definition for a not-built-for-purpose device in HB 44. After a lengthy discussion related to the terms “built-for-purpose” and “not-built-for-purpose,” the Sector agreed these terms were not clear and should be replaced with the terminology proposed above. The proposed definitions are based on the revision of OIML R 76 Non-automatic weighing instruments Subsections 5.5.1. (Type P) and 5.5.2. (Type U).

At the 2008 Interim Meeting, the SMA supported the intent of the item but stated that it is premature to place these definitions in HB 44. The SMA recommended that the status of the item be changed to Developing on the S&T Committee agenda. The Committee agreed to move Item 310-2 of the 2008 S&T Committee Interim agenda and assign Developing status as 360-2 Part 1, Item 2.

Conclusion: The Sector discussed why this item was moved to Developing by the S&T Committee. It seems that the only issue in question was the use of the “aka.” The Sector noted that it believes this item was already developed and should be placed on Informational status by the S&T so that additional discussion can be held on this item at open hearings.

The Sector again discussed “first final” and what is required. The NCWM Publication 14 states that first final is up to the first final indicated or recorded representation on which the transaction is based. NTEP only provides the guidelines for evaluation; it does not set regulations.

1.d. Software Identification/Markings

Source: NTETC Software Sector

Background/Discussion: During their October 2007 meeting, the Sector discussed the value and merits of required markings for software. This included the possible differences in some types of devices and marking requirements. After hearing several proposals, the Sector agreed to the following technical requirements applicable to the marking of software:

1. the NTEP CC Number must be continuously displayed or hard marked,
2. the version must be software-generated and shall not be hard marked,
3. the version is required for embedded (Type P) software,
4. printing the required identification information can be an option,
5. command or operator action can be considered as an option in lieu of a continuous display of the required information, and
6. devices with Type P (embedded) software must display or hard mark make, model, S.N. to comply with G-S.1. Identification.

The Sector developed marking information requirements and submitted a proposal to the S&T Committee for considered inclusion in NIST Handbook 44. Unfortunately, some changes made to the table as the item was prepared for Publication 16, did not reflect the content of the table as it was submitted by the Sector.

The table **as seen** in NCWM Publication 16 2008 Agenda Item:

Appendix A Part 1, Item 1 General Code: G-S.1. Identification – (Software)

Source: National Type Evaluation Technical Committee – Software Sector

Recommendation: Amend G-S.1. and/or G-S.1.1. to include the following:

Method	NTEP CC No.	Make/Model/Serial No.	Software Version/Revision ¹
TYPE P electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X	X	Not Acceptable
Continuously Displayed	X	X	X
By command or operator action	Not Acceptable	Not Acceptable	X ²
TYPE U electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X ³	X	Not Acceptable
Continuously Displayed	X	X	X
Via Menu (display) or Print Option	Not Acceptable	X ⁴	X ⁴
¹ If the manufacturer declares that the primary sensing element “software” is integral, has no end user interface and no print capability, the element may be considered exempt from the marking requirement for version/revision. Example: Primary sensing element may be Positive Displacement (P.D.) meter with integral correction, digital load cell (only for reference, not limiting). ² Information on how to obtain the Version/Revision shall be included on the NTEP CC. ³ Only if no means of displaying this information is available. ⁴ Information on how to obtain Make/Model, Version/Revision shall be included on the NTEP CC. Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.			

The Sector reviewed this table and made both corrections and further clarifications. The table as **currently proposed** by the Sector to the S&T Committee is as follows:

The table is split into Type P and Type U devices for clarity. While there are similarities between the Type P and Type U devices, they are unique and must be treated separately.

Method	NTEP CC No.	Make/Model/Serial No.	Software Version/Revision ¹
TYPE P electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X	X	Not Acceptable ¹
Continuously Displayed	X	X	X
By command or operator action	Not Acceptable	Not Acceptable	X ²
¹ If the manufacturer declares that the primary sensing element “software” is integral, has no end user interface and no print capability, the element may be considered exempt from the marking requirement for version/revision. the version/revision shall be hard marked on the device. Example: Primary sensing element may be Positive Displacement (P.D.) meter with integral correction, digital load cell (only for reference, not limiting). ² Information on how to obtain the Version/Revision shall be included on the NTEP CC. <u>Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.</u>			

Method	NTEP CC No.	Make/Model/Serial No.	Software Version/Revision
TYPE U electronic devices shall meet at least one of the methods in each column:			
Hard-Marked	X ³	X	Not Acceptable
Continuously Displayed	X	X	X
Via Menu (display) or Print Option	Not Acceptable	X ⁴	X ⁴
³ Only if no means of displaying this information is available. ⁴ Information on how to obtain Make/Model, Version/Revision shall be included on the NTEP CC. Metrologically significant software shall be clearly identified with the software version. The identification may consist of more than one part but one part shall be only dedicated for the metrologically significant portion.			

Conclusion: Submitted to NCWM S&T Committee.

2. Identification of Certified Software

Source: NTETC Software Sector

Discussion from Previous Meetings: The Sector agreed that the title of this item needs changed to “Identification of Certified Software.”

- Currently, use Version No., ID No., and Serial No.; however, there is no physical tie to the actual software.
- Some international documents, like the WELMEC document, tell how to do tie the ID to the software; these include:

Possible methods: (not limited to)
CRC (cyclical redundancy check),
Checksum,
Inextricably Linked version no.,
Encryption, and
Digital Signature.

The question remains: Is there some method to give the weights and measures inspector information that something has changed?

How can the W&M inspector easily identify an NTEP Certified version?

Required Documentation:

The documentation shall list the software identifications and describe how the software identification is created, how it is inextricably linked to the software itself, how it may be accessed for viewing, and how it is structured in order to differentiate between version changes with and without requiring a type approval.

NTEP strongly recommends that metrological software be separated from non-metrological software for ease of identification and evaluation.

