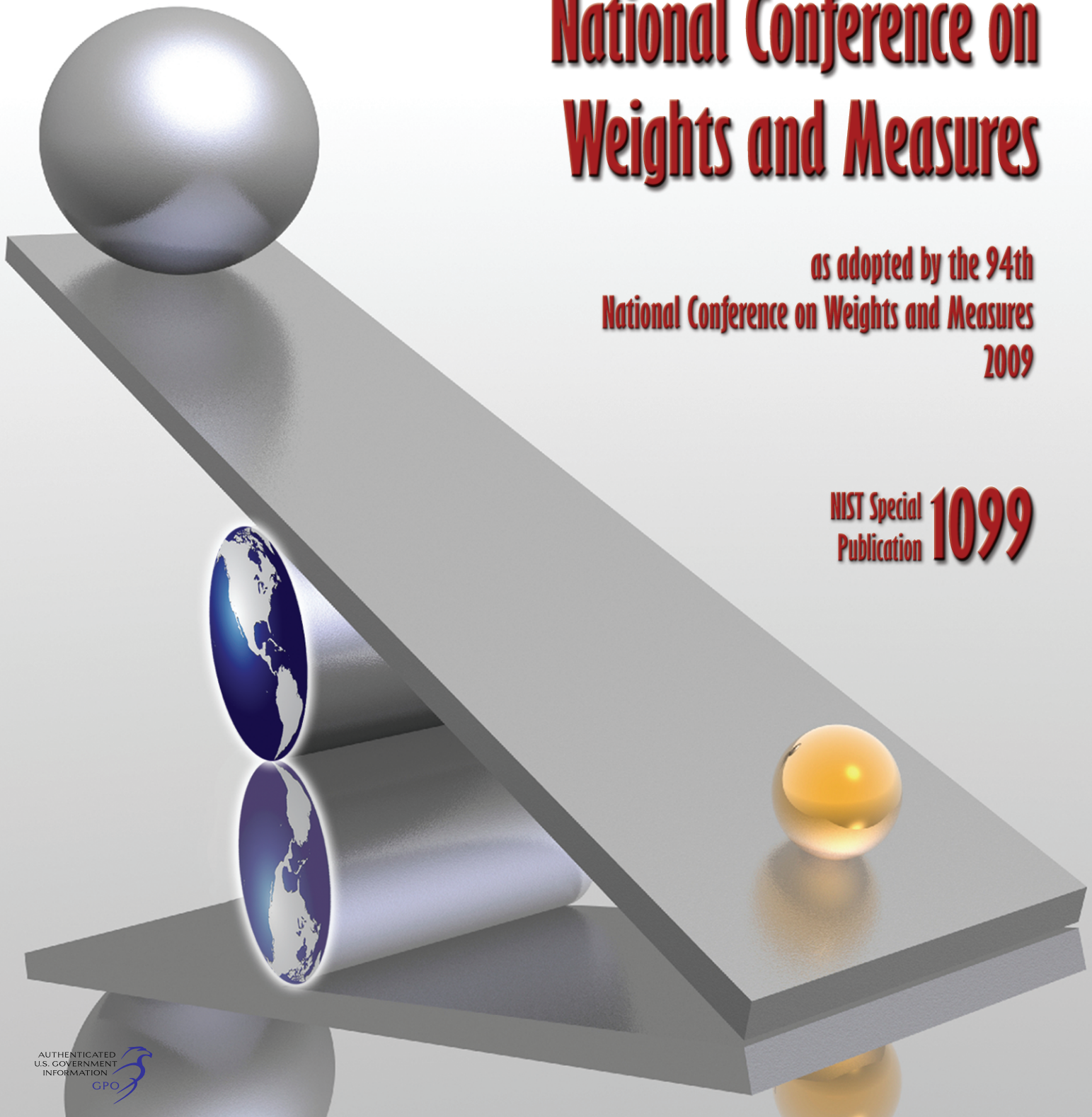
NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Report of the 94th National Conference on Weights and Measures

as adopted by the 94th
National Conference on Weights and Measures
2009

NIST Special Publication 1099



AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
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Report of the 94th National Conference on Weights and Measures

San Antonio, Texas – July 12 through 16, 2009
as adopted by the 94th National Conference on Weights and Measures 2009

Editors:
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National Institute of Standards and Technology
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NIST Special Publication 1099
November 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, and cities, as well as representatives from the U.S. Government, other nations, industry, and consumer organizations.

Abstract

The 94th Annual Meeting of the National Conference on Weights and Measures (NCWM) was held July 12 - 16, 2009, at the Marriott Plaza Hotel, San Antonio, Texas. The theme of the meeting was "Getting Involved, Making a Difference."

Reports by the NCWM Board of Directors, Standing Committees, and Special Purpose Committees constitute the major portion of this publication, along with the addresses delivered by Conference officials and other authorities from government and industry.

Special meetings included those of the Scale Manufacturers Association, Meter Manufacturers Association, Gasoline Pump Manufacturers Association, American Petroleum Institute, National Association of State Departments of Agriculture, the Industry Committee on Packaging and Labeling, and Associate Membership Committee.

Key words: laws and regulations; legal metrology; meters; scales; specifications and tolerances; training; type evaluation; uniform laws; weights and measures.

Library of Congress Catalog Card Number 26-27766.

Note: The policy of the National Institute of Standards and Technology is to use metric units of measurement in all of its publications. In this publication, however, recommendations received by the NCWM technical committees have been printed as they were submitted and, therefore, may contain references to inch-pound units where such units are commonly used in industry practice. Opinions expressed in non-NIST papers are those of the authors and not necessarily those of the National Institute of Standards and Technology. Non-NIST speakers are solely responsible for the content and quality of their material.

Natl. Inst. Stand. Technol. Spec. Pub. 1099, 858 Pages (November 2009) CODEN: NSPUE2

WASHINGTON: 2009

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Past Chairmen of the Conference

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

Laws & Regulations Committee

Position	Name/Affiliation (Term Ends)
Chair:	Joe Gomez, NM (2009)
Members:	Joe Benavides, TX (2011) Terence McBride, Memphis, TN (2010) John Gaccione, Westchester County, NY (2012) Jonelle Brent, IL (2013)
Associate Member Rep:	Rob Underwood, Petroleum Marketers Association (2013)
Canadian Tech Advisor:	Doug Hutchinson
NIST Tech. Advisors:	Kenneth Butcher Lisa Warfield
Fuels and Lubricants Subcommittee:	Ron Hayes, Chairman, MO

Specifications & Tolerances Committee

Position	Name/Affiliation (Term Ends)
Chair:	Todd Lucas, OH (2009)
Members:	Brett Saum, CA (2010) Kristin Macey, CO (2011) Steve Giguere, ME (2012) Ken Ramsburg, MD (2013)
Canadian Tech Advisor:	Ted Kingsbury
NIST Tech. Advisors:	Tina Butcher Steven Cook

NCWM Committees
(continued)

Professional Development Committee

Position	Name/Affiliation (Term Ends)
Chair:	Ross Andersen, NY (2010)
Members:	Richard Cote, NH (2009) 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. (2013)

Nominating Committee

Position	Name/Affiliation (Term Ends)
Chair:	Judy Cardin, WI
Members:	Ross Andersen, NY Dennis Ehrhart, AZ Thomas Geiler, MA Joe Gomez, NM Maxwell Gray, FL Steve Malone, NE

Credentials Committee

Chair:	Raymond Johnson, NM (2009)
Members:	Dave Pfahler, SD (2010) Kim Connor, Barnstable, MA (2011)
Coordinator:	Thomas Geiler, Barnstable, MA

Appointed Officers

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

Associate Membership Committee

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)

NTETC Weighing Sector

Chair: Darrell Flocken, Mettler-Toledo

Technical Advisor: Steven Cook, NIST/WMD

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

Private Sector Members:
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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

NTETC Measuring Sector

Chair: Michael Keilty, Endress & Hauser Flowtec AG

Technical Advisor: Tina Butcher, NIST/WMD

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

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

National Type Evaluation Technical Committees (NTETC) (continued)

NTETC Software Sector

Co-Chairs: Norm Ingram, CA
James Pettinato, FMC Technologies

Technical Advisor: Doug Bliss, Mettler-Toledo

Secretary: Teri Gulke, Liquid Controls LLC

Public Sector Members:
Dennis Beattie, MC
Bill Fishman, NY
Mike Frailer, MD
Todd Lucas, OH
John Roach, CA
Ambler Thompson, NIST/WMD

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 Mfgr. 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.

NTETC Grain Analyzer Sector

Chair: Cassie Eigenmann, DICKEY-john Corp.

Technical Advisors: G. Diane. Lee, NIST/WMD
John Barber, J. B. Associates

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

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

National Type Evaluation Technical Committees (NTETC) (continued)

NTETC Belt Conveyor Sector

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

Regional Weights and Measures Contacts

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
Hilton Clearwater Beach Resort
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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President's Address
National Conference on Weights and Measures
San Antonio, Texas
July 14, 2009

Dr. Belinda Collins
NIST, Technology Services Director

Dr. Belinda Collins addressed the National Conference on Weights and Measures Annual Meeting attendees in San Antonio, Texas, on July 14, 2009. Her presentation which touched on the National Institute of Standards and Technology's (NIST's) mission to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. The presentation gave an overview of the services that Technology Services (TS) provides, and TS's commitment to advancing standards and supporting the U.S. commercial measurement system. Dr. Collins concluded by stating that it is "essential for NIST and NCWM to work together in these difficult times in complementing each other's work, working towards securing uniformity in weights and measures, and seeking creative ideas for supporting the whole weights and measures infrastructure."

You are invited to review the following slide presentation, which was used at the Annual Meeting.

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National Conference on Weights and Measures – NIST Address

Belinda L. Collins, Ph.D.
Director, Technology Services
July 14, 2009

Technology Services NIST

Outline

- Introduction to NIST
- Weights and Measures
- What are NIST roles?
- What are the major issues?
- What does the future hold?

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Technology Services NIST

NIST Today: Mission

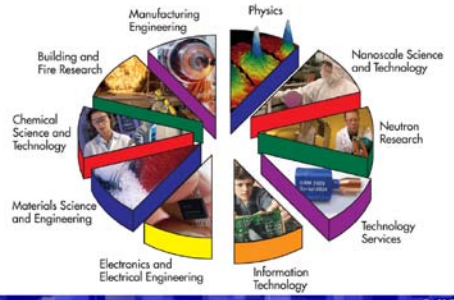
- To promote U.S. innovation and industrial competitiveness by advancing
  - measurement science,
  - standards, and
  - technology

in ways that enhance economic security and improve our quality of life



Technology Services NIST

The NIST Laboratories



Technology Services NIST

Technology Services Provides

- Access to NIST Standard Reference Materials and Data, calibrations, and laboratory accreditation
- Federal leadership, guidance, coordination, information and training on documentary standards and conformity assessment activities
- **Weights and Measures (Legal Metrology) training, recommendations and guidelines**
- Technology partnerships, including patents, licenses, cooperative agreements, etc
- Technical information and access to NIST publications

Technology Services NIST

Advancing Standards - Support for U.S. Commercial Measurement System

- Develop standards and test procedures for weights and measures to ensure equity in commerce
  - Harmonized national and international standards
  - Input to National Conference on Weights and Measures (NCWM); International Organization of Legal Metrology (OIML)
- Technical guidance to industry, retailers, and regulatory officials
  - Training for weights and measures officials in device inspection, pre-packaged goods, laboratory metrology, price scanner inspections, and weights and measures administration
  - Laboratory metrology training and support
  - Legal metrology laboratory training facility

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Technology Services NIST

What is Weights and Measures?

- **Technical and regulatory infrastructure that supports selling and buying of products or services on the basis of weight, measure or count**
- Responsibilities shared among federal, state and local governments with the bulk residing with the latter
  - NIST Organic Act --- Directs cooperation with the States in securing uniformity in weights and measures laws and methods of inspection

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Technology Services

Why Weights & Measures?

Ensure uniformity and equity in the marketplace

- **Consumers** want what they pay for.
- **Businesses** want fair compensation.
- **Industries** want fair competition.
- **Manufacturers** want "One standard, one test, accepted worldwide."

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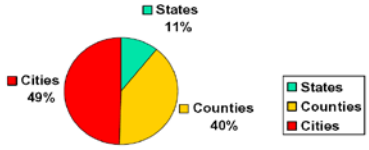
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NIST Role

- Provides standards, model laws and regulations, technical expertise and training to state and local weights and measures officials
- Obtain uniformity and provide traceability to fundamental units through cooperation, standards development and training
- No Federal regulation of weighing and measuring devices except for US Department of Agriculture (USDA)
- NIST has no police power or authority over the States
  - Works in cooperation with states directly and with the NCWM toward equity in commerce throughout the United States

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Enforcement is Typically Through U.S. Weights and Measures Jurisdictions*

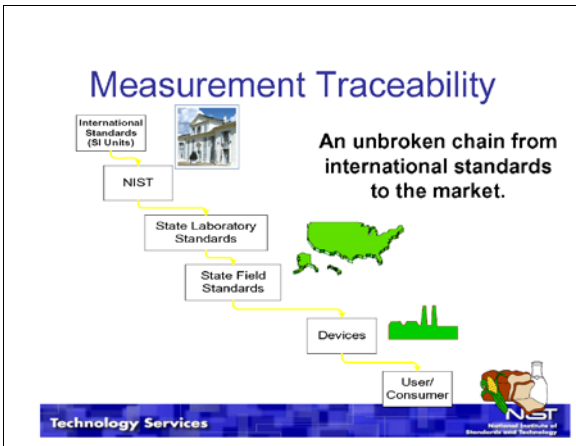


55 States & Territories
200 Counties
250 Cities
505 Total W&M Jurisdictions

*the number of jurisdictions and percentages are estimates only

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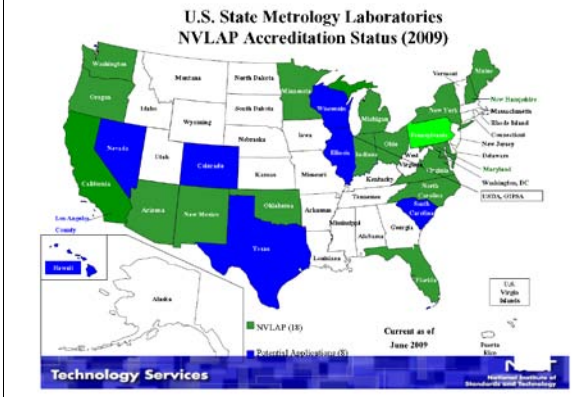




State Metrology Laboratories

- Most states have a state run laboratory
  - Some counties and territories
- Metrologists trained at NIST in our training laboratory for mass, volume and length calibrations
- Required to comply with NIST Handbook 143 for certificate of traceability
  - Requirements are Identical to ISO 17025

Technology Services



NIST WMD Activities

- **Coordination**
  - Responses to regulatory issues to promote uniformity and fair trade.
- **Technical Support to Stakeholders**
  - Regulatory officials
  - Business & industry
  - Standards Committees
  - Federal Agencies
  - Laboratories

Training
- State and Industry Laboratory Metrology
- Field Officials
- Administrators

- **Information Dissemination**
  - Publications and NIST Handbooks
- **Representation**
  - OIML, APLMF and other international organizations

Technology Services

NIST Handbooks Impact $535.4 Billion in U.S. Retail Food Sales

- With the National Conference on Weights and Measures, NIST provides the technical content for HB 44 and 133; NCWM then adopts
- All States adopt or use HB 44 and HB 133
- New Federal Adoptions in 2008
  - USDA adopted NIST Handbook 133, "Checking the Net Contents of Packaged Goods" for meat and poultry
  - DOC's Seafood Inspection Program now incorporates significant provisions of HB 133 and HB 44 for scales in its inspection procedures
- Result: State and Federal adoption ensure consistent national standards for verifying that contents are labeled accurately and that consumers and retailers get what they pay for

Technology Services

NIST and NCWM Successfully Working Together

- Technical Sector Support
- Pelletized Ice Cream Issue Resolved
  - FDA Acted Quickly
- Seafood Fraud Workshop
  - Cooperative effort to resolve a nationwide problem
- Moisture Loss Working Group
  - Tackling tough issues

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Marketplace Impact

- Only about $0.50 is spent per person per year in the United States by weights and measures enforcement programs!!
- Yet, W&M regulations impact on transactions in the marketplace involve over 50 % of the U.S. Gross Domestic Product
- Very few consumers are aware that W&M exists – until they have measurement problems in the marketplace or higher prices drive questions

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W&M in the Marketplace Example: Gas Pumps

- **Retail petroleum sales (at gas stations only) in 2002: $250B**
- Accuracy of retail motor fuel dispensers (gas pumps) heavily regulated in the U.S.
  - Permissible error: 0.5 %
  - Compliance rates in the U.S. in 2002 was > 93 %
- Need to balance value of presence in marketplace with compliance rate

*More than 93% compliance with **less** than 0.5 % error.*

- Mexico's 2004 survey indicates potential impact of lack of regulation:



*More than 80% failures with **more** than 1.25 % error.*

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Issues Facing the Weights and Measures Infrastructure

- Revenue challenges at state and local level
  - Cuts to programs and lab closures
- Unseen importance of infrastructure leading to cuts and reduced support
- Long term impacts likely
  - Experience has shown that areas without adequate oversight tend to fail to comply with the applicable requirements

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Examples of Problems

- In Israel, lack of oversight led to deviations detrimental to consumers at 75 % of gas pumps
- In Mexico, lack of oversight resulted in consumers receiving as little as half of what they paid for at 90 % of gas stations across the country, costing consumers at least $1 billion in one year

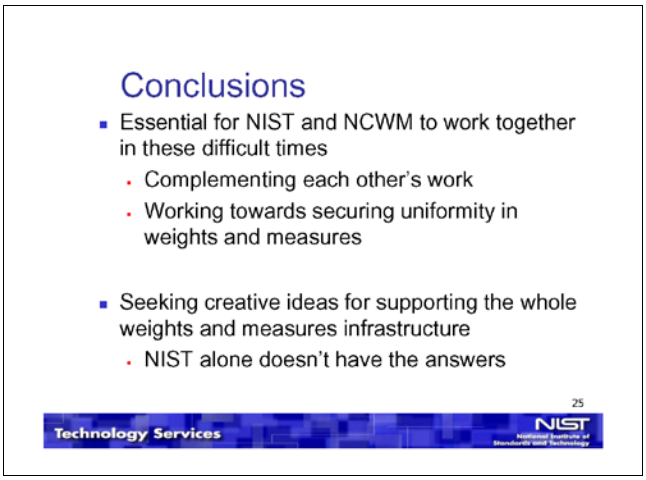
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Future Impacts

- NIST is concerned that lack of support for weights and measures could lead to similar failures in the United States
  - Disturbing trends are appearing across the country
- Letter expressing concern sent to all governors by NIST Deputy Director

Technology Services NIST


Conclusions
Essential for NIST and NCWM to work together in these difficult times
Complementing each other's work
Working towards securing uniformity in weights and measures
Seeking creative ideas for supporting the whole weights and measures infrastructure
NIST alone doesn't have the answers
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Technology Services
NIST

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Chairman's Address
94th National Conference on Weights and Measures
San Antonio, Texas
July 14, 2009

Jack Kane
Montana Business Standards Division

Good morning. On behalf of NCWM, Inc., I'd like to welcome you to the 94th Annual Meeting of the National Conference on Weights and Measures.