Separation of Software Parts – All software modules (programmes, subroutines, objects, etc.) that perform metrologically significant functions or that contain metrologically significant data domains form the metrologically significant software part of a measuring instrument (device or sub-assembly). The conformity requirement applies to all parts and parts shall be marked according to Section G-S-X.X.

If the separation of the software is not possible or needed, then the software is metrologically significant as a whole.

Segregation of parameters is currently allowed. (see table of sealable parameters)

May 2008 Meeting Discussion: The Sector discussed this item at great length. The following discussion points are suggestions under consideration by the Sector:

CC would have list of functions.

One suggestion is to have the manufacturer have “some number” that is “inextricably linked” to the software version; one method is CRC.

There is the suggestion that information will be on the CC as to how the inspector can find the information on the “device” regarding the software version or other methods of identification.

It seems the software developers in attendance do not have a problem with putting a statement in Publication 14 that if you have a CC, you have a version number. The inspector then can have a means of tying the version number that he/she sees when they walk up to the device to the information on the CC. The method to do this will be defined by the manufacturer and will be verified by the NTEP lab during evaluation of the device. The list of CRC, digital signature, inextricably linked, checksum are some possible methods to do this.

Question: Is the checksum or CRC on the CC? There was a response that there needs to be information on the CC that would indicate the CRC or checksum, etc. One possibility is an “audit trail” of changes that is on the device.

Fees may be an issue, but that does not need to be considered at this point.

Timing and lab backlog must also be considered.

In WELMEC, every change is reported, and they decide what is significant or not.

In discussion on tare values, is there a need to ID the tares with a checksum? This seems to be too extreme, this is auditable data. This must be accessed; this is like a unit price on a gas pump. Tare data is not included in the metrologically significant software part!

A member stated perhaps there should only be one “metrologically significant software part” if we use the same terminology as the international community, hence the change in plurality here.

How does a field inspector verify the proper tare was used if someone complains about a transaction a few days afterward (or a series of transactions)? Perhaps the tare data is being stored externally (e.g., a central host), so another question is how do you enforce proper Category III logging in a distributed system like that?

Example from DSW 2 CD:

The executable file “**tt100_12.exe**” is protected against modification by a checksum. The value of the checksum as determined by algorithm **XYZ** is **1A2B3C**.

Possibly “parametric data” could be used.

The Sector discussed the definition of an “enclosed system.” This means that the manufacturer has compiled their own software, and it is distributed to their own facilities or it runs on a server at a main location. There is “limited” access to the software from outside the “circle.”

Conclusion: The item needs additional discussion and development by the Sector.

3. Software Protection/Security

Source: NTETC Software Sector

Background from Previous Meetings: The Sector agreed that Handbook 44 already has audit trail and physical seal, but these may need to be enhanced.

From the WELMEC Document:

Protection Against Accidental or Unintentional Changes: Metrologically significant software and measurement data shall be protected against accidental or unintentional changes.

Specifying Notes: Possible reasons for accidental changes and faults are: unpredictable physical influences, effects caused by user functions and residual defects of the software even though state of the art development techniques have been applied.

This requirement includes:

- (a) Physical influences: Stored measurement data shall be protected against corruption or deletion when a fault occurs or, alternatively, the fault shall be detectable.
- (b) User functions: Confirmation shall be demanded before deleting or changing data.
- (c) Software defects: Appropriate measures shall be taken to protect data from unintentional changes that could occur through incorrect program design or programming errors, e.g., plausibility checks.

Required Documentation: The documentation should show the measures that have been taken to protect the software and data against unintentional changes.

Example of an Acceptable Solution:

- The accidental modification of software and measurement data may be checked by calculating a checksum over the relevant parts, comparing it with the nominal value, and stopping if anything has been modified.
- Measurement data are not deleted without prior authorization, e.g., a dialogue statement or window asking for confirmation of deletion.
- For fault detection see also Extension I.

The Sector continued to develop a proposed checklist for Publication 14. The numbering will still need to be added. This is roughly based on R 76-2 checklist and discussion from the October 2007 Sector meeting.

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The NTEP labs have been asked by the Sector Chair to begin to use this checklist for new devices coming into the labs. The main purpose of this trial by the NTEP labs is to begin to gather information on any possible problems with the checklist. At this point, this is a draft only and has not been submitted for review by the NTEP Committee.

The information requested by this checklist is currently voluntary; however, it is recommended that applicants comply with these requests or provide specific information as to why they may not be able to comply. Based on this information, the checklist may be amended to better fit with NTEP’s need for information and the applicant’s ability to comply.

The California, Maryland, and Ohio labs agreed to use this checklist on one of the next devices they have in the lab and report back to the Sector on what the problems may be.

Devices with embedded software TYPE P (aka built-for-purpose)		
	Declaration of the manufacturer that the software is used in a fixed hardware and software environment, and	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	cannot be modified or uploaded by any means after securing/verification	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	<i>Note: It is acceptable to break the “seal” and load new software; audit trail is also a sufficient seal.</i>	
	The software documentation contains:	
	description of the (all) metrologically significant functions (OIML states that there shall be no undocumented functions)	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	description of the securing means (evidence of an intervention)	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	software identification	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	description of how to check the actual software identification	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	The software identification is:	
	clearly assigned to the metrologically significant software and functions	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	provided by the device as documented	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Personal computers, instruments with PC components, and other instruments, devices, modules, and elements with programmable or loadable metrologically significant software TYPE U (aka not-built-for-purpose)		
	The <i>metrologically significant</i> software is:	
	documented with all relevant (see below for list of documents) information	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	protected against accidental or intentional changes	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	Evidence of intervention (such as, changes, uploads, circumvention) is available until the next verification/inspection (e.g., physical seal, checksum, CRC, audit trail, etc., means of security)	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Software with closed shell (no access to the operating system and/or programs possible for the user)		
	Check whether there is a complete set of commands (e.g., function keys or commands via external interfaces) supplied and accompanied by short descriptions	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	Check whether the manufacturer has submitted a written declaration of the completeness of the set of commands	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

Operating system and/or program(s) accessible for the user:		
	Check whether a checksum or equivalent signature is generated over the machine code of the metrologically significant software (program module(s) subject to legal control W&M jurisdiction and type-specific parameters)	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	Check whether the metrologically significant software will detect and act upon any unauthorized alteration of the metrologically significant software using simple software tools e.g., text editor.	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Software interface(s)		
	Verify the manufacturer has documented:	
	the program modules of the metrologically significant software are defined and separated	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	the protective software interface itself is part of the metrologically significant software	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	the <i>functions</i> of the metrologically significant software that can be accessed via the protective software interface	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	the <i>parameters</i> that may be exchanged via the protective software interface are defined	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	the description of the functions and parameters are conclusive and complete	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	there are software interface instructions for the third party (external) application programmer	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

From OIML DSW-2 CD as a reference ONLY.

x.y.z. Typical **Required** Documentation (for each measuring instrument, electronic device, or sub-assembly) basically includes:

- A description of the ~~legally relevant~~ metrologically significant software and how the requirements are met;
 - List of software modules that belong to metrologically significant part (~~Annex B~~) including a declaration that all metrologically significant functions are included in the description;
 - Description of the software interfaces of the metrologically significant software part and of the commands and data flows via this interface including a statement of completeness (~~Annex B~~);
 - Description of the generation of the software identification;
 - ~~Depending on the validation method chosen in the relevant OIML Recommendation (see 6.4) the source code shall be made available to the testing authority if high conformity or strong protection is required by the relevant OIML Recommendation;~~
 - List of parameters to be protected and description of protection means;
- A description of suitable system configuration and minimal required resources (see 5.2.4);
- A description of security means of the operating system (password, ... if applicable); (who controls the system, and at what level);
- A description of the (software) sealing method(s) (what may be altered, and how to keep from being altered);
- An overview of the system hardware, e.g., topology block diagram, type of computer(s), type of network etc. Where a hardware component is deemed legally relevant metrologically significant (find and replace) or performs metrologically significant functions, this should also be identified;

- A description of the accuracy of the algorithms (like filtering of A/D conversion results, price calculation, rounding algorithms, ...);
- A description of the user interface, menus and dialogues;
- The software identification and instructions for obtaining it from an instrument in use;
- List of commands of each hardware interface of the measuring instrument/electronic device/sub-assembly including a statement of completeness;
- List of durability errors that are detected by the software and if necessary for understanding, a description of the detecting algorithms (we may not understand this one);
- A description of datasets stored or transmitted;
- If fault detection is realised in software, a list of faults that are detected and a description of the detecting algorithm;
- An overview of the system hardware, e.g., topology block diagram, type of computer(s), type of network etc.;
- The operating manual.

This will go under a heading and be placed in a documentation paragraph.

From previous notes this may be part of another section in the publication.

Software Identification		
	The metrologically significant software is identified by a software identification	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	The software identification:	
	covers all program modules of the metrologically significant software and the type-specific parameters at runtime of the instrument	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	is easily provided by the instrument	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	can be compared with the reference identification fixed at type approval	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
	Spot check whether the checksums (signatures) are generated and means of identifying the software works as documented	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

<p>The audit trail (this needs to be changed to reflect a software update log) shall update and display (show, indicate) when the software version has changed</p> <p>An entry is generated for each software update. The software log/audit trail shall contain the following information:</p> <ul style="list-style-type: none"> • notification of the update procedure, • software identification of the installed version, • time stamp of the event, • identification of the downloading party. <p>Updates to software shall be either manually verified (Verified Update) or automatically performed and traced (Traced Update).</p> <p>For a Traced Update, an event logger is required. An entry shall be generated for each software update and must include the following:</p> <ul style="list-style-type: none"> • an event logger (with a minimum of 10 updates), • the parameter ID, which indicates the software update, • the date and time of the change, and • the new value of the parameter, which is the software identification of the installed version. 	<p>Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/></p>
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This information may need to be included in HB 44. It may be possible to add this to the General Code section.

May need to define what a software update log is.

G-S.9. Verification of Software Update

Only versions of metrologically significant software that conform to the approved type are allowed for use.

Updates to software shall be either manually verified (Verified Update) or automatically performed and traced (Traced Update).

For a Traced Update, an event logger is required. An entry shall be generated for each software update and must include the following:

- an event logger (with a minimum of 10 updates),
- the parameter ID, which indicates the software update,
- the date and time of the change, and
- the new value of the parameter, which is the software identification of the installed version.

~~An entry is generated for each software update.~~
~~The software log/audit trail shall contain the following information:~~

- ~~• parameter ID; software update, etc,~~
- ~~• new value; software identification of the installed version,~~
- ~~• date and time of the change,~~
- ~~• identification of the downloading party. (considered this~~

~~The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.~~

If the device continues to operate during a software update, then the metrological performance shall not be affected.

The Maryland lab wanted it on record that they disagree with this statement and are striking the first sentence based on discussions within the Weighing Sector and the Measuring Sector and the NTEP lab meetings on the subject of calibration and configuration while in the normal weighing measuring mode. The sentence that has been struck out was placed in the DES checklist years ago to address field concerns.

It was noted there is a statement in the WELMEC document that concurs with the statement above as stricken.

Use of a Category 3 audit trail is acceptable for the software update logger.

Definitions Recommendation:

Verified Update. A verified update is the process of installing new software where the security is broken and the device must be re-verified. Checking for authenticity and integrity is the responsibility of the owner/user.

Traced Update. A traced update is the process of installing new software where the software is automatically checked for authenticity and integrity, and the update is recorded in a software update log or audit trail.

Note: The Sector agreed that these two definitions directly above for Verified Update and Traced Update were acceptable.