It's been quite a year. As a board, we wrapped up several issues and began exploring options for several new ones, all with the end result of making NCWM a stronger, more viable, and more responsive organization. As I'm sure you all know, one of our larger projects was that of transitioning from utilizing the services of a management company to assuming the responsibility of hiring our own Executive Director to manage the affairs of the Conference including meetings, membership, and the NTEP program. I am glad to report that the transition went well; actually, much better than some on the Board of Directors thought it would.

As of today, the Conference has a permanent address in Lincoln, Nebraska. Don Onwiler, a past NCWM Chairman, has contracted with NCWM to serve as Executive Director and currently has a staff of three very capable folks including another of our own, Jim Truex, who is serving as the NTEP Administrator. My thanks to them and past chairman Judy Cardin for their hard work in making the transition as seamless as it was.

While the transition was a large project and consumed quite a bit of time, it was, as I mentioned, not the only project the Board took up this year. The Board has been involved in a review and overhaul of the NCWM strategic plan. The plan we had in place was developed several years ago, and upon review, it was felt that the goals needed to be revised to reflect where we wanted to be in the future. As developed, this is not a static document, rather, I hope you will view it and use it as it was designed, as a living document rigid enough to provide direction and guidance, yet constructed to be adaptable to the changing needs of this group.

The board also is reviewing NCWM's policies to ensure that they reflect the current needs of the organization, investigating alternative methods to increase member involvement in the standards development process, and implementing the first portion of the inspector training program. For all of their hard work, I compliment the entire Board of Directors and especially Randy Jennings the Chair-Elect for getting involved and making a difference. You are being well served by this group of folks. Which brings us to my theme for the year, "Get Involved, Make a Difference." The weights and measures community, like many others, is experiencing change; tough economic times have resulted in all jurisdictions having to tighten their belts to some extent. For the more fortunate among us, this has simply meant making do with a little less. For others, it has meant making do with a lot less; some even face severe curtailment of their programs.

We've also seen changes in the way state legislatures view our participation in the regulatory process with some states' lawmakers restricting the historical enforcement of equity issues we hold tight to, such as split weighing and privatization of Weights and Measures services. While changes such as these are difficult to deal with, in the short term, they are not insurmountable and the pendulum will swing; better times will come. Our programs will continue to be recognized for the value they have to offer. However, one change that I do not see going away is one of position longevity; when I began with weights and measures at the national level back in 1995, almost all of the various state administrators that I knew had been with weights and measures for years, often starting out as I did, packing cans and fifties and working ourselves up the ladder. While the majority of the state directors still come up through the ranks, other individuals who are recognized by their respective jurisdictions as extremely competent employees are being selected to run Weights and Measures programs in several states and jurisdictions, and, that's a good thing. I have long been an advocate that an infusion of outside people into a managerial unit provides a fresh perspective to that unit. While competent outsiders should be a welcome addition, we also need to insure that they

are well grounded in weights and measures issues in the event they are called upon to assume a leadership position. With that said, I'd like to re-issue to all of you the challenge to get involved and make a difference by recognizing the potential leaders in your jurisdictions, your different regions, and here at the national level, mentoring them and tasking them with progressive assignments to enable them to develop the skills necessary to someday lead the Conference.

As I've said in the past, and I think I can speak for all past chairmen, none of us made it here by ourselves. While we all possessed a desire to succeed, there was always a Sid Colebrook looking for volunteers for a committee, a Lou Straub appointing standing committee members, or an Aves Thompson shuffling the deck. For every Sid, Lou, or Aves looking for good solid people to select, there's a Jackie Walsh, a Kim Connor, or an Ivan Hankins who is willing to take that first step by accepting their first appointment to an NCWM committee and making a difference.

To paraphrase John Donne, as "no man is an island," neither is an organization unto itself. The strength and validity of NCWM lies not just with its members but with its partners as well. Our partners to the north, Measurement Canada, attend both the Annual and the Interim meetings, graciously providing competent, knowledgeable folks to help staff the standing committees; an arrangement that I hope continues for a long time. Our industry members also contribute immeasurably to this Conference through the work they do both here at the meetings and also back at their corporate offices. And, believe me, after working with Chris Guay, Darrel Flocken, Steve Lankford, and Bob Murnane on the Board of Directors, these folks put in a lot of time and a lot of effort helping NCWM achieve its goals.

And, last but not least, NIST, truly our partner since inception, provides technical resources beyond simply staffing the standing committees. The good folks at NIST have always been a huge asset to the weights and measures community. From sponsoring the Conference for those many years to providing instructor training, from lab quality standards to hydrogen standards, NIST has always been a solid ally of the Conference and a staunch supporter of weights and measures issues. To all of these folks and the many others who support the Conference, I offer my sincere thank you for getting involved and making a difference.

It's been a long year, and I feel as if we've accomplished quite a bit. For this I thank the Board of Directors, the standing committees, and Don Onwiler and his staff for their hard work and dedication.

For these last 15 years, weights and measures and the Conference has been a large part of my life. Thanks to all of you for the privilege and honor of serving as your Chairman.

New Chairman's Address
94th National Conference on Weights and Measures
San Antonio, Texas
July 14, 2009

Randy Jennings
Tennessee Department of Agriculture

Good Morning.

It is truly my pleasure to be standing here before the members of this organization as the person who will represent the NCWM as Chairman for the coming year. I want to thank each of you for trusting me with this responsibility. I also want to say a special "thanks" to each of the board of directors members that I have had the opportunity to work with over the past few years, and, in particular, Jack Kane and Judy Cardin, both who have served as Chairs over the past two years, and Carol Hockert, as the NCWM Executive Secretary. It has been a true learning experience working closely with this dynamic set of individuals, and without that experience I would not be nearly as prepared to assume this position at this time. Thank you, Judy, Jack, Carol, all the board members, and Don Onwiler and his staff at NCWM Headquarters.

The National Conference on Weights and Measures has made great strides both administratively and technically with standards development and revisions since I attended my first Annual Meeting in Little Rock, Arkansas in 1987. At that meeting, the most important item on the agenda for me was a proposed change in the Liquid Measuring Device (LMD) code for the tolerance values on wholesale meters. The proposal was to set a tolerance based on percent meter error. The new tolerance proposed for maintenance tests was three-tenths percent of the indicated volume. The current code was "fifty cubic inches for the first fifty gallons, and one-half cubic inch for each gallon in excess of fifty gallons." On a one thousand gallon test draft, that was moving from about a 2.2 gallon tolerance to a 3 gallon tolerance. I considered this an unnecessary relaxation of the code and was passionately opposed to the change. However, the consensus of the voting body was that the change was appropriate and the item was adopted, so I went home still in my box, feeling like the process was flawed. Nevertheless, we implemented the revised tolerance into our inspection program, and I continued to come back in order to participate in the process, providing input where I could, and soon realized that what I had experienced at my first meeting was the nature of an organization that seeks consensus. As an individual, you don't always get exactly what you want in a process such as ours, but at the end of the day, I do believe that in most cases, the final result is what is best for the majority of stakeholders. And I use the word "final" very loosely, as we know that our standards are continually being reviewed for possible revisions that may be appropriate in order to keep us on pace with time.

So with that, I'll introduce my theme for the following year, "Breaking Molds to Shape the Future." Just as I had to get out of my box after losing a campaign at my first meeting, I believe that we are at a point in time where we have to challenge ourselves as an organization to "think out of the box." I say this in terms of administrative procedures for managing the NCWM process, in our pursuit for standards development and training materials, and in our management of the National Type Evaluation Program.

Technology available now and in the future will be affecting our organization in many ways. The newly developed strategic plan being put forth by the Board of Directors for your review and comment leans heavily on that fact. The revised plan seeks to make this organization more effective in the development of our standards and to offer a return to all of our members that represent the foundation of this organization. We are working to offer on-line testing for the emerging National Certification Program, creation of an e-library of training materials, and exploring the construction of an on-line comment system that would provide the opportunity for all 2300 NCWM members to conveniently submit their position on Conference items and upload attachments for committee review.

From an administrative standpoint, we should further investigate how we can use e-services to be more efficient in our processes and at the same time provide our members with a more convenient path to be a part of that process. We are beginning to explore how we can effectively use Web meeting software for administrative meetings and

potentially for use by the technical standing committees; hopefully, providing for a more efficient path for development of items under each committee's jurisdiction.

Thinking out of the box is also important for our technical committees. In the course of our standards development process, it is important to be "looking around the corner" for the best emerging technology that can take us where we need to be. There may be times when we find it prudent to pass on a currently available option in favor of a long term solution with promising technology that could potentially serve us better in the future.

The Specifications and Tolerances Committee (S&T) has historically had an agenda that, due to both the number of items and scope of items, has been difficult to manage. I feel that it is time for us to begin discussing some possible alternative approaches as to how we can best deal with the volume of items that fall within the jurisdiction of the S&T Committee.

It is also our responsibility to review the structure of the National Type Evaluation Program and be willing to adapt and develop a strategic plan that ensures the long term success of this vital component of the NCWM.

These are a few examples of what I mean by "breaking molds to shape the future." We are in the process of completing our 94th Annual Meeting. This body is steeped in tradition, yet we have shown that we are capable of change. I want us to continue to operate with an open mind and be willing to discuss new ideas that may make us an even stronger organization and possibly lead to more traditions. In order to most effectively do that, the individuals serving in leadership positions are in need of feedback and ideas from every member of this organization. I want to encourage every stakeholder in this group to come forward with your ideas or suggestion as to how the NCWM can better serve the standards development process. I will always make myself available to members, so please feel free to contact me at any time. And, I know that Don Onwiler will always take time out to talk with anyone about the National Conference on Weights and Measures, no matter what the issue may be.

So with that, I will end by announcing the following appointments:

Board of Directors

To the Board of Directors, to fill the At-Large Director vacancy created with the advancement of Tim Tyson as Chairman-Elect, I have recommended to the Board and all have voted affirmatively for Mark Coyne, City of Brockton, Massachusetts.

Laws and Regulations Committee

- Raymond Johnson, New Mexico, for a five-year term replacing Joe Gomez, New Mexico

Specifications and Tolerances Committee

- Paul Moyer, State of Nebraska, for a five-year term replacing Todd Lucas, Ohio

Professional Development Committee

- Dale Saunders, State of Virginia, for a five-year term replacing Richard Cote, New Hampshire

Credentials Committee

- Kevin Upschulte, State of Missouri, for a three-year term replacing Raymond Johnson, New Mexico
- Tom Geiler – Coordinator, has agreed to serve one more year

Chaplain

- Stephen Langford, Cardinal Scale Manufacturing Company

Parliamentarian

- Louis Straub, Fairbanks Scales, Inc.

Presiding Officers

- Doug Deiman, State of Alaska
- Tim Chesser, State of Arkansas
- Maureen Henzler, State of Kansas
- Kim Connors, Barnstable, Massachusetts

Nomination Committee

- Jack Kane, Chair
- Judy Cardin
- Dennis Ehrhart
- Ross Andersen
- Thomas Geiler
- Maxwell Gray
- Steve Malone

Sergeants-at-Arms

- Richard Tredder, Minnesota
- Kathleen Sundt, Minnesota

Again, thank you for the opportunity to serve as Chairman for this coming year.

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NCWM 2009 Annual Meeting Honor Award Recipients

For Years of Attendance of NCWM Annual Meetings

Full Name	Organization	State	No. of Years
Joseph Silvestro	Retired Weights & Measures Official	NJ	40
Robert Reinfried	Scale Manufacturers Association	FL	25
Mark Coyne	City of Brockton	MA	20
Christopher Guay	Procter & Gamble	OH	20
Maxwell Gray	Florida Department of Agriculture & Consumer Services	FL	20
Ronald Hayes	Missouri Department of Agriculture	MO	20
Richard Tucker	RL Tucker Consulting	IN	20
Celeste Bennett	Michigan Department of Agriculture	MI	15
Darrell Flocken	Mettler-Toledo, Inc	OH	15
Stephen Langford	Cardinal Scale Manufacturing	MO	15
Juana Williams	NIST, Weights & Measures Division	MD	15
Michael Cleary	California Department of Food & Agriculture	CA	10
Nigel Mills	Hobart Corporation	OH	10
Ralph Richter	NIST, Weights & Measures Division	MD	10
Michael Sikula	New York Bureau of Weights & Measures	NY	10
Steven Steinborn	Hogan & Hartson, LLP	DC	10
Curtis Williams	Georgia Department of Agriculture	GA	10

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Report of the Board of Directors

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

Reference
Key Number

100 INTRODUCTION

The Board held its quarterly Board of Directors (BOD) meeting on Saturday, July 11, 2009, and continued that meeting during work sessions throughout the remainder of the Annual Meeting. The Board of Directors and the NTEP Committee invited members to dialogue with the BOD on the following issues: Improving Standards Development, Mutual Acceptance Arrangements, Increasing Efficiency and Effectiveness, and participation internationally, i.e., OIML, CFTM, APLMF, and 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, and Table C shows the results of voting items.

Table A
Table of Contents

Reference Key Number		Title of Item	Page
100	**INTRODUCTION**		**1**
1.	I	NCWM Automatic Temperature Compensation (ATC) Steering Committee	3
2.	W	Marketplace Surveys Update	3
3.	I	Membership and Meeting Attendance	3
4.	I	NCWM Newsletter and Website	4
5.	W	Members-Only Access to NTEP Database	4
6.	I	Meetings Update	5
7.	I	Participation in International Standard Setting	5
8.	I	Efficiency and Effectiveness	5
9.	W	Bylaws Amendment: Article IX, Section 4 – *Ad Hoc* Committees, Subcommittees, Task Forces, and Study Groups	7
10.	I	Strategic Planning	7
11.	I	Financial Report	8

Table B
Appendices

Appendix	Title	Page
A	Report on the Activities of the International Organization of Legal Metrology (OIML) and Regional Legal Metrology Organizations	A1
B	Associate Membership Committee (AMC) Agenda and Meeting Minutes	B1

Table C
Voting Results

Reference Key Number	House of State Representatives		House of Delegates		Results
	Yeas	Nays	Yeas	Nays	
Adopt the Report (voice)					Adopted

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

1. I NCWM Automatic Temperature Compensation (ATC) 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 will reassess the future of the ATC Steering Committee at the fall 2009 board meeting based on the outcome of temperature compensation issues in July 2009.

2. W Marketplace Surveys Update

This item was withdrawn.

At the 2009 Interim Meeting, the Board of Directors had selected a subject for a new marketplace survey. During the planning stages, it was determined that the survey would no longer take place.

This item is withdrawn until such time as the Board of Directors determines a survey will be done and a subject for the survey has been determined.

Any surveys conducted by NCWM will be in accordance with the survey protocol adopted by NCWM in 1999.

3. I Membership and Meeting Attendance

The Board continues to assess avenues for improving membership and participation at Interim and Annual Meetings. Membership and attendance are driven to some degree by the items on the 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						
	June 2009	**June 2008**	**June 2007**	**June 2006**	**June 2005**	**June 2004**
Associate	822	848	863	837	828	837
Foreign Assc	53	56	53	61	41	42
Federal Gov't	10	9	9	13	12	18
NIST	14	15	14	12	9	18
State Gov't	696	831	825	847	828	890
Local Gov't	558	554	565	492	490	527
Int'l Gov't	24	22	31	23	31	21
Retired	196	232	221	215	225	225
Total	**2373**	**2567**	**2581**	**2465**	**2483**	**2516**

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 website, 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 Policy Manual 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. W Members-Only Access to NTEP Database

This item was withdrawn.

The Board is considering ways to add value to the NCWM membership. One proposal under consideration was to limit access to the searchable NTEP database to members only. 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.

The item was withdrawn from consideration following open hearings of the 2009 Annual Meeting in response to continued concerns consistent with those the Board received at the Interim Meeting.

6. I Meetings Update

Interim Meetings	
January 24 - 27, 2010	Hilton Nashville Downtown, Nashville, Tennessee
January 23 - 26, 2011	The Fairmont Dallas, Dallas, Texas
January 2012	To be determined
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 10 - 14, 2011	Holiday Inn Downtown at the Park, Missoula, Montana
July 2012	To be held in the Northeastern Region

After receiving recommendations from the Western Region for a location to conduct the 2011 Annual Meeting, the Board of Directors has selected the Holiday Inn Downtown in Missoula, Montana. The hotel is adjacent to the Clark Fork River and within easy walking distance to the downtown district, where one can enjoy food and entertainment that caters to tourists, the college crowd, and locals.