Question: Do we need the definitions below any longer? Comment: There is text in these definitions that doesn't belong in the definition, but may be applicable for other purposes, primarily the bit about the software protection environment being at the same level after upgrade when doing traced update. The Sector has not addressed that yet and it is important.

Previous definitions:

Verified Update. The software to be updated can be loaded locally (e.g., directly) on the weighing or measuring device or remotely via a network. Loading and installation may be two different steps combined to one, depending on the needs of the technical solution. After update of the metrologically significant software of a weighing or measuring device, exchanged with another approved version or re-installation, the weighing or measuring device is not allowed to be used for legal purposes before a (subsequent) verification of the instrument has been performed, and the securing means has been renewed. A person responsible for verification must be at place. (**NOTE:** This may need to be in the handbook under user requirement.)

Traced Update. Traced update is the procedure of changing software in a weighing or measuring device after which the subsequent verification by a responsible person at place is not necessary. The software to be updated can be loaded locally (e.g., directly) on the weighing or measuring device or remotely via a network. The software update is recorded in a software log or audit trail.

Traced update of software shall be automatic. On completion of the update procedure, the software protection environment shall be at the same level as required by the type approval.

Comment: The data storage device does not appear to be appropriate for the U.S. weights and measures system.

A member provided an explanation of a Data Storage Device (DSD) explaining it is an EU requirement for "legal requirements." This is the alibi memory that is a replacement for the paper printout that is required in EU. A Watt Meter will also act as DSD and store information on electricity usage over a long period of time.

The Sector agreed to delete the DSD checklist from future discussions of this Sector.

Data storage devices (DSD)		
From the previous meeting, this was tabled (This checklist was not reworked at this time)		
5.5.3	G.3.1	DSD realised with embedded software (examine software acc. to G.1) Yes <input type="checkbox"/> No <input type="checkbox"/>
		DSD realised with programmable/loadable software (examine software acc. to G.1) Yes <input type="checkbox"/> No <input type="checkbox"/>
		documentation with all relevant information
5.5.3.1	G.3.2	sufficient storage capacity for the intended purpose
		data are stored and given back correctly
		sufficient description of measures to prevent data loss
5.5.3.2	G.3.3	storage of all relevant information necessary to reconstruct an earlier weighing, i.e. gross, net, tare values, decimal signs, units, identifications of the data set, instrument number, load receptor, (if applicable), checksum / signature of the data set stored.
5.5.3.3	G.3.4	protection of the stored metrologically significant data against accidental or intentional changes
		protection of the stored metrologically significant data at least with a parity check during transmission to the storage device
		protection of the stored metrologically significant data at least with a parity check of a storage device with embedded software (5.5.1)
		protection of the stored metrologically significant data by an adequate checksum or of a storage device with programmable or loadable software (5.5.2)
5.5.3.4	G.3.5	identification and indication of the stored metrologically significant data with an identification number
		record of the identification number on the official transaction medium, i.e. on the print out
5.5.3.5	G.3.6	automatic storage of the metrologically significant data
5.5.3.6	G.3.7	a device subject to legal control prints or displays the stored metrologically significant data for verifying

Conclusion: The Sector agreed to further develop a proposal to forward to the S&T Committee, adding a Section G-S.9. and two definitions to Handbook 44. It was agreed the Item G-S.9. would be sent out for ballot to the Sector members and meeting attendees.

[**Note:** In the summer of 2008, a ballot was sent to all members of the Sector. A majority of the members returning ballots voted in favor of the proposal (7 to 2). However, there were several comments received from both yea and nay voters regarding the proposal. After review of the comments, the Sector Chair decided that, considering all the circumstances, the Sector needed more discussion on the item before it is moved forward in the process and is submitted to the S&T Committee.]

4. Software Maintenance and Reconfiguration

Source: NTETC Software Sector

Background: After the software is completed, what do the manufacturers use to secure their software?

Discussion: The following items were reviewed by the Sector. Note that agenda Item 3 also contains information on Verified and Traced updates and Software Log.

- a. Verify that the update process is documented (OK)
- b. For traced updates, installed software is authenticated and checked for integrity

Technical means shall be employed to guarantee the authenticity of the loaded software i.e., that it originates from the owner of the type approval certificate. This can be accomplished e.g., by cryptographic means like signing. The signature is checked during loading. If the loaded software fails this test, the instrument shall discard it and either use the previous version of the software or become inoperative.

Technical means shall be employed to guarantee the integrity of the loaded software i.e., that it has not been inadmissibly changed before loading. This can be accomplished e.g., by adding a checksum or hash code of the loaded software and verifying it during the loading procedure. If the loaded software fails this test, the instrument shall discard it and either use the previous version of the software or become inoperative.

Examples are not limiting or exclusive.

- c. Verify that the sealing requirements are met

The Sector asked, “What sealing requirements are we talking about?”

This item is only addressing the software update; it can be either verified or traced. It is possible that there are two different security means, one for protecting software updates (software log) and one for protecting the other metrological parameters (Category I, II, or III method of sealing).

Some examples provided by the Sector members include but are not limited to physical seal, software log, Category III method of sealing and can contain both means of security.

- d. Verify that if the upgrade process fails, the device is inoperable or the original software is restored

The question before the group is, “Can this be made mandatory?”

The manufacturer shall ensure by appropriate technical means (e.g., an audit trail) that traced updates of metrologically significant software are adequately traceable within the instrument for subsequent verification and surveillance or inspection. *This requirement enables inspection authorities, which are responsible for the metrological surveillance of legally controlled instruments, to back-trace traced updates of metrologically significant software over an adequate period of time (that depends on national legislation).* The statement in italics will need to be reworded to comply with U.S. weights and measures requirements.

See agenda Item 3, G-S.9.

Only versions of metrologically significant software that conform to the approved type are allowed for use.

Updates to software shall be either manually verified (Verified Update) or automatically performed and traced (Traced Update).

For a Traced Update, an event logger is required. The logger shall be capable of storing a minimum of the 10 most recent updates. An entry shall be generated for each software update and must include the following:

- the event type/parameter ID, which indicates a software update event (if not using a dedicated update log),
- the date and time of the change, and
- the new value of the parameter, which is the software identification of the newly installed version.

The traceability means and records are part of the metrologically significant software and should be protected as such. The software used for displaying the audit trail belongs to the fixed metrologically significant software. **Note:** This requires further discussion due to some manufacturers' concerns about where the software that displays the audit trail information is located, and who has access if this feature is provided. Manufacturers did indicate that there are methods available to encrypt the audit trail information; however, it cannot be protected from being deleted.

The following flowchart is sourced from OIML TC 5/SC 2, D-SW and is currently under revision.

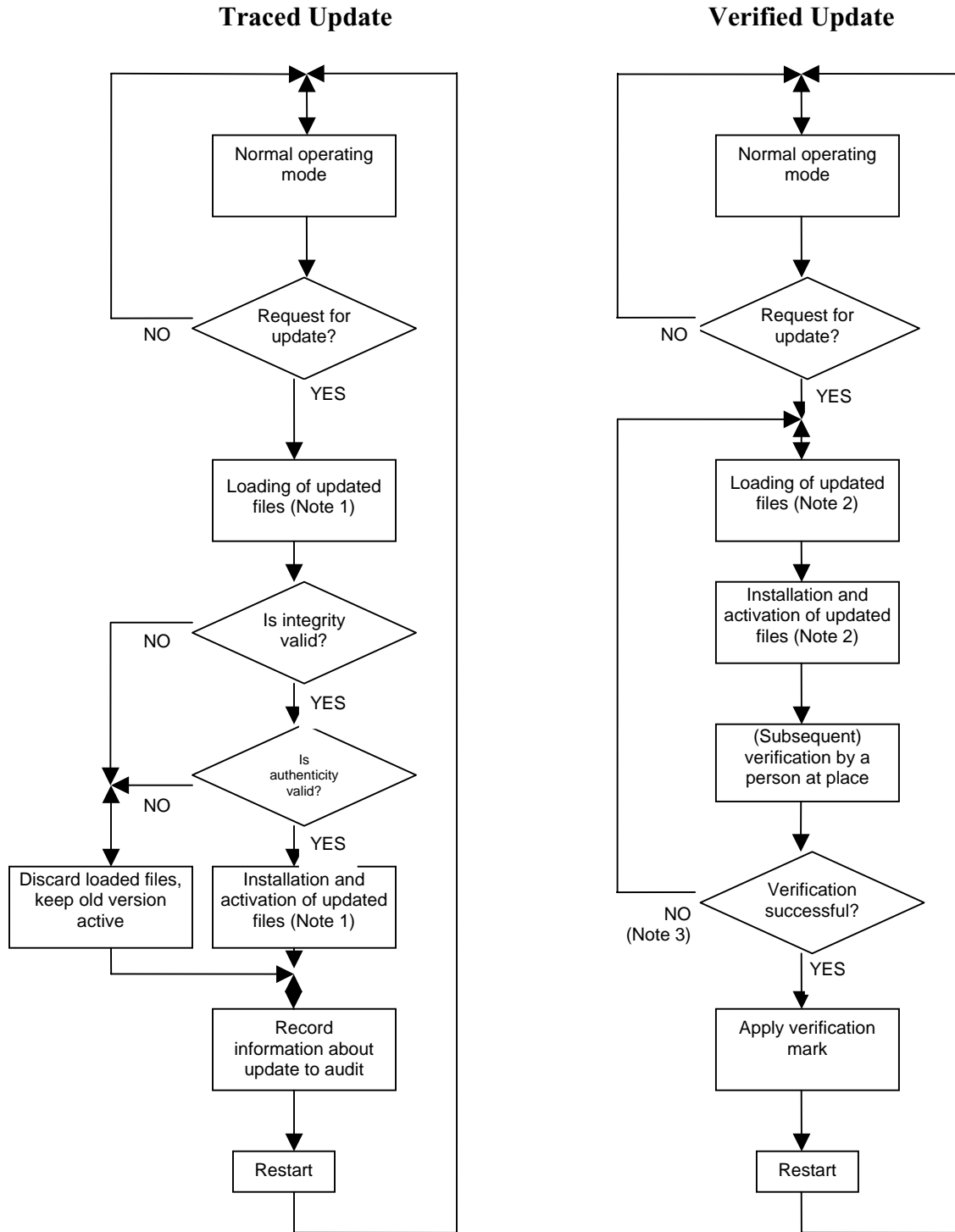


Figure 5-1: Software update procedures

Notes to Figure 5-1:

- 1) In case of *Traced Update*, updating is separated into the steps: “loading” and “installing/activating”. This implies that the software is temporarily stored after loading without being activated because it must be possible to discard the loaded software if the checks fail, and either fall back to the old version, **or become inoperative.**
- 2) In case of *Verified Update*, the software may also be loaded and temporarily stored before installation but depending on the technical solution, loading and installation may also be accomplished in one step.
- 3) Here, only failing of the verification because of the software update is considered. Failing because of other reasons doesn’t require re-loading and re-installing of the software, symbolised by the “NO” branch.

Conclusion: This agenda item is closely tied to agenda Item 3, Software Protection/Security; in fact much of the content from previous Sector reports has been moved to Item 3. This item needs to be discussed further due to some manufacturers’ concerns about where the software that displays the audit trail information is located, and who has access if this feature is provided. The Sector will continue to develop this item.

5. Verification in the Field, by the Weights and Measures Inspector

Source: NTETC Software Sector

Background Question: What tools does the field inspector need?