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.

NCWM is currently researching locations for the 2012 Interim Meeting.

7. I Participation in International Standard Setting

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

Of particular interest is the CIML Meeting to be held at the Doubletree Hotel in Orlando, Florida, September 20 - 24, 2010. Those interested in attending should contact Charles Ehrlich, NIST at (301) 975-4834 or Lisa Warfield, NIST at (301) 975-3308 for more information. Interested vendors should contact Bob Murnane, Seraphin Test Measure at (609) 267-0922.

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.

Website

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 has considered 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.

At the May 2009 Board Meeting, the Board adopted the following policy for hosting regional websites:

1. NCWM will invoice the Treasurers of participating regional associations annually during the month of January in the amount of $200.00 for hosting and maintenance of regional association websites.

2. Hosting fees will pertain to any routine website maintenance and updates that are performed in-house.

3. A bid will be provided to the regional association for any requested services that would involve fees outside the scope of normal maintenance. Additional costs for these services will be assessed to the regional association.

4. NCWM will contact the regional representative for each participating regional association on a quarterly basis requesting any updates to their respective web pages.

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 of 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 also attended the 2009 Annual Meeting in San Antonio, Texas. An invitation was 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.

Specifications and Tolerances Committee: The Board is exploring the possibility of splitting the Specifications and Tolerances Committee into two separate standing committees – one for measuring instruments and one for weighing instruments. Historically, the agenda of the S&T Committee has been very demanding. By dividing the committee into more specialized scopes, it would:

- Effectively reduce the number of agenda items for a standing committee,
- Allow the committees to give more attention to the items that are on their respective agendas,
- Provide specialized expertise to each standing committee, and
- Expedite the standards development process.

The Board envisions that General Code items and codes that do not fall clearly into "weighing" or "measuring" would be addressed by some form of joint committee.

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 has developed a new strategic plan that will be updated and revised on a continual basis as goals are met, changed, or added. The purpose of the Strategic Plan is to ensure the organization is moving forward and in the right direction. Members may view the new and exciting Strategic Plan on the website at www.ncwm.net/members/.

Background

The Board dedicated the first day of its quarterly meeting to strategic planning, resulting in a new plan in the draft and development stage. The plan consisted of six primary goals with numerous strategies for achieving them. The work to further develop and refine the plan was continued at the May and July 2009 Board meetings. In July, the Board combined two of the goals, reducing the total to the five goals shown below.

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 (NTEP).
4. Expand the role of the National Conference on Weights on Measures as a resource for state and local weights and measures programs.
5. Ensure financial stability of the 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 full-time employees 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 fulltime 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 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 June 30, 2009.

ASSETS	June 30, 2009
Current Assets	$
Checking/Savings	
Associate Member Fund	4,478.14
Certificates of Deposit	619,115.50
Checking	37,513.43
Savings	169,903.70
Total Checking/Savings	831,010.77
Accounts Receivable	-500.00
Other Current Assets	66,741.11
TOTAL ASSETS	897,251.88
LIABILITIES & EQUITY	
Liabilities	
Other Current Liabilities	5,466.64
Total Liabilities	5,466.64
Equity	
Unrestricted Net Assets	-19,348.05
Opening Balance Equity	-92,738.10
Retained Earnings	688,607.06
Net Income	315,264.33
Total Equity	891,785.24
TOTAL LIABILITIES & EQUITY	$ 897,251.88

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

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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.*
- *The United States will host the annual meeting of the International Committee of Legal Metrology (CIML) in Orlando, Florida, September 20 - 24, 2010.*

Table A
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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. In April 2009, the Secretariat distributed the 1CD of a new document entitled "The role of measurement uncertainty in conformity assessment decisions in legal metrology." International comments on this document are requested by September 2009. For more information on the activities of this subcommittee, please 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)
NIST hosted the OIML TC 6 in Gaithersburg, Maryland to continue 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 was held in 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 now chairs a working group that is drafting the separate sections of R 71 and R 85 that will include the specific requirements for specialized tanks. The postal ballot review period for OIML R 80-1 "Road and rail tankers" was completed in January 2009, and the document was published in May 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 2008 in Burlington, Vermont, and the NCWM Annual Meeting in July 2009 in San Antonio, Texas. Measurement Canada has also been

a strong contributor to this effort. Subcommittee work is continuing on the development of R 117-2 "Test methods" and R 117-3 "Test report format." Meetings of the IWG for R 117-2 were held in Paris in November 2008 and 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 working draft was distributed in January 2009, and a joint meeting of the three organizations was held in May 2009 in Ottawa, Canada. The joint working group is now developing a new committee draft based on submitted comments and decisions made in Ottawa. 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" has also received CIML approval and was published in June 2008. 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 this Recommendation has now been published. 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 by the CIML, and the document was published in July 2008. The Secretariat accommodated U.S. concerns on this document by inserting a statement 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 Ottawa, Canada, to discuss comments on the 1 CD, and a TC 17/SC 8 meeting was hosted by NIST to discuss the 2 CD. At the NIST 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 this document. 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

Final Report of the NCWM Associate Member Committee (AMC)

San Antonio, Texas
Minutes, July 13, 2009

CALL TO ORDER:

Chairman Paul Lewis called the meeting to order at 12:15 p.m.

MINUTES:

A copy of the January 2009 meeting minutes was distributed. These minutes were reviewed and one change was made; under **AMC FUND DISBURSEMENT REPORTS**, the following was added to the third paragraph: "This motion was seconded and approved." Alex Schuettenberg made a motion to approve the minutes with the changes and Steven Grabski seconded it. With no further discussion, the minutes were approved.

FINANCIAL CONDITION:

A copy of the financial report was distributed. Chairman Lewis reviewed the deposit/disbursements and reported a current balance of $4,205.36 as of July 1, 2009. Steve Grabski made a motion to accept the Financial Reports and Al Schuettenberg seconded it. With no other discussion the Financial Report was accepted.

BOARD OF DIRECTORS REPORT:

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

- The Total Transition Expense to transfer the NCWM office from Rockville, Maryland, to Lincoln, Nebraska, was $184,000.
- There is a projected net income of $185,000 by the end of fiscal year 2009.
- There is a projected surplus of $42,000 for the 2010 budget.
- The website needs to be converted to a different platform. The hourly cost will go from $150/hour to $85/hour. Current annual hosting cost is $6,600 vs. $350 with the new host.
- At last count, there were 36 State Representatives at this meeting.
- Bob reported that there were discussions about splitting the S&T Committee into two groups: Weighing and Measuring. The reasons given were to improve quality and expedite workload.
- It was mentioned that the committee reports will no longer contain any written testimony in the hard copy of Pub 16; however, these testimonies will be on-line and in the CD version of Pub 16.
- The BOD strategic plans:
  - Investigating the possibility of opening a NCWM brick & mortar NTEP lab. (Some tests will be performed at the manufacturer's facility)
  - Update contact information of Certificates of Conformance (CC) at no charge (changes will be made when the annual maintenance fees are paid).
  - Steve Langford discussed the proposed Verified Conformity Assessment Program (VCAP) checklist.
  - Still talking about moving the NTEP CC database to the members only website.
- The 2011 NCWM Annual Meeting will be in Missoula, Montana.

PROFESSIONAL DEVELOPMENT REPORT:

Steve Grabski, the Associate Membership Representative on the PDC, gave a report about the Committee's activities.

- A national training program is being created and a Beta exam will be ready by the end of the year.
- Tests will be given on-line with random questions.
- One re-test will be allowed if the initial test is failed.
- The Beta test will be free.
- There will be a fee to take the actual test.

LAWS & REGULATIONS REPORT:

Rob Underwood, the Associate Membership Representative on the L&R Committee, gave a report about the Committee's activities. The Committee will be hearing comments on the "Guidance on Allowing for Moisture Loss and Other Revisions" Section 260-1. Members of the AMC should highlight their questions and concerns during the open hearings because of the number of revisions to that section.

AMC FUND DISBURSEMENT REPORT:

Chairman Lewis reported on the disbursement:

- $1,000 was requested by Charles Carroll from the State of Massachusetts for training but as of today Mr. Carroll has not submitted an Expense Reimbursement Form for AMC Training Funds.
- Kenneth Ramsburg from Maryland Weights and Measures requested $1,500 for training. This request was at first denied because it was to reimburse a trainer of a single private company to come to Maryland to train inspectors on their equipment. Upon further questioning, it was revealed that several companies were asked to come and train; however, only one company accepted this request. With this information the request for $1,500 was approved. Will Wotthlie was notified that the request for these funds was approved; Mr. Wotthlie recalled the request for the $1,500.
- Steve Bommann from Colorado Weights and Measures requested $1,000 for books, DVDs and CDs for training, and Jonathan Handy, also from the Colorado Weights and Measures, submitted an Expense Reimbursement Form for AMC Training Funds for $272.78. A check was written for this amount to Colorado Weights and Measures.
- At the Interim Meeting in January, it was voted to give each of the four regions $2,000 for training. Chairman Lewis reported that these funds were dispersed and read the letter that accompanied these disbursements. A thank you letter from NEWMA was also read.

FILLING VACANT POSITIONS:

- Steve Grabski accepted another one-year position on the PDC.
- Rob Underwood accepted another five-year position on the L&R Committee.
- Darrell Flocken accepted the Secretary/Treasurer position.
- Robert Murnane accepted the Vice Chair position.
- Paul Lewis accepted another five-year term on the AMC.
- Rob Underwood accepted another one-year term on the AMC.
- Steven Grabski accepted another two-year term on the AMC.
- Kathleen Madaras accepted another two-year term on the AMC.

OLD BUSINESS:

Proposed changes to the by-laws and training fund guidelines were presented by Steve Patoray and Bob Murnane and discussed.

NEW BUSINESS:

The PDC requested $1,000 to purchase video equipment to record training seminars. Bob Murnane made a motion to give the PDC up to $1,000 to purchase video equipment for training. Steve Grabski seconded the motion, and with no further discussion this motion was approved.

ADJOURNMENT:

With no further new business, Chairman Lewis adjourned the meeting at 1:55 p.m.

Respectfully submitted,

Paul Lewis, Chairman, AMC

The following individuals were in attendance:

Darrell Flocken – Mettler Toledo
Steven Grabski – Walmart
Christopher Guay – Procter and Gamble
Krister Hard af Segerstad – IKEA North America Services, LLC
James Hewston – Scale Source
Paul Hoar – Agri Fuels, LLC/NBB
Paul Hoffman – Kraft Foods Global, Inc
Zina Juroch – Pier 1 Imports
Katherine Kirk – PETCO Animal Supplies Stores Inc.
Dennis Kolsun – H.J. Heinz, Co.
Robert Lagg – Southwest Research Institute
Steve Langford – Cardinal Scale Manufacturing Co.
Paul Lewis – Rice Lake Weighing Systems
Kathleen Madaras – Fuel Merchants Association of New Jersey
Kevin Mikoski – Irving Oil Terminals, Inc
Robert Murnane – Seraphin Test Measure
Pete O'Bryan – Foster Farms
Stephen Patoray – Consultants on Certification, LLC
Rebecca Richardson – MARC IV Consulting
Alexander Schuettenberg – ConocoPhillips
Steve Steinborn – Hogan & Harson LLP
Rob Underwood – Petroleum Marketers
Sayandro Versteylen – PPI

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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Report of the Laws and Regulations Committee

Joe Gomez, Chairman
Las Cruces, New Mexico

Reference
Key Number

200 INTRODUCTION

This is the report of the Laws and Regulations Committee (hereinafter referred to as the "Committee") for the 94th Annual Meeting of the National Conference on Weights and Measures (NCWM). It is based on the Interim Report offered in the NCWM Publication 16, "Committee Reports," testimony at public hearings, comments received from the regional weights and measures associations and other parties, the addendum sheets issued at the Annual Meeting, and actions taken by the membership at the voting session of the Annual Meeting. The Informational items presented below were adopted as presented when this report was approved.

Table A identifies the agenda items in the report by reference key number, title, and page number. The first three digits of the reference key numbers of the items are assigned from the subject series listed below. Voting items are indicated with a "**V**" after the item number. Items marked with an "**I**" are informational. Items marked with a "**D**" are developing items. The developing designation indicates an item has merit; however, the item is returned to the submitter for further development before any further action is taken by the Committee. Items marked "**W**" have been withdrawn from consideration. Table B lists the appendices to the report, and Table C provides a summary of the results of the voting on the Committee's items and the report in entirety.

This report contains recommendations to amend National Institute of Standards and Technology (NIST) Handbook 130, 2009 Edition, "Uniform Laws and Regulations," or NIST Handbook 133, "Checking the Net Contents of Packaged Goods," Fourth Edition (January 2005). 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. New items proposed for the handbooks are designated as such and shown in **bold face print**. Text presented for information only is shown in *italic* print. When used in this report, the term "weight" means "mass."

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 they were submitted and, therefore, some may contain only 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

Examination Procedure for Price Verification ..... 240 Series

Interpretations and Guidelines ..... 250 Series

NIST Handbook 133 ..... 260 Series

Other Items ..... 270 Series

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Table C
Voting Results

Reference Key Number	House of State Representatives		House of Delegates		Results
	Yeas	Nays	Yeas	Nays	
232-3	15	19	24	9	Failed
237-1	32	3	33	2	Passed

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

232 METHOD OF SALE REGULATION

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

(Items 232-1 and 232-2 were withdrawn)

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 An**nual 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 2008," (Spring 2009).**

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.

2008 Activities, Interim and Annual Meeting

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.

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.

2009 Activities, Interim and Annual Meeting

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.

The AB868 Fuel Delivery Temperature Study report was completed on March 12, 2009. The report can be viewed at www.energy.ca.gov/2009publications/CEC-600-2009-002/CEC-600-2009-002-CMF.PDF.

The State of Alaska commissioned an independent ATC cost/benefit study. The final study was released on July 5, 2009, and can be viewed at www.alaskafuelproject.com (refer to Appendix C for a summary of the study). This study consisted of two surveys regarding a comparative analysis of the costs and benefits of selecting a gross gallon versus a net gallon.

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 was 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 allow 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 2009 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 6 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 9 and 11 for additional background and 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.

At the 2009 Annual Meeting in San Antonio, Texas, the Committee reviewed the data, reports and comments received (refer to Appendix D for letters submitted). The Committee withdrew both Items 232-1 and 232-2 in their entirety. Neither of these items will appear on future agendas unless a proposal is submitted by a Regional Association. It was voted by the Conference that the following language appear as presented and no changes be made after the Conference. The Conference adopted the following summary of the Committee's assessment of the comments received on these items and also agreed not to allow the Secretary editorial privilege.

The Committee heard over 45 comments during the open hearings on both 232-1 and 232-2. The Committee reviewed all testimony, studies, letters, and past conference reports in making their decision.

There were very few proponents to ATC under 232-2. There were comments from State officials that they would not support mandatory ATC but would consider supporting permissive ATC. A major reason to have ATC would be to provide a model law for uniformity amongst the states. Those states that do not want ATC could prohibit through law or regulation. A majority of the comments indicated that there needed to be a way to make transactions transparent to consumers. A county sealer stated that the CEC recommended that more research is needed and that temperature differences exist for retailers that are in the same marketplace. A few comments were made that having temperature compensation would be the most fair and equitable means for selling fuels.

The overwhelming majority of comments were opposing ATC. Primary reasons for the Committee's decision were conference consensus against ATC, economic cost factors, lack of benefit to consumers, absence of uniformity in the marketplace, and the additional cost to Weights and Measures officials and service companies. Due to the current economic situation, States currently have decreasing budgets which limits their resources for additional testing time and equipment. Consumers may have to incur the cost for the implementation of ATC and would have to deal with the possibility of fewer retailers in the marketplace. There was also concern with retailers in rural areas and how this additional burden would be a financial and economic hardship. Two studies, the California Energy Commission (CEC) study titled "Fuel Delivery Temperature Study" and the "Alaska Fuel Metering Project," were submitted. With the release of the CEC study, it was documented that it was not cost beneficial for either consumer or industry. A few stakeholders expressed that making it permissive and or mandatory would be anti-competitive. There was concern about educating consumers on ATC. Consumers would have to know the difference between purchasing gas in today's market and an ATC market in order to make a value comparison.

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

(This item was withdrawn)

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 5 and 9 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 term~~s~~ "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)
Gasoline, gasoline-oxygenate blends (3.7 mass percent oxygen, maximum), gasoline ethanol blends (10 volume percent maximum)	API Table 6b	62 API (730 kg/m^3)
Diesel Fuel (grade 2-D), biodiesel blends (20 volume percent biodiesel, maximum)	API Table 6b	37 API (840 kg/m^3)
Other fuels TBD	-	-

(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).

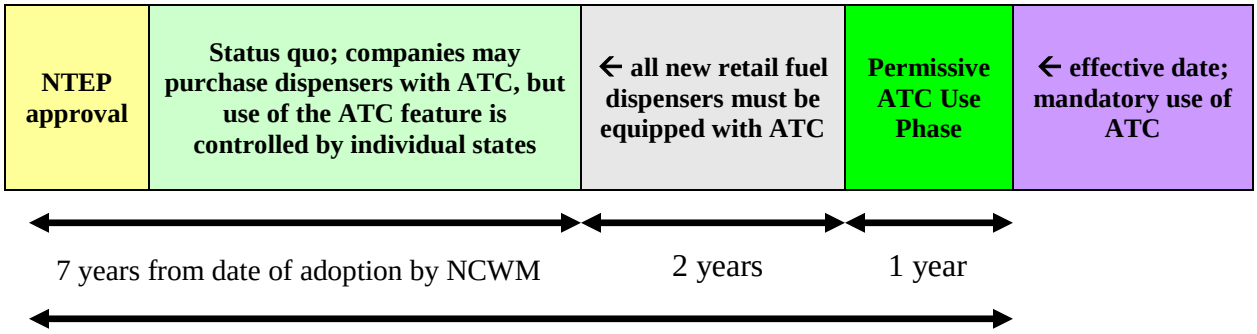
Discussion (ATCSC): The ATCSC believes that if temperature compensation is adopted for the retail sales of refined petroleum products, then the ultimate goal is to have mandatory use of ATC to provide a single method of sale. The time period before the mandatory use of ATC is a debatable point. The ATCSC recommends that 10 years after the adoption of an ATC method of sale, using temperature compensation should be mandatory. During the first seven 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 (two 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 seven-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 W Original Recommendation for a Method of Sale Proposal for ATC Developed by the 2007 Committee

(This item was withdrawn)

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 in^3 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 that 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."

At 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.

At the CWMA 2009 Annual Meeting held May 2 - 6, 2009, in St. Louis, Missouri, the Committee recommended that both 232-1 and 232-2 be opposed based upon extensive comments from petroleum marketers and state officials heard in their open hearings. There were two concerns that were specifically discussed in 232-2; the first concern was the removal of the word "permissive" from the title while the proposal states that "products may be sold on the basis of temperature-compensated volume." The second concern was the lack of density values for the products in the proposal.

Statements were made that permissive ATC would prevent uniformity in the sale of engine fuels and non-engine fuels. ATC would not provide transparency in retail transactions and may cause consumer confusion. An industry representative commented that the science of temperature compensation is not relevant to the discrepancy of energy content caused by the varying concentrations of ethanol. There were comments made in support of this item. Members feel that the NCWM is the appropriate place to make decisions regarding ATC rather than it being mandated by either Congress or individual state legislatures.

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 that 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.

At the 2009 NEWMA Annual Meeting, May 11 - 14, 2009 the regional members opposed both Items 232-1 and 232-2. A recommendation was made by the Committee that both items be withdrawn. The Committee discussed the CEC report which concluded that "ATC should not be required since the results of the cost benefit analysis show a net cost for consumers." A state official commented that the L&R has not demonstrated how the marketplace will be different with ATC. An industry representative commented that new gasolines will have varying BTU's and mandating ATC will not balance out the BTU difference.

A recommendation was made by the Committee that both 232-1 and 232-2 be withdrawn and replaced with the attached language prepared by Ross Andersen, NewYork, (see proposal below). This proposal will create a method of sale for motor engine fuels and heating fuels that will require all retail sales be measured in gross gallons.

Proposal to amend NIST Handbook 130, Method of Sale Regulation to create a method of sale for fuels.

2.XX. Engine Fuels and Heating Fuels

2.XX.1. Definitions.

2.XX.1.1. Engine Fuel. – any liquid used for the generation of power in an internal combustion engine. This does not include any substance that must be kept under pressure or maintained at cryogenic temperatures to remain in the liquid state.

2.XX.1.2. Non-engine Fuel. – any liquid matter used for the generation of heat, power, or similar uses. This does not include any substance that must be kept under pressure or maintained at cryogenic temperatures to remain in the liquid state.

2.XX.1.3. Gross Volume. – the volume of a liquid at the conditions at the time of sale.

2.XX.1.4. Net Volume. – the volume of a liquid after correction for temperature expansion/contraction to the reference temperature.

2.XX.2. Declaration of Quantity.

2.XX.2.1. Retail Transactions. – Engine fuels and non-engine fuels shall be sold or offered for sale at retail in units of gross volume, except for individual transactions of 6000 liters (1500 gallons) or more where the buyer may request to purchase in units of volume corrected to 15.56 °C (60 °F).

2.XX.2.2. Wholesale Transactions. – Engine fuels and non-engine fuels shall be sold or offered for sale in units of gross volume or in units of volume automatically corrected to 15.56 °C (60 °F). Factors for correction shall be those in ASTM D1250 Table 6b or other suitable reference source.

2.XX.2.X. (Optional permissive use of temperature correction) Specific Retail Transactions. – (Describe the specific product or type of retail transaction here) shall be sold or offered for sale in units of gross volume or in units of net volume automatically corrected to 15.56 °C (60 °F). The following density factors shall be used in automatic temperature compensating equipment for all transactions under this subsection:

(a) (Name or type of fuel for each fuel) and (density factor in API gravity, kg/m^3, or g/cm^3). (Add additional items (b), (c), etc. to this list as necessary.)

2.XX.2.Y. (Optional mandatory use of temperature correction) Specific Retail Transactions. – (Describe the specific product or type of retail transaction here) shall be sold or offered for sale in units of volume automatically corrected to 15.56 °C (60 °F). The following density factors shall be used in automatic temperature compensating equipment for all transactions under this subsection:

(a) (Name or type of fuel for each fuel) and (density factor in API gravity, kg/m^3, or g/cm^3). (Add additional items (b), (c), etc. to this list as necessary.)

2.XX.3. Receipt, ticket, or sales invoice.

2.XX.3.1. Retail transactions, gross volume. – If the seller provides the buyer a receipt, ticket or sales invoice, it shall declare the gross volume delivered and the appropriate unit of volumetric measure used (liter, gallon, barrel, etc).

2.XX.3.2. Retail transactions, net volume. – If the seller provides the buyer a receipt, ticket or sales invoice, it shall declare the net volume delivered with the appropriate unit of volumetric measure (liter, gallon, barrel, etc), and the statement "volume corrected to ___" with the blank being filled in with the reference temperature, e.g. "volume corrected to 60 °F". In the case of a single transaction exceeding 6,000 liters (1,500 gallons) being sold on a net basis as provided in subsection 2.XX.2.1., the seller shall provide a receipt, ticket or sales invoice as described in this section, and the seller shall also declare the density of the fuel, the fuel temperature at time of sale, and the gross volume with appropriate unit of measure.

2.XX.3.3. Wholesale transactions, gross volume. – The seller shall provide a delivery receipt, ticket or sales invoice to the buyer declaring the volume delivered and the appropriate unit of volumetric measure used.

2.XX.3.4. Wholesale transactions, net volume. – The seller shall provide a receipt, ticket or sales invoice to the buyer declaring the net volume delivered with appropriate unit of measure, the density of

the fuel, the fuel temperature at time of sale, and the gross volume with appropriate unit of measure. The net volume shall be clearly designated either "net at ___" or "volume corrected to ___" with the blank filled in with the reference temperature.

2.XX.4. Additional requirements.

2.XX.4.1. All transactions, gross volume. – The seller shall not use external sources of heat to expand the volume of fuels sold on a gross volume basis. This includes any application of heat to the product, using dark colors on above-ground storage tanks to increase absorption of solar energy, or similar acts.

2.XX.4.2. Retail transactions, net volume.

(a) All sales at a business location shall be in net volume units on a continuous basis. 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.

(b) The seller shall clearly and conspicuously indicate "ATC" in association with unit price advertisements to indicate that the sales are being made on a net volume basis.

2.XX.4.3. Wholesale transactions, net volume. – All sales to a particular buyer in net volume units shall be in those units for a continuous 12-month period unless otherwise agreed to by the parties in writing.

Justification for the proposal*:* The California Energy Commission (CEC) Fuel Delivery Temperature Study has shown that mandatory ATC for RMFDs is an overwhelming net negative for consumers. In keeping with that reality, their fourth recommendation to the California Legislature suggests clarifying the statute. The obvious interpretation of that recommendation would mean mandating gross gallon sales. The proposal above is one attempt to do that in the form of a Method of Sale Regulation.

Because of the number of combinations involved, the regulation is fairly complicated. There are definitions in the first section, methods of sale in the second, and requirements for receipts in the third and general requirements for gross and net sales in the fourth. This section includes prohibition on artificially heating product to expand volume when using gross volume sales.

The proposal includes two optional sections in 2.XX.2. that permit states to either permit net sales at retail, or mandate it, for specific types of fuels or applications. This provides flexibility to states that already permit net sales for some products or applications. As the state adopts the optional section of their choice, they fill in the blanks accordingly. For example, if a state wanted to permit net sales of home heating fuels delivered from a vehicle tank meter, they could add that as 2.XX.2.3. to do that and specify product densities for #1 oil or kerosene, #2 oil and #4 oil. They may also wish to include densities for B100 and various biodiesel blends or include them under other product densities.

NEWMA believes this proposal would:

- Offer clarity of the statue as the CEC recommended
- Retain voluntary ATC usage at wholesale
- Retain mandatory gross retail sales and prohibit artificial heating
- Provide options for an individual state to specifically mandate or permit ATC for specific applications
- Permit the S&T Committee to complete its work on ATC specifications and tolerances
- Eliminate the apprehension that NCWM members have towards adopting S&T ATC items because of the concern that their inclusion into HB 44 would constitute a "method of sale"
- Permit NTEP to develop test criteria and checklists, and start certifying ATC devices
- Erase the void that exists in states that neither allow nor prohibit ATC.

NEWMA also believes the proposal does not close the door on ATC. NEWMA projects that it would facilitate ATC upgrades if and when the economics are feasible to consider ATC. It also would permit manufacturers to include ATC options to NTEP CC's in anticipation of future regulatory changes.

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 - Temperature Compensation. The full report is available from NIST WMD.

The WWMA held their Annual Meeting in Anchorage, Alaska, September 7 - 11, 2008. It was recommended that this item continue to remain Informational. The WWMA would like to review the CEC report upon completion. 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

(This item neither passed or failed and was returned to Committee)

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 its 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.

At the CWMA 2009 Annual Meeting held in St. Louis, Missouri, on May 3 - 6, 2009, the NIST Technical Advisor recommended that the proposal be changed in Section 2.4.3.(a) to read as …fractions of liters ~~cubic meters~~. A state regulator stated that the proposal conflicts with HB 44 "Units of Measures" and believes that liters should only be used for fluid measurements. After review of HB 44, Appendix C (pgs C-2 and C-8), the L&R Committee did not feel that there is a conflict. The Committee supports this item for the following reasons: "A precedent has been established for use of liters in dry measure (e.g., mulch), traditional industry practices utilize liters as their method of sale, it provides a better value comparison, and it would remove the current conflict with violation of the Rule of 1000 when cubic meters are used."

At the 2009 NEWMA Annual Meeting held in South Portland, Maine, May 11 - 14, 2009, the Committee supported this item along with the recommended changes from the NIST Technical Advisor. The NIST Technical Advisor recommended that the proposal be change in Section 2.4.3.(a) to read as …fractions of liters ~~cubic meters~~. A state official stated that the changes to this section are being made to correct a technical error with the use of metric measure and that customary units will not change. An industry representative questioned whether liters would be the correct metric measure and suggested decimeters. It was noted that decimeters and liters are equivalent.

At the 2009 Annual Meeting in San Antonio, Texas, there was discussion that this proposal needs additional review by the Committee for editorial changes. The proposal is not clear and precise as presently submitted. It was recommended that the term "fraction of liters and cubic feet" be given consideration. This proposal is being returned to the Committee for additional clarification.

Committee Recommendation: Amend Section 2.4.3. as follows:

2.4.3. Quantity. – Fireplace and stove wood – 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 m^3 ($^1/_8$ cord or 16 ft^3) 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 m^3 ($^1/_8$ cord or 16 ft^3) 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

(This item was adopted)

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 waivered 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 ºC (102 ºF) 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 %.

At the 2009 CWMA and NEWMA Annual Meetings both regions fully supported this item.

The Committee received no opposition to the item prior to or at the 2009 Annual Meeting (refer to Appendix E for comments submitted).

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:

Section 2. Standard Fuel Specifications (See NIST Handbook 130, 2009 Edition, page 172)

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. Gasoline-Ethanol Blends.

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. Gasoline-Ethanol Blends. – 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.~~ (a) The maximum vapor pressure shall not exceed the ASTM D4814 limits by more than 1.0 psi for:

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

~~2.1.3.1.2.~~ (2) All blends of 1 to 10 volume percent ethanol from September 16 through May 31.

~~2.1.3.2.~~ (b) 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) (see Notes 1 and 2).

~~2.1.3.3.~~ (c) 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 (see Notes 1 and 2):

(1) Class 1 shall be ~~51.5~~ 54 °C (~~125~~ 129 °F)

(2) Class 2 shall be ~~49.0~~ 50. °C (~~120~~ 122 °F)

(3) Class 3 shall be ~~45.0~~ 47 °C (~~113~~ 116 °F)

(4) Class 4 shall be 41.5 °C (107 °F)

(5) Class 5 shall be 39.0 °C (102 °F)

(6) 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.

NOTE 1: The value for the 50 volume percent evaporated point noted in Section 2.1.3.(b) and the values for Classes 1, 2, and 3 for the minimum temperature for a Vapor-Liquid Ratio of 20 in Section 2.1.3.(c) are now aligned and identical to those that are being published in ASTM D4814-09b and apply equally to gasoline and gasoline-ethanol blends. In future editions of NIST Handbook 130, Section 2.1.3.(b) will be removed editorially and the reference to Classes 1, 2, and 3 in Section 2.1.3.(c) will be removed editorially.

NOTE 2: The temperature values (e.g., 54 °C, 50. °C, 41.5 °C) are presented in the format prescribed in ASTM E29 "Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications."

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 D 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 2009 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.

At the CWMA 2009 Annual Meeting held May 3 - 6 in St. Louis, Missouri, the Committee recommended support of this item after reviewing the current proposed revisions to HB 133.. Comments documented during open hearings included the following recommendations from an industry representative: Chapter 1-3 – add "compliance" to the reasons listed since manufacturers "overpack" to meet current regulations; Chapter 1-2 – "moisture" should be

inserted in front of allowance (last paragraph of L&R - C5; there is a need to recognize that other products may be subject to moisture loss for which allowances have not been established; Chapter 2-3 and Chapter 2-5 – the dates referenced can be removed since they are already in the past. The representative cautioned that this proposal does not "finish" the issue with moisture loss. There are two questions which remain: 1) What guidance can be provided for manufacturers with products other than those listed for moisture loss? and 2) What methodology is necessary for manufacturers to demonstrate the data needed for a moisture allowance?

A state regulator objected to this proposal as a voting item and stated that members cannot vote on this item since the information will not be available until the July meeting. He recommended that the proposal be moved to Informational. He acknowledged that Handbook 133 is a NIST publication but stated that due process must be provided since the NCWM does vote to adopt the changes in this handbook.

At the CWMA voting session, the membership voted not to accept the recommendation of the Committee and recommended the item be made Informational.

At the 2009 NEWMA Annual Meeting, held May 11 - 14, 2009, in South Portland, Maine, the Committee recommended support of this item. The group discussed the meaning of "editorial" and agreed that due to the volume of changes being recommended, the correct process is to review all comments received, and then have a vote on them by NCWM. A state official suggested that the document be distributed over the NIST Commodities Server List. A recommended change to HB 133 Chapter 3, Section 2.6. specifically references the use of glaze with frozen seafood products. It was suggested that wording include other glazed products such as frozen chicken (i.e., glazed chicken wings).

At the NCWM 2009 Annual Meeting in San Antonio, Texas, the MLWG met on July 12. The NIST Technical Advisor informed the Committee and the MLWG that the draft HB 133 was sent out mid-May 2009 on the Weights and Measures Directors, NCWM HB 44 and Commodities list servers, and e-mailed to interested stakeholders, MLWG attendees, and trade associations. Additional comments and recommendations received were distributed to the Committee.

Handbook 133 was reviewed in its entirety by the MLWG. Current changes and recommendations to HB 133 are reflected in Appendix F. State Directors voiced concern that they had not had ample time to thoroughly review and evaluate the changes. A working draft document of Handbook 133 is located in Appendix G.

Committee recommendation is to keep this item Informational. NIST will incorporate changes from the July 12 MLWG meeting. NIST will disseminate this information to all stakeholders using their contact point information system and list servers (W&M Directors and the NCWM HB 44 and Commodities list server).

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 fully develop 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 D 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 Informational 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 Informational 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.

At the CWMA 2009 Annual Meeting, the Committee recommended that this item remain informational. The Chairman of the Fuels and Lubricants Subcommittee provided an update on the work being done at ASTM. ASTM conducted a round robin to develop better precision for measuring lubricity. There is a Coordinating Research Council study to determine whether the wear scar limit is adequate to provide protection.

At the 2009 NEWMA Annual Meeting, the Committee recommended that this item remain Informational. The Chairman of the Fuels and Lubricants Subcommittee stated the committee is continuing to work on this item.

At the 2009 Annual Meeting held in San Antonio, Texas, the FALS Chairperson gave an update that ASTM is still working on improving the precision of the test method. This should go to ballot at ASTM this semester and be final in December. The Committee recommends that this item remain Informationalal until ASTM adopts a revision to its standard.

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 a 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 D 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 and Annual 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 Appendix H). 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 refer to Item 237-2 in the report of the 94th Interim Meeting in 2009) 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.

At the 2009 Annual Meeting in San Antonio, Texas, the NIST Technical Advisor presented a letter dated April 17, 2009, (see Appendix I) from the FDA regarding their decision regarding the method of sale for pelletized ice cream. The FDA declared that pelletized ice cream is a semisolid food, in accordance with 21 CFR 101.105(a), the appropriate net quantity of content declaration for this type of product is net weight. An FDA official attending the Annual Meeting stated that manufacturers have until April 2010 to modify their labels with a net weight declaration. Manufacturers that are unable to meet this deadline will need to contact the FDA. The FDA will look at each extension request on a case-by-case basis only.

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

Source: Western Weights and Measures Association (WWMA)

Proposal: The proposal is to add a Informational 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: Twenty-four 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) for the Development of Commercial Hydrogen Measurement Standards 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 retail hydrogen applications become 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 and Annual Meetings, the NIST Technical Advisor briefed the Committee on work that the USNWG Fuels Specifications Subcommittee (FSS) has done to date (refer to Appendix J).