Possible Answers:

- NTEP CC number are continuously displayed (needs some type of protection) during the normal weighing or measuring operation.
- Clear and simple instructions on NTEP CC to get to the other inspection information.
- CRC, checksum, version number etc., needs to be easily accessible from operator console.
- Inspector needs to know how to access audit trail.
- System information is easily accessible (ram, OS, etc).
- System parameters are easily accessible (AZT, motion, time-outs, etc.).

May 2008 Meeting: There was no additional discussion on this item. The Sector will continue to develop this item.

6. NTEP Application

Source: NTETC Software Sector

May 2008 Meeting: There was no additional discussion on this item by the Sector at this time.

New Items

7. Recommendation on Sector Chair and Technical Advisor

Source: NTEP Director

Background: With the changes to the management structure of NCWM, the Sector will need to discuss and make recommendations regarding persons to fill the roles of (NTETC) Sector Chair, and Technical Advisor to the Sector. Refer to NCWM Publication 14 Administrative Policy Section B. Administration, Subsection B.3. Paragraph 2, page AP-4.

Recommendation to NTEP Committee: The Sector discussed various options and candidates and now recommends the following Sector members for the described roles.

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Documentation (scribe): Teri Gulke, Liquid Controls

Technical Advisor: Doug Bliss, Mettler-Toledo

Co-Sector Chairs: Norm Ingram, California Division of Measurement Standards
Jim Pettinato, FMC Technologies

8. Next Meeting

The Sector members were informed they are now on a yearly schedule for Sector meetings.

The Sector discussed the pros and cons of various meeting times and coordination with other NTEP or NCWM meetings. The NTEP Administrator will determine when the next meeting is possible.

Appendix E

Verified Conformity Assessment Program (VCAP) Frequently Asked Questions (Emphasis on Load Cells)

National Conference on Weights and Measures/National Type Evaluation Program



What is it?

The Verified Conformity Assessment Program, or VCAP, is a program proposed by the National Conference on Weights and Measures to ensure compliance of certain device types with environmental requirements. These device types are those devices whose performance can be affected by changes in their physical environment. The intent of the VCAP is to provide a level of assurance that these devices perform at a level equal to or better than the device that was evaluated by NTEP.

What devices fall under the VCAP?

Any device listed on a NTEP CC whose performance can be affected by changes in its operating environment. Generally, these include load cells, digital weight indicators, weighing and load-receiving elements using load cells that do not have an NTEP certificate, complete scales, automatic weighing systems, belt-conveyor scales, and automatic bulk weighing systems. The program will begin with load cells only.

Why is NTEP initiating this program now?

The National Conference on Weights and Measures (NCWM) and National Type Evaluation Program (NTEP) have been concerned about production meeting type, protecting the integrity of the NTEP CC since the inception of NTEP. A WG was developed to assist the NCWM with this effort, which has provided feedback and recommendations to the conference. The NCWM Board of Directors thinks it has reached a point that the Verified Conformity Assessment Program can be launched. Load cells traceable to NTEP certificates have been selected for the initial effort.

Who must comply with the VCAP?

Any holder of an NTEP CC for a device type listed above must comply with the program. Again the program will begin with load cells.

Why two programs, SMA/PMT and NCWM/VCAP? What's different?

The PMT and VCAP are administered by two different organizations. Although similar, PMT is a manufacturer program developed by manufacturers, where VCAP is a regulatory requirement developed by the NCWM.

Is it enough for a manufacturer to submit a PMT compliance certificate?

No. The Certification Body report must state compliance with VCAP. The PMT and VCAP are similar but not identical.

Must I have my quality system ISO-certified to comply with VCAP?

No. While the ISO 9000 series quality standards and VCAP share a number of common features, ISO certification is not required.

Our company has an ISO-certified quality system. Isn't that enough for compliance with VCAP?

No. Although there are some similarities, VCAP differs in its requirements so ISO certification alone is not an acceptable substitute.

Who is going to pay for this?

The CC holder is responsible for providing proof of VCAP certification, by a Certification Body, to NTEP. NTEP will not pay any costs associated with accreditation, audits, testing or certification.

We do not produce any cells but we have private label agreements and certificates. Other than notifying the load cell manufacturers (vendors), do we need to do anything else? It appears the responsibility falls on the manufacturers.

In the eyes of NTEP, the CC holder is responsible for the product, including taking responsibility for assuring that production devices meet type. NTEP expects the CC holder to take responsibility for the integrity of the certificate and product (device, instrument, main element, component, etc.). NTEP is expecting private label certificate holders to verify with the manufacturer under contract that VCAP requirements are being met. It is expected CC holders will have QA procedures in place, including controls over the supplier, purchase and compliance of the product covered under the private label agreement.

How do I know whether my supplier complies with the VCAP or not?

You are responsible for making certain that your supplier complies with the VCAP program. If your supplier fails to conform, their NTEP CC will ultimately become inactive as well as your private label certificate (if you have one). One way to make sure your supplier complies is to ask that you receive a copy of the VCAP auditor's report.

Does this mean that the NCWM/NTEP will notify CC holders, schedule a date for review, perform the initial review of the CC holder's process, and perform the audit at the manufacturing site?

No. The CC holder is responsible for assuring a documented quality management system, meeting VCAP requirements, is in place and providing NTEP with a Certification Body audit report containing a clear statement of compliance with VCAP.

In general, what must I do to comply with VCAP?