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 crate 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 –

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 one 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 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 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 K) 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.

At the 2009 Annual Meeting in San Antonio, Texas, the Technical Advisor announced that NIST held a Seafood Forum meeting on May 28, 2009, in Gaithersburg, Maryland, to discuss the problem and solutions to short net weight fraud occurring in the seafood industry. The meeting was a collaborative effort attended by 30 participants representing federal agencies, state weights and measures officials, trade associations and industry representatives. The purpose of the meeting was to achieve three primary objectives: 1) to clearly define the problem and economic impact from short net weight fraud, 2) to provide understanding of each agency's role, responsibility, authority, enforcement, and oversight of seafood and net content compliance, and 3) to develop a plan for clear and immediate action and solutions to slow down and stop the problem of short weighing and to maintain the public's trust in the regulatory system.

Judy Cardin, Wisconsin, will be taking the lead on coordinating follow-up meetings with state and federal agencies to discuss enforcement issues.

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

MOTOR FUELS

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

GAO Accountability · Integrity · Reliability
Highlights

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.

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.

United States Government Accountability Office

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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

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

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

[3]Throughout 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. stakeholders[4] 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

[4]Throughout 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.

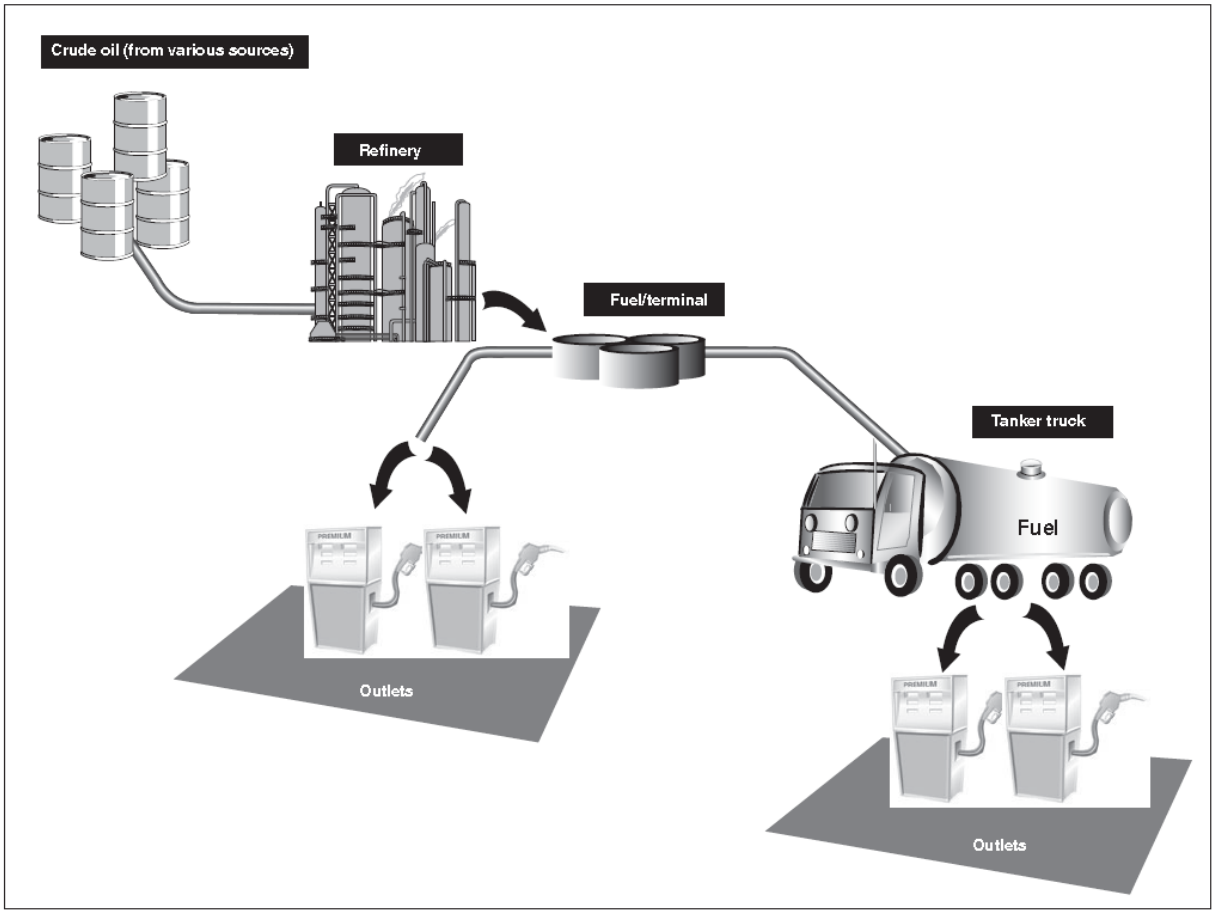
In the United States, the petroleum industry often adjusts for temperature-related changes in wholesale transactions for gasoline and diesel and in retail sales for other petroleum products, such as home heating oil, liquefied petroleum gas, and prepackaged liquids such as motor oil. In contrast, virtually 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

[5]The 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.

[6]The 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

[7]GAO, *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

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

[9]Canada 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 substantively, 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

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

Alaska Fuel Metering Project

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Alaska Fuel Metering Project

Final Report

7/5/2009

Prepared by:

Northern Economic Research Associates
7300 Chena Hot Springs Rd. Fairbanks Alaska 99712

for

State of Alaska Department of Transportation and Public Facilities

Measurement Standards and Commercial Vehicle Enforcement

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Executive Summary

The Crux of the Issue

It comes as a surprise to Alaska consumers that there are two different kinds of gallons being sold in certain retail petroleum markets. To a layman, a "gallon" means the standard U.S. gallon, (231 cu. inches). That gallon will have to be called a "gross" gallon in this report because there is another kind of gallon being sold too. It is well known to petroleum professionals, and is called a "net" gallon.

For the layman, it is really not useful to go beyond the fact that a net gallon is smaller in Alaska. So we have smaller gallons being sold alongside larger gallons. With two different gallons being sold, consumers cannot make meaningful price comparisons. They can very well be buying the more expensive gallon when they think they are buying the less expensive gallon.

The purpose of this report was to determine what definition of "gallon" should prevail in Alaska petroleum retail markets. The conclusion of the report is that given present technology, there should be one retail petroleum gallon in Alaska – and it should be the standard "gross" gallon already familiar to consumers. A requirement to sell "net" gallons would force the statewide adoption of more expensive dispensing equipment, and the costs would outweigh the benefits.

Comment on the draft report suggested that the study may have pursued the objective of choosing the retail gallon that was the least expensive for the consumer. But that was not the objective of the study. It is tantamount to saying benefits were not considered. They were. But benefits did not justify the costs vis-à-vis a gross gallon standard.

Markets Affected

In Alaska, retail fuel is sold either at gas stations (land and marine) through gas pumps, or it is delivered by fuel trucks. Gasoline stations sell both gasoline and diesel to cars and trucks, and at marine stations fuel is sold to vessels. Fuel trucks on the other hand deliver fuel oil to homes and businesses for heat, to electrical plants, and also to aircraft at airports. There is also some off-road diesel delivered for heavy equipment by fuel trucks.

States have different rules governing gas pumps and fuel truck deliveries. In Alaska, gas station pumps sell gross gallons. There are no net gallon gas station pumps in Alaska. There are none in the USA although certain groups are pushing for it. But fuel trucks can deliver either gross gallons or net gallons in Alaska. So it is in fuel truck deliveries only where both gross and net gallons are being sold – not in gasoline stations.

Home heating oil, fuel oil for electricity production, aviation gasoline – these are the markets where retail customers might be buying net gallons and might be buying gross gallons, depending on the method of delivery selected by the retailer. If your invoice reads "volume adjusted to 60 F" it means you have bought net gallons.

It is quite possible that in the future gasoline stations will be able to sell either net or gross gallons unless regulations are established by Alaska that choose one or the other. This has occurred in Canada already. Part of the study purpose is to determine whether net gallons should be sold through gas pumps at gasoline stations like in Canada.

Gross vs. Net Gallons

Fuel expands as it warms and contracts as it cools. The idea of a "net" gallon is to adjust the size of the gallon as fuel either expands or contracts. As stated earlier, a gross gallon is 231 cubic inches. It does not vary with temperature. The volume of a net gallon depends on temperature. At 60 F a net gallon is the same volume as a gross gallon. Below 60 F, which is the majority of the time across Alaska, the net gallon is smaller than the gross gallon (see figure E1):

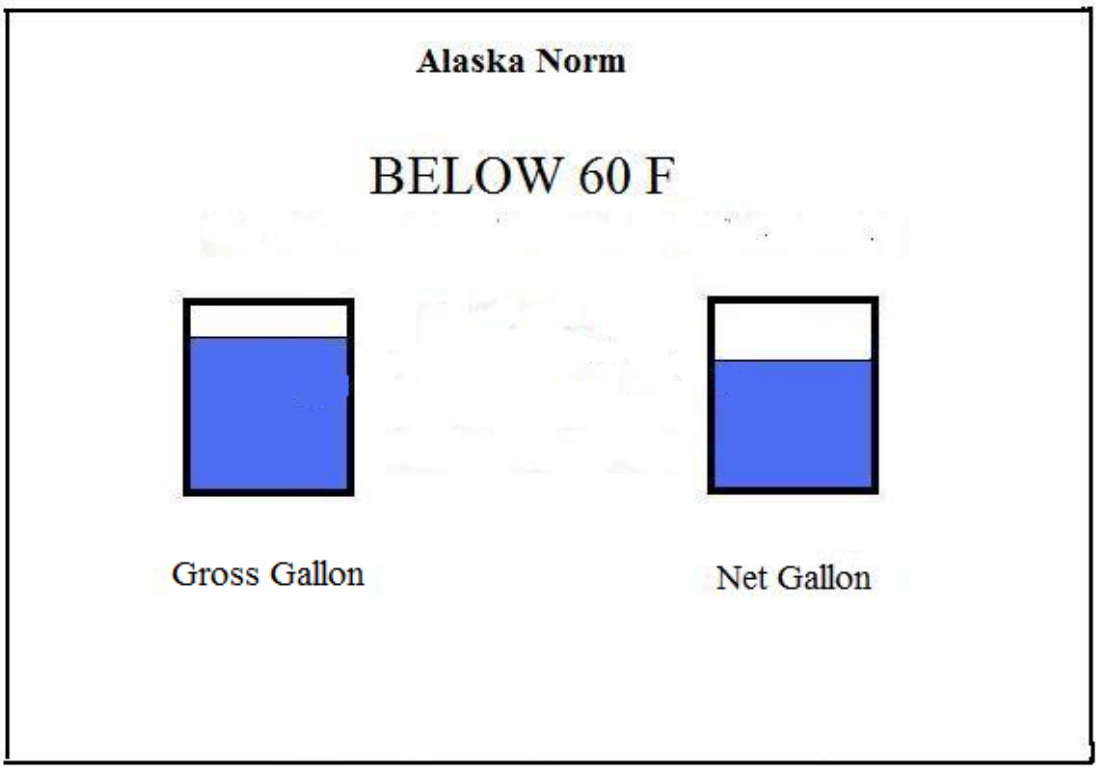


Figure E1

A rule of thumb for gasoline is that for every 15 degree drop in temperature, the net gallon is 1% smaller. At thirty below zero the net gallon is about 6% smaller than the gross gallon. It is also true that at temperatures above 60 F, the net gallon is larger than the gross gallon. But as a practical matter for Alaska net gallons are smaller, particularly when we understand that the major fuel oil season is in the winter when temperatures are extremely cold.

It is more expensive to meter net gallons because it requires taking the temperature of the fuel and adjusting the size of the gallon, depending on that temperature. Ultimately, the cost of doing so will be borne by the consumer.

In the language of the layman, should Alaska allow the smaller gallon and the larger gallon to be sold alongside one another when consumers do not know the difference? Should the smaller gallon be the standard? Should the larger gallon be the standard?

Draft comment from industry representatives that purchased ATC devices suggest the use of "smaller" and "larger" gallon is inflammatory and should not be used. But obscuring that fact to consumers deprives them of the most important thing for them to understand.

Cost Benefit Results

The objectives of weights and measures standards are price transparency, equity, and of course economy. In this report we consider both net and gross gallon sales in gasoline station and fuel truck markets. It is clear that allowing both is the worst case scenario for consumers. Allowing either net or gross gallon sales at the same time introduces what is probably the largest discrepancy in gallon sizes from retailer to retailer in the entire nation.

It is fairly clear that the net gallon standard is more ideal from an engineer's perspective. But it requires more sophisticated equipment to meter fuel this way. The temperature of the fuel must be measured, and the size of the gallon must be either increased or decreased accordingly.

It would cost millions to outfit either fuel trucks or gasoline stations in Alaska this way, and the cost would be relatively more onerous for bush Alaska than for communities along the road system. Installation of retrofits for dispensers or trucks in remote sites are in the ten thousand dollar range, and the benefits of doing so are so small as to be essentially nil.

It is true that the additional cost of ATC equipment is small on a per gallon basis. But a small inefficiency is not a net benefit.

The gross gallon standard is not a perfect way of metering fuel, but it is the most economical. In all of the studies that were reviewed where gross gallon vs. net gallon standards were studied from a cost/benefit standard, the gross gallon proved to be superior. So it should not come as a surprise to find the same thing in Alaska.

Introduction and Literature Review

Introduction

> "…good, open measurement leads to fair, honest and just trade."[1]

This sums up one of the main motivations for studies on temperature-adjusted vs. absolute volumetric measuring of fuel sales at retail. Is the gross gallon better, the net gallon, or should it be permissive, where either method is used at the discretion of willing buyers and sellers? Yet another approach is to redefine the volume standard for a gallon, which is an approach Hawaii took.

Measuring by volume has historically been the least-costly method of dispensing fuel at the retail pump. It is extremely simple and reliable. A meter is merely a device that spins as fuel moves, and it drives another device that registers the quantity of fuel metered. There is very little that can go wrong mechanically. Weights and Measures departments of state governments have for many decades accepted and presided over their use as efficient and equitable.

If fuel could be sold by weight, there would be no temperature adjustment controversy. But selling by weight is much less practical than metering in the customary manner.[2] Temperature adjustment can be thought of as a way to approximate selling fuel by weight instead of by volume. But it is a more expensive means of doing so.

Changes in technology over time, such as the adoption of digital registers in fuel dispensers, have made it less expensive to adopt temperature compensation at retail. It is still more expensive than gross gallon metering, but in part the reduction in expense has caused some consideration for whether it should be utilized as a universal method of sale.

For lack of a better word, automatic temperature compensation (ATC) has "crept" into some markets such as Canada and Alaska without prior economic analysis of its costs and benefits. This literature review shows that in general where ATC has been practiced at retail it has not been studied from a cost/benefit perspective – and where it has, ATC has not been adopted.

Definitions:

U.S. Gallon or Gross Gallon = 231 cu. in. (regardless of temperature)

Petroleum Gallon or Net gallon = Temperature Corrected Gallon (231 cu in. @ 60^0F)

The effect of temperature on fuel volume has been known for a very long time. A given gasoline or fuel oil volume increases with temperature. A widely cited rule of thumb for gasoline is that

[1] Paton, R. and Boam, D. UK National Weights and Measures (1999), p 2.
[2] There is a method of metering (mass flow metering) that is technically capable of determining the weight of fuel delivered – but it is much more expensive per unit.

there is one percent fuel volume expansion for each fifteen degree temperature increase. The expansion is a little less for fuel oil or diesel. The warmer the fuel, the less energy and fewer miles to the gallon a vehicle will receive – or the less heat it will produce per unit volume.

If one wants to standardize by weight or energy content, a reference temperature has to be selected. For the U.S. that reference temperature is 60 F. A petroleum gallon or net gallon is the same volume and weight as a gross gallon at 60 F. At temperatures above 60 F the net gallon is larger in volume than 231 cu. Inches, but it has the same weight and energy content as it did at 60 F. At temperatures less than 60 F the net gallon has smaller volume, but again the same weight and energy content as it did at 60 F.

In Alaska we would be speaking about fuel contraction rather than expansion – as fuel cools it becomes denser and has more energy per unit volume. Using our rule of thumb, a net gallon of gasoline at -60 F has about 8% smaller volume than it does at 60 F. A net gallon would be about 214 cu. inches at – 60 F. The total energy in the smaller, net gallon stays the same, but, since the volume is smaller, the energy per cubic inch (or whatever volumetric unit is used) would be greater. Please refer to Figure 1.

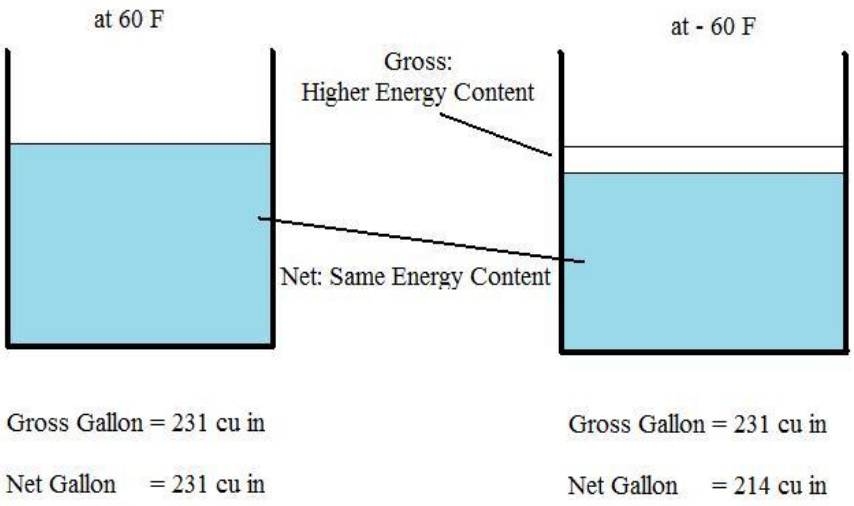


Figure 1

As we can see from the figure, a gross gallon in Alaska at – 60 F is considerably larger (231 cubic inches) than the net gallon (214 cubic inches). The gross gallon has about 8% more energy content in total than the net gallon. It would be true to say that a net gallon more or less guarantees the same energy content every time. But it is a guarantee that energy content is lower than that provided by a gross gallon at the temperatures of retailed fuels in Alaska.

Impetus for Study

Trade is facilitated by universally accepted standards of measure, and impeded when standards differ, or where they are not enforced. What is meant by "price" is not transparent when the unit of measure differs across retailers. Equity amongst retailers / suppliers and amongst customers will not prevail when there are different measures meted by one supplier vs. another. Differences in temperatures of fuel between suppliers introduces a potential lack of transparency and equity in the marketplace. It raises the question whether net gallon sales should be adopted at retail.

So generally the question for researchers in the net gallon vs. gross gallon debate has been which gallon to adopt at retail – gross or net. In this study however we are beginning with a situation in which both net and gross gallons are being sold in the marketplace, specifically for fuel metered from vehicle tanks. , and therefore whether elimination of one of them passes a cost/benefit test.

Because Alaska has had a permissive approach to fuels delivered by vehicle tanks, there are differences in gallon contents across suppliers that may very well exceed those for any other jurisdiction in the nation. Under the permissive standard, delivering fuel on a net gallon basis is essentially the same as delivering fuel at 60 F. We cannot say with very much precision what the average temperature difference is between gross gallon retailers, but the temperature data collected indicates it would be an order of magnitude less than what is possible between net and gross retailers.

During the winter the average effective difference between a gross gallon supplier and a net gallon supplier can exceed sixty degrees. This is the primary heating oil season. When gross gallon retailers are storing and transporting their fuel in a similar manner, the temperature of the fuel is going to be similar with both following the ambient much more closely than 60 F.

Whatever differences there are between gross gallon suppliers, and whatever lack of transparency or equity exists under a gross gallon standard – the permissive standard introduces an order of magnitude more problems in transparency and equity.

Regardless of whether the gross gallon standard or the net gallon standard is more efficient in a cost-benefit setting, it is abundantly clear that the permissive standard is inferior to either one. The permissive standard introduces an order of magnitude more differential between retailers than weather or refining or delivery schedules can on their own. Also, the permissive standard has some costs associated with it that the gross gallon standard does not (more expensive metering and calibrating on the net gallons). So if we were to rank legal regimes, the permissive standard is the worst due to cost, lack of transparency and inequity to the consumer. The public policy question becomes whether the net or gross standard is more efficient.

Temperature Compensation at Wholesale vs. Retail

For a refinery purchasing at wholesale, temperature is important because the warmer the crude oil it is purchasing, the fewer gallons of product that will be produced at the end of processing

(warmer gallons contain less energy). When you are processing millions of barrels and profit margins are small percentages, it makes enough difference to matter. So in the early part of the last century the method of temperature correction was developed, a reference temperature selected, and tables produced where anyone could compute the net gallon content given a product density, temperature, and volume.

The petroleum industry has generally relied on temperature-adjusted gallons for these large wholesale transactions for an additional reason. It is economical to perform temperature adjustment in large quantities. If you are offloading a ship with millions of gallons, then measuring temperature, measuring gross volume, and calculating the net gallon content is essentially costless on a per gallon basis. If there is any benefit at all in taking such a measure, it will be worth it.

The smaller the transaction, the more costly is the attempt to measure accurately. When we move from millions of gallons to thousands to mere gallons in a transaction, any additional measuring cost starts to become significant. In comments before the California Commission, the Chief of New York State Weights and Measures estimated that in moving from wholesale to retail fuel transactions, there were about fifty times the number of meters measuring the fuel (fifty retail meters per wholesale meter)[3]. What makes sense at ten thousand gallon transactions does not necessarily make sense at ten gallons when you are multiplying that cost by fifty times.

Increased "accuracy" does not even make sense from a technical perspective when the transactions become small enough. Observe the tolerance specifications in the National Institute of Standards and Technology (NIST) Handbook 44 when we move from larger retail sales to smaller retail sales[4]:

Tolerance by Flow Rates - Temperature Compensation		
Flow Rate	Tolerance	Degrees
Over 30 gpm	0.15%	2.25
>1-30 gpm	0.30%	4.5
1 gpm	0.75%	11.25

Figure 2

The published tolerances are in percentage errors. We can convert those into degrees Fahrenheit to ask essentially the same question – how much can temperature be misjudged

[3] http://www.energy.ca.gov/transportation/fuel_delivery_temperature_study/documents/2008-12-09_workshop/comments/Ross_J_Anderson_TN-49465.PDF

[4] The National Institute of Standards and Technology (NIST) produces regulatory language for states that is often adopted (Alaska is one of those). Handbook 44 contains provisions pertaining to liquid measures of concern in this report.

before the meter is no longer within acceptable tolerances?[5] For flow rates above 30 gallons per minute (such as many home heating oil deliveries), the meter can be off by two degrees and it is still within tolerance. At flow rates of 1-30 gallons per minute (gasoline station dispensers) it can be off by four degrees and still be within tolerance. And for very small transactions of 1 gallons per minute or less – the meter can be off by over ten degrees.

It isn't even technically feasible as a practical matter to temperature compensate a cup or even a quart of fuel given that some initial flow is required to stabilize a temperature reading. There isn't any cost that is justified once the transactions become small enough, regardless of whether in theory temperature compensation is superior.

The issue is not whether temperature compensation of fuels makes "academic" sense at retail. The question is whether it is practical. Do the benefits outweigh the costs? When we are speaking about retail transactions, the variation in temperatures amongst retailers has to become fairly significant before temperature compensation meters can even "tell the difference" – meaning discriminate with an accuracy greater than tolerance specifications.

The required discrimination is not between the delivered temperature and 60 F. The discrimination must be between suppliers essentially across the street from one another – ones that are competing for the same customers. It makes no difference to temperature compensate fuels when temperature fluctuations are minimal between suppliers. It does not make sense to bear the cost of adjusting for something that as a practical matter makes no difference.

We are not concerned whether delivered fuel temperatures vary from 60 F. We are concerned with how much temperatures variation there can be between retailers essentially across the street from one another and competing for the same customers. It makes no difference to temperature compensate fuels when temperature fluctuations are minimal between suppliers. It does not make sense to bear the cost of adjusting for something that as a practical matter makes no difference.

Interest Groups and Media Coverage

In reviewing literature on this matter, it is clear that consumer and supplier groups have different motivations driving their opinion about net vs. gross gallons, depending on what side of 60 F fuel temperatures we are speaking of. These differing motivations cloud public policy debates because interest groups push agendas that suit their objectives, and their ideas work their way into the popular media.

All else the same, consumers would like to buy the larger gallon whereas retailers / suppliers would like to provide the smaller one. In cold states retailers have an incentive to sell petroleum gallons, or net gallons, because they are smaller. In warm states, they would like to sell gross gallons because those are the smaller gallons above 60 F. But consumer groups have the

[5] Comment on the draft report questioned how tolerances specified in volume can be translated into temperature differences. It is through the temperature-volume expansion coefficient.

opposite incentive, and make efforts towards requiring suppliers to sell net gallons in warm states. However, consumer groups have not yet been active in requiring gross gallon sales in cold states.

Some of the arguments made for public consumption by various interest groups are significant nuisances to decision making. For example, it is somewhat easy to manipulate consumers into thinking they will get larger gallons at the same price if the retailers are forced to sell larger gallons – as if doubling the size of a gallon will result in half the cost to consumers. This is a fallacy of the free lunch.

It is also somewhat easy to manipulate consumers into thinking that there is some kind of fraud going on with suppliers when they are "buying net and selling gross" in warm states. There is a belief by somewhat misguided consumer groups that inventory is created out of thin air in this manner because the retailer is purchasing larger (net) gallons, but selling smaller (gross) gallons. However, there simply is no principle that retailers are obligated to sell products in exactly the same units or content that they were purchased in. More will be said on this presently.

California's Study and Application to Alaska

California undertook the most extensive study to date, and the results were recently published. It is a "warm fuel" state where temperatures are above the 60 F standard. It is quite important to understand that one significant impetus for that study was very different from Alaska's motivation. We are referring to the persistent assertion by many groups that retailers were purchasing fuel on a net gallon basis, but delivering on a gross gallon basis (buying large gallons and selling small ones) – thereby profiting from the creation of inventory gallons by sleight of hand.

That assertion (creation of inventory by buying net and selling gross) turns out to not only be untrue, but also irrelevant to transparency and equity. What is important is whether fuel varies in temperature *across suppliers* – not whether fuel from all suppliers varies from 60 F. Whether they all sell fuel at 120 F or they all sell fuel at -30 F, there is no lack of transparency and no lack of equity. Everyone is selling the same gallon.

There are two red herrings in this arena of "buy net and sell gross" that need to be eliminated in the public policy debate. The California study did address these, but we wish to make the points more direct and forceful. First, there is no relation whatsoever between "buying net" (at 60 F reference) and the actual temperature of the fuel. The fuel might be 100 F, and it might be – 20 F when purchased by a retailer. The reference temperature is not the temperature of the fuel. In November through February of 2008, for example, the average temperature of #1 heating oil at the North Pole Flint Hills rack was in the 20's. It was invoiced to retailers at the reference temperature of 60 F. Whatever shrinkage occurred was not relative to 60 F, but to 20 F, an average of about forty degrees less.

Secondly, it is not a given that changing the method of delivery from gross to net, or vice-versa, will allow consumers to extract from suppliers a bigger gallon at the same price. Hawaii tried to accomplish this extraction in its conversion of a gallon from 231 cubic inches to 233 cubic

inches. The law might just as well define a gallon to be a thousand cubic inches. If all suppliers are selling in the same unit of measure, it does not matter what that unit is; 233 cubic inches or 1000 cubic inches. There is nothing to be gained in transfers between consumers and suppliers when we only change the unit of measure. We must retain focus on the objectives of transparency and equity, which has to do with variations in content between suppliers.

California's study in the end hinged on whether small (10 F), random differences in the temperatures of delivered fuel from retailer to retailer were worth the cost of imposing net gallon metering. The costs were well over a hundred million dollars (more expensive meters and more expensive ongoing maintenance and calibration) and the benefits were estimated at around two hundred thousand dollars (half from eliminating seasonal variations in the energy content of a gallon and the remainder from eliminating retailer to retailer fluctuations) - net gallon metering did not pass the cost-benefit test. This 10 degree temperature differential (between suppliers on a given day) was not established by the temperature study itself, but was the maximum proposed in theory.

In view of the California study, in order for Alaska to pass a cost-benefit test for a net gallon standard the temperature differentials amongst suppliers would have to be extreme – so extreme that it is impossible to come up with a scenario where such differentials could be sustained. Moreover, since Alaska has such a low volume of fuel turnover in remote locations, and a much higher cost of installation, the costs are even more onerous by comparison.

Canada and Permissive ATC

It has been observed that Canada has permissive temperature compensation for motor fuels at retail, and over 90% of Canadian retailers have adopted temperature compensation. The reason for this conversion is perfectly straightforward: Selling the smaller liters, when consumers don't know the difference, makes the best economic sense to an individual retailer, although not necessarily to society as a whole. Canada is a "cold fuel" state where net liters are smaller than gross liters.

The Canadian government has itself not produced a report explaining with clarity how ATC devices came to be used in their country, nor evaluated the costs and benefits. This is partly because their introduction was not the result of legislative or executive branch inquiry into the temperature-corrected fuels issue in the first place. What we can find instead is interesting for what it lacks in particulars. This is from Measurement Canada in a recent information bulletin pertaining to temperature compensation[6]:

> **Is Temperature Compensation New?**
>
> Temperature compensation has been used in applications such as pipelines, ship-loading and tank farm transfers for decades and for the retail sale of gasoline for the past 20 years. Prior to the advent of modern electronics, there

[6] http://www.ic.gc.ca/epic/site/mc-mc.nsf/en/lm01094e.html Note: Between the time of initial literature review and final drafting of this report the information bulletin appears to have been superceded by a Policy Statement.

> was no way to perform this function accurately in retail dispensers. In 1984, a Canadian electronics manufacturer designed a device which could readily measure the temperature of liquids and perform the necessary calculations. Now, the vast majority of gasoline pumps in Canada are equipped with automatic temperature compensating equipment.

The passage makes it seem as though the change in technology was enough of a breakthrough that both sides of the market (consumers and retailers) adopted a more mutually agreeable system of dispensing.

We have to look a little harder for the history. Testimony before Congress in 2007 by Hugh Cooley of Shell oil is quoted extensively here[7]:

> **Number 4**: Why is automatic temperature adjustment used for retail sales in Canada?
>
> 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.

Similar testimony in later passages:

> My current understanding is as follows: The Canadian government made automatic temperature adjustment permissive at the retail level approximately fifteen years ago. Media reports indicate that a manufacturer of automatic temperature adjustment devices first proposed that Canadian regulators allow automatic temperature adjustment and then marketed the device after the law was changed. We also understand that few, if any, retailers installed automatic temperature adjustment devices in Canada for the first few years after it was allowed. Apparently some retailers started to install automatic temperature adjusting devices, which allowed them in a cold climate to sell smaller volumetric gallons than their non-adjusting competitors, giving them a potential competitive advantage over other retailers because they had a lower effective unit price. Once a number of retailers had installed automatic temperature adjustment devices, other retailers appear to have followed suit to avoid being competitively disadvantaged. Shell Canada apparently followed those retailers that started the trend to convert to automatic temperature adjustment. After most stations had converted and the market essentially had transitioned to automatic temperature adjustment, basic economics leads us to believe that prices at the street level would have adjusted to take into account the new temperature adjusted unit of measure.

What is meant by “lowered unit cost”? This is a device that costs money to install. But if you are selling a smaller liter than your competition, then on an equivalent basis it is indeed a lower cost.

[7] It is noted by Northern Economic Research Associates (NERA) that this witness did make generalizations that were untrue about the status of state laws and that the testimony of the NIST was more accurate on that subject.

The introduction of the temperature compensating devices took place exactly in the manner one would expect from a profit-maximizing perspective: where the devices paid for themselves most handsomely first: that is, where the volumes were highest[8]. Regular no-lead occurred first, followed by premium and blended fuels. This is not to say there is anything untoward or shady in their use. It was a legal method of sale, and it was introduced where it was most profitable first.

One of the very interesting responses of the Canadian government to their use was a regulation prohibiting the intentional switching on-and-off of ATC devices: turning them on in the winter and off in the summer.[9] The intentions to use them in this way demonstrates what was stated earlier – the incentive is simply to sell the smaller gallon at all times.

It is acknowledged that a stated rationale for their use was to ameliorate inventory losses from fuel shrinkage in the cold. That is a similar argument made by proponents of their use in Alaska.

But selling a smaller gallon against competition selling a larger gallon (or liter) is profitable whether there is shrinkage, no shrinkage, or expansion of inventory. It is profitable regardless of what is happening to inventory. If all retailers are in the aggregate losing inventory in the winter months, basic economics dictates that market price adjusts to a higher level from the loss in supply regardless of whether individual retailers even consciously acknowledge this themselves.

Moreover, inventory loss from handling, from vaporization, from sump drainage, from theft, spills, etc. all occurs. The answer to these problems is not to sell smaller gallons, but rather to factor such losses into the price. Additionally, the amount of inventory shrinkage bears no relation to the 60 F or 15 C temperature reference. There is no reason to temperature compensate to 60 F if the fuel was purchased at 20 F.

Hawaii and Redefining the Fixed Volume Standard

Hawaii is the only case we can find where a change in the legal volume standard was put into effect in order to "correct" in some way for fuel expansion or contraction. A "Hawaii gallon" is 233.8 cubic inches rather than 231 cubic inches because it is based upon a reference temperature of around 80 F[10]. Hawaii is a hot fuel state where fuel is retailed consistently above 60 F.

The drive behind changing the Hawaii volume standard was Mr. George Mattimoe, who was previously the Deputy Director, Division of Weights and Measures, Department of Agriculture, State of Hawaii, and former chair of the National Conference of Weights and Measures.

[8] http://www.ic.gc.ca/eic/site/mc-mc.nsf/eng/lm00106.html
[9] Ibid – See section 3.0 "Background".
[10] This seems to be an ambient average rather than the underground fuel temperature average, which can be deduced by comparing the California section pertaining to Hawaii and the submission by Mr. Mattimoe.

The motivation is supplied in a paper Mr. Mattimoe submitted to the California Commission in January of 2009.[11] On page 9 the crux of the matter is identified: that retailers "short" consumers about 3.1 cubic inches of gasoline by selling a 231 cubic inch gallon when, on average, the temperatures of retailed fuels in Hawaii would result in 234.1 cubic inches if sold as net gallons. This number is based on the average temperature of fuel stored in underground service station tanks.

The logic simply does not follow. There need be no relation whatsoever between what the units of measure are at wholesale and what they are at retail. In virtually all markets, wholesalers purchase in different units than they sell at retail. Purchases might be in metric tons, and sales in pounds or ounces. Purchases might be in concentrations of product vastly exceeding the concentrations at retail – in the cases of drugs, demanding they be equivalent would result in injury or death.

In the case of juices, soft drinks, and a host of other commodities it would preclude their sale altogether because people would not buy them if the ingredient quantities or concentrations purchased were required to be retailed in their wholesale form or quantity. This idea is some kind of fictional concept of business – that whatever is purchased by a vendor must be passed on precisely in the same form and content to consumers. The most basic premise of retailing is to purchase in larger quantities than are sold – so it very nearly turns the entire retailing principle on its head when applied elsewhere.