If you are the manufacturer of the device, there are a number of requirements. You may already comply with most or all of them. They include:

- a. A Quality Management System that governs the design and manufacture of the device. This Quality Management System must be documented in your Quality Manual.
- b. Production and testing equipment and facilities necessary for the production and subsequent testing of the device.
- c. You must identify those metrologically significant components (MSC) used in the device. These are the components, materials, processes, and software that have an effect on the performance of the device. It is up to you as a manufacturer to identify these items. To determine whether an item is metrologically significant or not you must ask whether a change in the characteristics of that item will affect the performance of the device. If the answer is yes, then the item is metrologically significant.
- d. You must possess and use appropriate statistical tools or methods to ensure that the processes used to manufacture the device are in control. This is often referred to as statistical process control and is a means to determine whether your processes are consistent and repeatable.
- e. An appropriate sampling plan along with the required acceptance criteria for testing of the device. The sampling plan that you choose must be traceable to a nationally recognized quality standard. Optionally, you may use the sampling plan that is presented in Appendix A of the VCAP program description.
- f. Possess the required operators' manual and calibration procedures for all appropriate production and testing equipment. Of course, you must not only possess these manuals, you must also ensure that your operators are familiar with them and follow the procedures contained within them.
- g. A system to deal with nonconforming material and components, whether you purchase them or build them yourself. This system must deal with the identification, control, and disposition of these items.
- h. Adequate controls over suppliers to ensure the material or components they supply meet the necessary requirements.
- i. A corrective action system designed and implemented to handle noncompliant or nonconforming material and components.
- j. An engineering change system to control engineering design changes that affect metrologically significant components.
- k. A document and data control system to document, record, and distribute to affected parties changes affecting metrologically significant components.
- l. A production control system that manages changes that affect metrologically significant components.
- m. A system that identifies and traces metrologically significant components.
- n. A training system for personnel with documentation to verify that the appropriate training has taken place.

How can I show compliance with VCAP?

Compliance with the VCAP can be verified by submitting to a VCAP audit of your manufacturing/testing facility by a VCAP auditor. The auditor will verify that the previously mentioned quality and control elements exist, are documented, and that the appropriate procedures are being followed. The auditor also verifies that the proper equipment needed to test and calibrate the devices you manufacture are present, are sufficient for the task, and that they are being properly calibrated and operated. The audit may also include testing of a randomly selected device. For that reason, it is best to schedule the audit at a time when devices are available for testing.

Where do I find an auditor? Can any quality auditor perform the VCAP audit?

To perform a VCAP audit, the auditor must meet certain requirements. First, the auditor must be part of a Certification Body that is accredited by ANSI-ASQ National Accreditation Board (ANAB). The Certification Body must have accreditation to Standard Industry Classification (SIC) codes 3596 and 3821 or Sequence Number 847 NAICS, U.S. Code 333997, Scale and Balance Manufacturing defined in the 2007 North American Industry Classification System or equivalent accreditation. There are several Certification Bodies that have auditors qualified to perform VCAP audits. We cannot make any specific recommendations.

What role does this Certification Body play in VCAP conformity?

The Certification Body is the organization that provides the auditor that actually performs the VCAP audit. It is the Certification Body that actually sends the auditor's report to the NCWM to show compliance with the VCAP. The requirements for this report are listed in Section S.1.c. of the Administrative Policy as shown in NCWM Publication 14.

I have multiple manufacturing sites. Must each one of the sites undergo a VCAP audit?

The VCAP audit is site specific. If there is more than one site where the testing of the device takes place, then each site must be audited. If the site does not perform any activities that affect the performance of the device and does not perform any device testing, it does not need to be subjected to a VCAP audit.

Who or what organization is going to test NTEP devices in or from a manufacturing arena in a competent manner that confirms NTEP conformity and compatibility? This question centers specifically on the manufacturing or laboratory test equipment itself.

The basic concept of NTEP is that by accepting an NTEP Certificate of Conformance (CC), each NTEP CC holder agrees to continue to manufacture and sell devices that meet the current requirements of NIST Handbook 44 and the requirements described in the NTEP CC. Devices must show, by their markings, that they have an NTEP CC, and what tolerance values, class etc. the device meets. The NTEP CC holder has submitted a device which is typical of the production devices that will be manufactured and sold subsequent to the issuance of the NTEP CC. The intent of VCAP is to ensure that the NTEP CC holder has an acceptable Quality Management System in place for the requirements that must meet Influence Factors. In the case of load cells this is mainly temperature effects on linearity, hysteresis, span, repeatability, zero (vmin or MDLO), and creep. This can also include effects of barometric pressure and in the case of digital load cells, effects of variation in power supply parameters.

The simple answer is that the audit, by the Certification Body, which is based on the parameters described in the VCAP procedures, will be the basis of evidence that the NTEP CC holder is capable of meeting those requirements. The VCAP procedure is loosely based on ISO 9001:2000. The procedure describes an audit of the quality management system, with an addition of objective evidence, in the form of audits on devices that indicate the capability of the NTEP CC to meet the influence factor requirements. The audits of devices are conducted by the NTEP CC holder. If the auditor is convinced that the VCAP requirements are being met, then a certificate indicating compliance would be issued and submitted to NTEP for review.

What test equipment accuracy do you need to test devices for NTEP compliance? For many companies, this will mean aggressive capital appropriations in order to replace old electronic indicators with resolutions of less than 20,000 divisions, temperature chambers with internal thermal differentiations, and dead weights or hydraulic loading machines with unknown or inadequate accuracies. Not to mention the real-world headaches in achieving manufacturing repeatability less than 0.01 %, which subsequently slows down the product lines?

NCWM Publication 14, Weighing Devices, Load Cells describes the testing accuracy required in Section C. In part it states:

“The error in the test process for force transducer (load cell) evaluations may not exceed one-third of the tolerance applied at the force transducer (load cell) (0.7 times the tolerance for the weighing system). The important characteristics for the test process for force transducers (load cells) (and indicators) for compliance with the influence factors requirements is linearity and repeatability, not absolute accuracy. This means that the accuracy of the applied load is not critical, but the change in performance of output of the force transducer (load cell) (or indicator) under the same load but different environmental conditions is important. Consequently, the uncertainty in the reference standard may not be significant provided the uncertainty of the linearity of the total system is within one-third of the tolerance to be applied to the force transducer (load cell).”

So it is clear what the general requirements are for test equipment.

There are many different methods to achieve quality in a load cell. This could extend from testing each device to auditing one sample from a lot. This could also extend from following the test procedures described in Publication 14 for every load cell, to reducing the time and load to a minimum value to properly characterize the device under test. NTEP is not attempting to dictate the quality management system nor the testing or auditing methods used to ensure that devices meet the requirements. This will be up to each of the NTEP CC holders to determine. It will then be up to the auditors to determine that the VCAP requirements are being met. In some cases this may require some investment in equipment upgrades, calibrations, etc.; however, it is the belief of NTEP that this equipment and quality management system should already be in place, and should not present a significant burden on the NTEP CC holders.

Since there is no such thing as 100 % NTEP manufacturing first pass yields for anyone in the scale industry, then what do you do with the product that has larger metrological division errors?

If the product does not meet applicable Handbook 44 requirements, including tolerances, it cannot be sold for use in a commercial (legal for trade) application.

The VCAP program description makes it clear that the program is focused on the device’s response to environmental influences; primarily temperature but also including humidity, variations in the magnitude of the electrical supply voltage, RF/EMI, and so on. Section 1.2. requires that the manufacturer have a documented procedure for the identification of metrologically significant components (MSCs). It is clear that there are some components that would be considered to be metrologically significant yet they are unaffected by the environmental influence factors. For example, software is unaffected by the physical environment yet it is metrologically significant. Further, some integrated circuits are metrologically significant but are not affected by changes in the environment over the operating range of the device. With this in mind, are the MSCs that are to be identified and controlled under the VCAP program ONLY those MSCs that are also affected by the physical environment or does it cover “every” MSC regardless of whether its operation is influenced by the environment or not?

VCAP does not cover every component of a device, only those that are metrologically significant and are susceptible to T.N.8. Influence Factors. A manufacturer can choose to consider the complete device or main element to be metrologically significant.

Some manufacturers may identify an assembly like a printed circuit board as being a metrologically significant component rather than the few components in the printed circuit board assembly that control the metrological function and are sensitive to changes in the environment. Is this practice acceptable? (It would certainly make the management and control of MSCs easier to accomplish.) Section 1.2.2. states that a metrologically significant component “is a part, assembly, material, design, or procedure that has a direct influence on the performance or operation of a device or component thereof as identified by the manufacturer.” It would seem that the previously mentioned practice of identifying an assembly as a metrologically significant component rather than the individual components and/or materials comprising it that are metrologically significant components under the VCAP definition is in opposition to the intent of the program authors. Is that correct? Can we identify assemblies only as metrologically significant components rather than the components and materials that are used to construct them? Examples given in Section 1.2.4. seem to disallow that practice.

It is up to the manufacturer to declare a component an MSC. That could be an individual component or the assembly in which the component is used.

The VCAP plan states that 90 days will be given to address and correct any major nonconformity identified during the audit but how many major and/or minor nonconformities are allowed before it is concluded that you are not compliant?

Any nonconformities, be it major or minor, must have corrective action taken within 90 days. The difference between the two is that a minor can be verified by the auditor via paperwork and does not require a revisit by the auditor where a major does require a revisit. Each nonconformance is unique but this is a general understanding. At the time of the audit, the auditor may advise you of whether a follow-up audit is required or if only a review of objective evidence is required to show that the non-conformities have been addressed.

When checking the effect of temperature on load cell output (span TC) what, exactly, is the minimum load that must be applied to the load cell during testing to show compliance?

Compliance testing must represent the test requirements as shown in Publication 14.

We hold a number of NTEP Certificates of Conformance. Do we have to submit to a VCAP audit for each certificate?

No. For example, if your company manufactures five different families of load cells each with its own NTEP CC you must only submit to one VCAP audit. Successful completion of the VCAP audit will apply to all five NTEP Certificates of Conformance. During the audit, the auditor will know what NTEP Certificates of Conformance you are being audited to and will take the necessary steps to ensure that all are covered. If, for example, you make load cells of different capacities, the auditor will ensure that you have testing equipment sufficient to apply the appropriate test loads to each model of load cell that you manufacture.

What happens if the auditor identifies a non-conformity that is specific to one device type? Are all of our NTEP Certificates in jeopardy?

No. For example, if the auditor finds that you have sufficient production equipment to produce your full line of load cells but have testing equipment that can only test up to 5000 pounds, then only those load cells that require performance testing to loads greater than 5000 pounds will not comply. Failure to obtain the required testing equipment could ultimately result in the loss of the NTEP Certificate that covers the cells with capacities greater than 5000 pounds.

What happens if a CC holder fails to comply?

NCWM Publication 14, NTEP Administrative Policy, Section S.2. states the certificate(s) will be declared inactive. NTEP anticipates a certificate could also be withdrawn.

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Nominating Committee Interim Report

Judy Cardin, Chairman
Chief, Weights and Measures
Wisconsin Department of Agriculture & Consumer Protection

The Nominating Committee met during the Interim Meeting at the Hilton Daytona Beach Hotel, Daytona Beach, Florida, at which time the Committee nominated the persons listed below to be officers of the 95th National Conference on Weights and Measures. In the selection of nominees from the active membership, consideration was given to professional experience, qualifications of individuals, Conference attendance and participation, and other factors considered to be important.

The following slate of officers was selected by unanimous vote of the Nominating Committee:

CHAIRMAN-ELECT:	Tim Tyson, State of Kansas
BOARD OF DIRECTORS NORTHEASTERN	Michael Sikula, State of New York
TREASURER:	Will Wotthlie, State of Maryland

Judy Cardin, Wisconsin, Chairman

Ross Andersen, New York
Dennis Ehrhart, Arizona
Tom Geiler, Barnstable, Massachusetts
Max Gray, Florida
Steve Malone, Nebraska,
Joe Gomez, New Mexico

Nominating Committee

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