Rather than imposing sales of net gallons at retail though, the approach in the case of Hawaii was to fix the volume of the gross gallon to its net gallon equivalent on average. That strategy seems to be one of imposing recalibration costs without the benefits cited by the NCWM for ATC. Hawaii is still selling a gross gallon. So it does not eliminate retailer-to-retailer fluctuations in temperatures.

Every retailer was selling the same sized gallon at 231 cu. inches before. Every retailer is selling the same sized gallon now at 233.8 cu. inches. It could just as easily be 235 or 300 or 500 cubic inches, and price transparency or equity would not change in the least.

Redefining the volume standard for a gallon is not under consideration in this study. Doing so seems to reflect a lack of understanding in basic economics. As long as the units of volume for sales are the same across retailers, it simply does not matter what that standard is.

Belgium Adopts Mandatory ATC at Retail

This leaves us at one significant case to study where mandatory ATC has been adopted at retail: Belgium. It is difficult to find technical analysis underlying the Belgian decision, but the GAO did interview Belgian officials directly regarding their rationale:

[11] http://www.energy.ca.gov/transportation/fuel_delivery_temperature_study/documents/comments/2009-01-13_George_Mattimoe-Intellectually_Dishonest_Myth_Re_Accurate_Deliver_of_a_Gallon_of_Gas_TN-49799.PDF

> 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[12]

As the GAO notes later in their report, the costs and benefits of ATC have not actually been formally studied for Belgium. We have a rationale here that is familiar amongst ATC advocates, and that is the intention to provide consistency in the content of fuel sold to consumers. *But the costs and benefits have not actually been measured.*

The statement above though does point to something that is of interest – the idea of retailers profiting from, and consumers being harmed by artificially heating fuel. We might remark that the least expensive way of effectively doing that in a "cold fuel" state is to temperature compensate fuels when competitors are not – because temperature compensating gallons to 60 F is effectively the same thing as heating fuel to 60 F.

Nobody in this arena seems to have noticed that permissive ATC provides, essentially, the cheapest and most reliable manner of heating fuel to 60 F in cold environments, and that permissive ATC is induces essentially the exact opposite effect intended by mandatory ATC advocates: consistency in the energy content of fuel sold to consumers.

Professional Literature Review

We shall review a variety of professional literature on temperature compensation at retail. In general, it has not done very well under scrutiny. The most recent report of value to us was performed by California (2009). Given what preceded it, the results should not really be surprising.

Dickerman and Radian Corp (1982) prepared a report for the American Petroleum Institute. They stated that

> "The principle argument against requiring temperature adjustment at the retail service station level is that it could impose hundreds of millions of dollars in capital for retrofit and new installations without commensurate benefits. The costs of purchasing and maintaining automatic temperature compensators would be passed on to the consumer; the increased costs of regulating this practice would be passed on to the taxpayer ... all without increasing the supply of product.
>
> To the extent that the petroleum product market is competitive and that all outlets in a given market area are similarly affected by temperature changes, there should be little or no gain or loss to the consumer from the effects of product

[12] http://www.gao.gov/new.items/d081114.pdf

> shrinkage or expansion ... In this way the market itself serves to remove inequities within a market area – assuming a high degree of competition."[13]

A number of useful studies have been done in Australia. The Australian Institute of Petroleum (1996) report, the Industry Commission Report into Petroleum Products (1994), and the Access Economics (1992) report all agreed that mandatory temperature corrections were not justified in there. From Access Economics:

> "The central argument for temperature correction is an equity argument: that is, the "benefits" of temperature correction are essentially *distributional* benefits. The case for correction is *not* intrinsically an efficiency argument at all: gross costs of temperature correction *are* a quantifiable drain on scarce resources, but the gross benefits are gains to some at the expense of others *within* the economy.
>
> In net terms, from a national economic perspective, temperature correction by definition is a *negative-sum proposal*. The economy as a whole must lose if temperature correction is costly, with the distribution of that loss depending on the temperature at which sales are made."[14]

The Australian Institute of Petroleum (1996) report pointed out the use of a 15°C reference temperature for the collection of excise ensures that there is consistency in the taxation base. This excise is imposed directly on the refiner marketer companies, not the motorists. It is unrelated to issues of equity between consumers.[15] (The 15°C number does not represent the average temperature of fuel). The net loss from mandatory temperature correction per motorist was estimated to be between $5 to $24 per year depending on location.

This report estimated capital costs of $300 million and annual operating costs of $50 million for a change to mandatory correction. For perspective, an additional capital cost of $300 million represented nearly total annual profits of all four refiner marketer companies in the Australian downstream oil industry at the time. These costs would simply be passed on to consumers.

The Industry Commission Report (1994) flatly stated there were no economic efficiency arguments for requiring temperature adjustment. It cited self-adjusting market behavior and "When trialled in several Canadian provinces, temperature correction did not lower prices or otherwise win consumer favour."[16]

The last Australian report reviewed was the Victoria Consumer and Business Affairs (2001) study. This report recommended that wholesale transactions at refineries/terminals be temperature adjusted. It again cited numerous authorities pointing to the cost-inefficiency of requiring so for retail sales at the pump. An increasing problem with "hot fuel" sales to retailers,

[13] Passages from Dickerman and Radian (1982) p 6-15.
[14] Access Economics (1992), p 4.
[15] AIP(1996), p 1.
[16] Industry Commission; (1994) p.243

the complexity resulting from taxes being assessed on petroleum gallons and some concern over transparency and relative market power resulted in this wholesale rule.

In the UK Temperature Compensation Study (1999) the main focus was the apparent volume losses of product due to temperature changes within the distribution chain. At the time, the petroleum gallon system was used throughout the UK industry for bulk transfers and for duties on fuels. Stable retail temperatures, as well as high capital and labor expense involved in correction made the temperature-adjusted concept cost-inefficient when applied to either retailers or final customers.

But by 1999 in the UK, the move to sealing road tankers due to environmental regulations eliminated the enforcement powers (dipping for volume) of the Trading Standards Officer or customers. Fuel shrinkage from cooling in transport or storage would imply "losses" into the environment unless volumes were temperature-adjusted. So multiagency regulation interaction was occurring in the UK that partly drove the ATC fuel discussion.

Ultimately the UK report recommended that as changing technology brought capital and labor retrofit costs down that Standard Temperature Accounting be adopted but should be voluntary and based on contract negotiation. At this time there are no temperature-compensation meters at retail gas pumps in the UK. Oil companies still use voluntary temperature-adjusted exchange agreements within the industry.

California Study

California is being looked to by a number of states. In 2007 AB 868 directed the California Energy Commission to conduct a Fuel Delivery Temperature Study. That study has now been completed and the upshot is that temperature compensation costs are not worth the limited and unclear benefits.

The amounts are instructive. The initial costs were estimated to be at least $110,000,000, along with increased annual costs in the $7 million dollar range; the benefits were on the order of $200,000 per year. This was under the *best case scenario* for temperature compensation.

There are a number of reasons why benefits are probably overstated. One is the lack of recognition that temperature compensated sales themselves still vary from retailer to retailer because of the tolerances mentioned earlier. The assumption in the California study was that every gallon of temperature compensated sales was *perfectly measured*. Correspondence with Murphy and Topel[17] also pointed out an additional analytical reason benefits are overstated, but it simply is not worth quibbling over details when the results are so overwhelming.[18]

[17] Correspondence with Kevin Murphy March 13, 2009

[18] Their analysis assumed for example that in the summertime people overestimated the energy content of gasoline. But an automobile cannot misperceive energy content. So regardless of what consumers perceive, the car cannot go further than the gasoline allows. So consumers must either adjust their perceptions about fuel content, or else budget constraints force them to curtail expenditures on all things, including gasoline (referred to

The California result can be summarized fairly succinctly by saying that in the long run the costs are on the order of a thousand times more than the benefits. The costs are not large when brought to a per gallon figure, but nevertheless are an inefficiency and essentially a nuisance.

There are a few very important observations about the initial motivations behind the California study that ultimately were not clearly addressed in the final report, yet were absolutely central to its conclusions.

Ultimately, it boils down to the fallacy of the free lunch, but it begins with a myth about inventory "fraud". As mentioned earlier, there has been a misguided consumer advocacy theory that retailers are "buying net and selling gross" and that in a hot fuel state this means they are profiting from the purchase of larger gallons than they are selling. To address this problem, retailers ought to be forced into selling larger gallons.

Computing benefits in such a scenario is straightforward. The California Study was at the county level. They had proposed measuring temperatures in every county, along with sales, to estimate benefits per county in accordance with the following formula[19]:

County Benefits = (fuel volume) x (fuel price) x (volume correction factor)

As the logic of the California study initially went, since different counties have different average temperatures and sales, the benefits will vary across counties. But in all cases, since the gallons sold after ATC implementation will be larger, the benefits will be positive. Requiring temperature controlled sales in this framework fosters the illusion that consumers will recapture gains the industry allegedly makes with this shady practice of selling warmer (lower BTU) U.S. gallons instead of the temperature-adjusted gallons that they are buying.

In the end, this methodology was dropped after economists from Chicago (Murphy and Topel, 2009) intervened with what is conceptually a fairly simple idea, but analytically difficult to estimate. The upshot is that Murphy and Topel forced a focus on what the NCWM articulated about transparency and equity. It is the temperature differences *between retailers* that is of concern, and not the difference between retail temperatures and the 60 F reference temperature.

We had thought that the California temperature study would provide data on the differences in temperature from retailer to retailer on any given day, and that this information could be correlated with other information, such as refinery production schedules or storage practices. This information would be useful in adapting results elsewhere, including Alaska.

But because the methodology of that study was directed towards comparing prices on average to the 60 F reference, the temperature variations that turn out to be the most important for cost-benefit analysis were not derived. In the Murphy-Topel analysis it was assumed, and

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as an "income effect"). So to the extent we claim gasoline is "overpurchased" with incorrect perceptions, reality nevertheless ameliorates those incorrect perceptions in some way.

[19] AB 868 Fuel Delivery Temperature Study Staff Workshop California Energy Commission June 5, 2008 Gordon Schremp Fuels and Transportation Division pg 39

reasonably so, that the differences amongst suppliers on any given day would not exceed ten degrees.

Testimony during the course of the study directed attention to the manner in which inventories are actually calculated by service stations in order to address what is best termed a myth about the creation of inventory out of nothing when retailers "buy net and sell gross".

Ample professional testimony demonstrated that retail fuel stations are within 0.1 or 0.2 percent accuracy over the year in inventory control. It is a myth that there are extra gallons being sold.[20] This was not clearly demonstrated in the final report. The "extra gallon" myth is worthwhile to explore because there is a corollary on the other side of 60 F – that there is inventory loss necessitating the sale of smaller gallons when fuel is cold.

In California, inventories enter the retail station books as gross gallons, even though the total cost is determined by a net gallon price.

> "There are bills of lading that are produced when the wholesale transaction is consummated. And that bill of lading information… has both net, gross, temperature, even density information on the bill of lading, as well as the date, obviously".[21]
>
> "But the gross gallon figure on the bill of lading is the one that went into the inventory record. And that's how they run their business. Even though they may pay on a net gallon calculation of price, the number that they take into their inventory is a gross gallon figure. And that's the only way they can make their inventory balance at the end of the year."[22]

We are hearing the same observation from retailers in Alaska: they clearly recognize and are concerned with shrinkage of fuel as ambient air temperatures fall from the 70's and 80's in the summertime to -30's and -40's in the wintertime. It is a legitimate concern.

Any fuel to a remote location and stored over the wintertime will shrink. We have to ask the question then, what happens when a fuel supply is lost for *any* reason – whether it is a hurricane, war in the Middle East, the depletion of reserves, or what have you.

We of course accept the premise that market supply is reduced from temperature induced shrinkage. What is true for any one retailer must be true for the market as a whole. In the aggregate losses are a summation across supply losses for each retailer. We are compelled by basic economics to conclude that the price increases accordingly, as shown in Figure 3. Supply shifts from S_1 to S2 and price increases from P1 to P2.

[20] Transcripts from Staff Workshop before the California Energy Resources Conservation and Development Commission in then matter of: Implementation of Assembly Bill 868 Docket No. pg 130 onward
[21] Ibid pg 8.
[22] Ibid pg 146.

Recent National and Federal Government Actions and Studies

There are two sources of information we have found that converge in Hearings before Congressman Kucinich in June of 2007. Certain consumer advocacy groups were lobbying for ATC requirements under the theory consumers were being shorted with "hot gallons". Numerous private lawsuits had accumulated by this time and more attention was being brought to the issue because of high fuel prices. The National Institute of Standards and Technology (NIST) had been debating the issue for decades and Richard Suitor spoke on behalf of the NIST before Kucinich's committee[23]:

> For over 30 years, temperature compensation has been discussed and debated in the weights and measures community. NIST has been in the middle of the discussion, providing technical advice and information as evidenced by the 1979 publication of our report: "Symposium on Temperature Compensated Volumes in the Sale of Petroleum Products."
>
> So what is temperature compensation? Temperature compensation as it relates to the sale of petroleum is an adjustment made that **assures that each gallon of fuel sold contains the same energy content.** To put it simply, energy per unit of fuel is measured at 60 degrees Fahrenheit and when the external temperature is warmer it causes the fuel to expand. A warm gallon of gas does not provide as much energy as a cold one. That is because when that cold gallon of gas is warmed, its volume expands.

We have placed emphasis here on the assertion about energy content because although that may be the intent, it is not strictly true. It assures sales by weight instead of by volume, and the intention is fulfilled only when everyone sells the same product. There will also still be differences in additives for boutique mixes by region and season as well as other inherent qualities of the oil being refined that differ across gasoline sold at different stations.

It is also the case that variation amongst retailers will occur because, under ATC, tolerances are provided that clearly allow such variation. If temperatures only vary a couple of degrees between retailers there is essentially no benefit provided by temperature compensation; measurement tolerances for ATC allow for about that much variation in the first place.

A good summary of the situation across states was given in this testimony:

> In some states, compensating for the temperature of refined petroleum products being sold has taken place at the wholesale level – but not at the retail gas pump (diesel included) or for deliveries of home heating fuel. Some states prohibit temperature compensation at retail and some states prohibit temperature compensation anywhere in the petroleum distribution chain. Most states require temperature compensation for certain products, such as for liquefied petroleum

[23] http://www.nist.gov/testimony/2007/rsuiter%20hover-govt%20subc%20dom%20pol%206-8-07.htm

> gas (LPG) sales, or propane for home heating, but not necessarily for other products[24].
>
> In 2000 a delegate from the State of Oregon, through the Western Weights and Measures Association, submitted an item to the NCWM Specifications and Tolerances Committee to recognize temperature compensation in NIST Handbook 44 for vehicle-tank meter applications. These include meters installed on home heating fuel delivery trucks. The Specifications and Tolerances committee is made up of weights and measures officials with some expertise in the design and operation of commercial devices. As mentioned earlier NIST/WMD serves as technical advisor to the Specifications and Tolerances committee.
>
> After two years of committee development, the issue became a voting item on the Committee's agenda in 2002. At the NCWM Annual Meeting, the conference could not reach an agreement during the voting process. Because the NCWM is a consensus organization, the item was returned to the Specifications and Tolerances Committee for further development. The same result occurred at the conference the following two years. The item has remained as an information item on the Committee's Agenda since that time. In 2004, an item was submitted to the NCWM Laws and Regulations Committee proposing a change to the Uniform Regulation for the Method of Sale of Commodities to require temperature compensation in certain applications such as heating oil tanker trucks, loading rack meters at wholesale gasoline, diesel or even ethanol tank farms, and high volume (truck stop) dispensers. The proposal was modified in January 2007 to recognize voluntary temperature compensation at all levels and is currently a voting item on the committee agenda that is expected to be taken up in July 2007. If adopted this would permit temperature compensation adjustment at additional levels of the distribution chain, but not mandate it.

A steering committee of the NCWM was formed and met through 2008, producing literature that demonstrates we are no further along than we have been before. It is acknowledged that in theory, temperature compensated fuels could provide greater price transparency and equity when we assume there are temperature variations across retailers. The steering committee did not take a position pro or anti-ATC.

The council steering committee recommended that if ATC were adopted at all that it be mandatory. It recommended a phase-in period of one year that includes permissive use should be followed by full conversion to mandatory ATC.

In late 2008, the GAO released a report on temperature compensation, and a couple of summary comments are worth noting here:

> …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…

[24] The expansion coefficients for these products are an order of magnitude more than that for gasoline or fuel oil. In such cases temperature compensation has a much more pronounced effect in moderating variation amongst retailers when temperatures vary.

> In Belgium, temperature compensation has been implemented too recently to study its effects.

What we can say in having scrutinized the literature regarding temperature compensation is that where ATC has been implemented, there is an absence of preliminary cost/benefit analysis and instead we are still waiting on some kind of professional analysis regarding its effects. Wherever it has been studied carefully in a cost/benefit framework, it has not been implemented.

To be fair to industry that has invested in ATC in Alaska, and since these hearings have been cited, it bears commenting on Representative Kucinich's statement on ATC in those hearings Representative Kucinich had the impression in calling the hearings that the industry was operating under some "double standards".[25] After the June 12 Alaska Fuel Project meeting, that testimony was submitted for consideration.

Representative Kucinich relies on the premise that if industry does it at wholesale, the default position is that it must be the appropriate retail too. Otherwise it is a "double standard". In the first place this is again the fallacy that whatever form the wholesaler purchases the commodity in must be preserved in retailing. There simply is no such principle.

The premise also ignores the basic diminishing returns economics to ATC. When there are fifty times the number of meters at retail vs. wholesale, the benefits have to be vastly greater to pass a cost-benefit test. It does not follow that what is economical at wholesale is economical at retail.

Kucinich furthermore argues the nearly universal adoption in Canada under a permissive standard proves something is amiss in the USA. He does not understand the smaller gallon is sold in each respective market – cold vs. warm. Finally, Representative Kucinich observes that LP gas is sold with ATC making another "double standard". That ignores the much higher temperature expansion coefficient for LP gas which absolutely does work in favor of ATC vis-à-vis fuel oil or gasoline.

Market Adjustments to Changes in Supply

It might be a mystery how the market adjusts for temperature when it actually matters. But this point is absolutely essential to a cost/benefit study. It is something that we do not see recognized anywhere in the professional literature. Carl Boyett, representing the Society of Independent Gasoline Marketers of America provided, revealing testimony in the California study that is relevant to Alaska:

> "We operated a station in South Lake Tahoe for ten years roughly. And during the winter I know we lost thousands of gallons of gasoline. And so, you know, that probably was partly due to temperature, with snow on the ground and

[25] See Kucinich's June 25 testimony: http://domesticpolicy.oversight.house.gov/documents/20070725132158.pdf

> whatever. So we consciously raised prices to try to compensate for that during that period of time[26]."

We are hearing the same observation from retailers in Alaska: they clearly recognize and are concerned with shrinkage of fuel as ambient air temperatures fall from the 70's and 80's in the summertime to -30's and -40's in the wintertime. It is a legitimate concern.

Any fuel to a remote location and stored over the wintertime will shrink. We have to ask the question then, what happens when a fuel supply is lost for *any* reason – whether it is a hurricane, war in the Middle East, the depletion of reserves, or what have you.

We of course accept the premise that market supply is reduced from temperature induced shrinkage. What is true for any one retailer must be true for the market as a whole. In the aggregate losses are a summation across supply losses for each retailer. We are compelled by basic economics to conclude that the price increases accordingly, as shown in Figure 3. Supply shifts from S_1 to S_2 and price increases from P_1 to P_2.

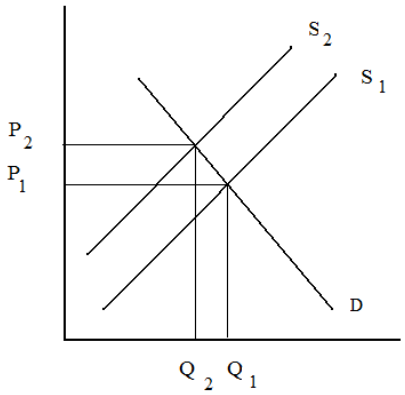


Figure 3

To deny that this is the case is to assert that markets do not work. It really isn't even necessary to introduce testimony that specific retailers are acknowledging supply losses by factoring it into price. The way markets generally work is that retailers notice that at the current price, sales indicate the market will bear a higher price. Alternatively, if sales become sluggish at the current price, it indicates the market is signaling a lower equilibrium price is required.

We are surprised that this basic lesson has not been introduced anywhere that we have seen. Generally the temperature compensation issue has been "hottest" in warm fuel states where it is asserted supplies are increasing from fuel expansion. One cannot simultaneously assert, however, that supply is expanding while at the same time price is not adjusting (falling). Whatever gains are had from fuel expansion by any individual retailer are reduced on a net basis by the fact price is falling at the same time.

[26] Ibid Pg 55, 56

We do agree that it is beyond the power of any individual retailer to arbitrarily increase his price independent of other retailers. Instead it is market forces working in the aggregate that cause prices to adjust whether or not any individual retailer acknowledges that is the underlying reason.

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Temperature Data Analysis for Refineries, Tank Farms and Underground Tanks PLEASE REFER TO FILE Appendix 1 Alaska Fuel Metering Project 103

Appendix 2 103

Benefits Computations for ATC Regulatory Regimes PLEASE REFER TO FILE Appendix 2 Alaska Fuel Metering Project 103

Appendix 3 103

Estimated Fuel Use for Heating and Electricity Production PLEASE REFER TO FILE Appendix 3 Alaska Fuel Metering Project 103

Petroleum Production, Consumption, and Sales in Alaska

Introduction

There are a number of sources from the federal and state government pertaining to the fuel industry in Alaska. The full statewide scope and regional details are not accounted for in any one place. Their objectives and authorities are all different. We cannot speak with a lot of precision except in the case of taxed fuels, but we can form a pretty good idea of relative magnitudes overall. Jet fuel production and consumption leads the list; for international flight refueling. Highway fuels subject to motor fuels taxation would be a pretty distant second, then heating fuel. Fuel for production of electric power would be close behind heating fuel, and then marine fuel.

We don't have independent reports with comprehensive and complete data either, but some good efforts under the circumstances of so few firms and the associated privacy restrictions on reporting data. What material we do have from federal and state sources seems inconsistent in some ways, and to some degree that is expected because the data collection methodologies and categorizations of fuel are different. Some data are from tax reporting requirements and are therefore quite complete and reliable. Voluntary surveys are just that – voluntary.

Fuel sales data are proprietary and it is understandable why, in a small retail market – possibly with only one or two suppliers – information is not reported, even when it has been collected. When there are many firms, private information is not being given out because only category totals are given, and not assigned to any particular firm. Not so in a one or two-firm market such in rural Alaska. Because of this, there is a degree of uncertainty in the completeness and accuracy of what data we have.

It is a bit difficult to reconcile the different sources with one another. Nevertheless we will review and compare these sources in order to formulate an idea about the fuel industry in Alaska:

1) Refineries in Alaska (Division of Oil and Gas Annual Report (2007) Section Five (Refining)
2) Alaska Prime Suppliers Sales Volumes (U.S. Energy Information Agency)
3) Alaska Division of Tax Annual Reports
4) Institute of Social and Economic Research (ISER) Reports
    a) Institute for Social and Economic Research, *Components of Delivered Fuel Prices in Alaska* prepared for the Alaska Energy Authority June 2008
    b) Institute for Social and Economic Research, *Alaska Community Fuel Use* prepared for the Alaska Energy Authority October 2008.

But first, we discuss a schematic overview of the Alaska Petroleum industry in Alaska. This is accomplished in Figure 4.

Alaska Crude oil is produced in two places – the North Slope and Cook Inlet. The North Slope oil is delivered by pipeline to Valdez, through North Pole. There are two refineries in North Pole and one in Valdez. Cook Inlet oil production is exclusively refined at the Tesoro facility in Nikiski.

There are three refineries that process oil from the Trans-Alaska Pipeline System (TAPS). Finished product is distilled from a crude stream, and a residual of up to 75% may be re-injected into the pipeline. There are also a couple of refineries on the North Slope for production of Arctic Heating Oil. This production is strictly in association with oil field operations and is not marketed south of the Brooks Range.

The refineries in North Pole produce finished products such as jet fuel, gasoline, diesel, and heating oil that are distributed by road, rail, and air. The railroad delivers fuel from North Pole to an Anchorage terminal and from there by pipeline to the Anchorage Port. From the Anchorage "rack" and the Port it is further distributed by barge, road, and rail throughout Alaska. Fuel is also trucked by road to Nenana, where it is barged throughout Interior Alaska on the Tanana and Yukon River to local village tank farms.

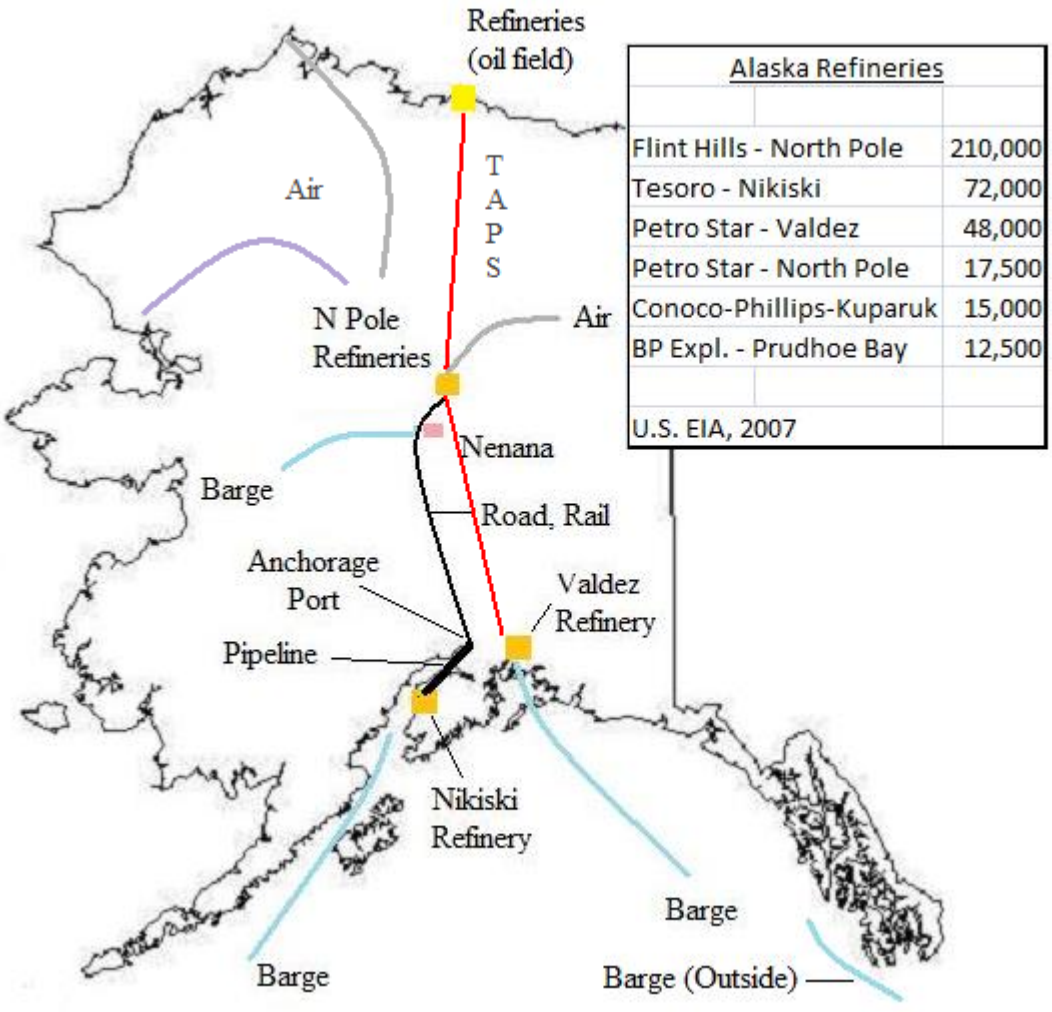
Cook Inlet oil processed at the Nikiski Refinery is distributed by pipeline to the Anchorage Port, and also by spur line to the Anchorage International Airport. Fuel is also distributed by barge and by road from the Nikiski Tesoro facility. Refinery output in Valdez is distributed by barge and road. Of course, the majority of crude oil is being exported by tanker out of Valdez.

Finally, we have barged fuel both arriving to Alaska from Northwest U.S., (occasionally foreign) and some refined products being shipped south. Heavy oils and seasonal gasoline go south from the Nikiski refinery along with the crude oil from the pipeline terminus in Valdez. Refined jet fuel, diesel, marine fuel, gasoline and aviation gasoline come up from Puget Sound largely to Southeast Alaska, but also further north.

The refinery data appearing on Figure 4 refers to throughput capacity. Finished products are varying proportions of throughput that may be as low as 25%. The refineries are not all operating at capacity, but it is the relative sizes of the refineries that are important here. The capacity data sometimes disagrees across sources, but the magnitudes are close enough.

The Flint Hills refinery is the largest by far, located in North Pole at 210,000 barrels per day. It is followed by Tesoro's Nikiski refinery at 72,000. Petro Star has a combined capacity in Valdez and North Pole that is close behind at 65,500. The North Slope refineries are a combined 17,500 barrel per day capacity.

Barged fuel from Puget Sound is delivered throughout Southeast, but potentially as far as Dutch Harbor. At Haines it can be delivered to the interior by road. The Port of Anchorage also receives refined fuels distributed from there throughout Alaska



Alaska Refineries	
Flint Hills - North Pole	210,000
Tesoro - Nikiski	72,000
Petro Star - Valdez	48,000
Petro Star - North Pole	17,500
Conoco-Phillips-Kuparuk	15,000
BP Expl. - Prudhoe Bay	12,500
U.S. EIA, 2007	

Figure 4

Refining in Alaska

This section will discuss the refining industry in Alaska, for the most part following the Alaska Department of Oil and Gas 2007 Annual Report – the most recent available. There are some small discrepancies with US EIA (Energy Information Administration) numbers on capacity but nothing major. The discrepancies in fuel produced or sold however, are substantial.[27] We will illustrate where.

A few words on refining first:

Final products from refining include these major groups:

Motor Gasoline – for vehicles with reciprocating engines

[27] The State DOG report, p 5-6, discusses the major discrepancy between state tax sources and federal data – international flight refueling. But there is clearly more than this.

Aviation Gasoline – For aircraft with reciprocating engines

Jet Fuel – kerosene based fuel for aircraft with turbine engines

Distillates

#1 – Fuel oil, heating oil or diesel fuel

#2 – Fuel oil, heating oil or diesel fuel

There are a number of different potential products, some of which are made in Alaska. For example naphtha is similar to gasoline or white gas, at the lighter end. Golden Valley uses it in turbines for electrical production for example. At the other end are heavier oils and asphalts. These are produced in Nikiski and marketed in Alaska and exported. Aviation gasoline (100 low lead) is imported.

According to ISER, the estimated combined production from the four refineries in Alaska was about 127,000 barrels per day in 2008[28]. In the sections that follow from the DOG report, data are not all from the same year, and are expressed as ranges.[29], but roughly agree with this figure. The total throughput potential is about three times that much. Refineries do not operate at full capacity in Alaska and moreover only a portion of the stream taken off the Trans-Alaska Pipeline System is refined. The remainder is returned to the pipeline.

Flint Hills North Pole

The Flint Hills Resources Refinery in North Pole is the largest in Alaska. The refinery receives Alaska North Slope crude oil from the Trans Alaska Pipeline. According to the Alaska State Division of Oil and Gas, it has throughput of about 226,500 barrels per day[30]. Of that, about 60,000 barrels per day of refined products are produced and sold. That's about 911 million gallons per year. The remainder is injected back into the TAPS and sent on to Valdez.

Flint Hills produces mostly jet fuel and #1 fuel oil as can be seen in Figure 5. The State DOG indicates about 60% of Flint Hills production serves the aviation market. It does so primarily in Anchorage, where the bulk of international flight refueling takes place at the Anchorage International Airport. One source of fuel they do not produce is ultra-low sulfur diesel. It is imported from elsewhere and distributed by Flint Hills.

[28] ISER Fuel Price Components p 15.
[29] The amount of finished product is not quite clear in the State DOG report
[30] Elsewhere, including the report being referred to, a 210,000 barrel per day capacity is cited.

Flint Hills Production	
Gasoline & Naptha	10%
Jet Fuel #1 Fuel Oil	77%
#2 Diesel	8%
Gas Oil	4%
Asphalt	1%

Figure 5

The company owns two large terminals (racks) in Fairbanks and Anchorage that store and distribute asphalt, diesel, jet fuel, and gasoline. There is a also a Fairbanks terminal located at the International Airport. It stores fuel that has been delivered by tanker truck from the refinery. From there, jet fuel is loaded from tanks into 10,000 gallon aircraft refueling trucks. Between 18 and 24 flights a day are refueled.

The Anchorage terminal storage facility has 700,000 gallons of capacity. Fuel is delivered by rail in tanker cars to this facility where it is further distributed by truck, rail, and pipeline. The pipeline delivers fuel about half a mile away to the Port of Anchorage terminal where 60-80 vessels a year are loaded for bulk deliveries to other Alaska locations.

The State Division of Oil and Gas reports over 577.5 million gallons a year delivered to the Anchorage terminal for 2006[31].

Tesoro Nikiski

Tesoro operates the oldest refinery in Alaska at Nikiski, which refines all of the oil produced in Cook Inlet. It also refines Alaska North Slope oil and imported foreign crude oil. The refinery has a capacity throughput of 72,000 barrels a day. About 55,000 barrels a day are produced for distribution to its 125 Tesoro retail stations and other retailers across Alaska.

Tesoro Production	
Gasoline & Naphtha	28%
Jet Fuel	
Diesel	45-55%
Gas Oil	
Bottoms/Resid (Asphalt)	22%

Figure 6

[31] P 5-2 Alaska Refining. Alaska State DOG 2007 Annual Report

The company operates a 75-mile multi-product pipeline northward across Cook Inlet to the Port of Anchorage where its terminal facility is located. A spur-line to the Anchorage International Airport delivers to the airport tank farm. It is estimated that Tesoro supplies about 40% of the monthly jet fuel demand.

The residuals are sold to Alaska markets (Asphalts), but largely these are heavy oils exported to states in the Lower '48. Gasoline produced in the summertime is all marketed in Alaska, whereas in the winter both gasoline and diesel are exported to the Pacific Northwest.

Petro Star – North Pole and Valdez

Petro Star owns refineries extracting throughput from TAPS in both North Pole and Valdez. They operate similarly to Flint Hills, refining a portion of throughput (about 25%) and returning the rest to the pipeline. The larger and newer of the two facilities is in Valdez, processing about 48,000 barrels per day, with jet fuel as the primary refined product. The North Pole facility has a capacity of about 18,000 barrels per day. It was established primarily for producing and distributing light fuels for heat.

Petro Star N. Pole + Valdez Production	
Jet Fuel/Fuel Oil	68%
Diesel/#2 Heating Oil	32%

Figure 7

Petro Star owns Sourdough Fuels, a primary fuel oil distributor in Interior Alaska, along with a lubricant distribution concern. Both military and commercial air customers are served in Anchorage. It distributes fuels in western Alaska through companies such as Kodiak Oil sales and North Pacific Fuel. The Valdez petroleum terminal is owned by Tesoro.

BP Prudhoe Bay and Conoco-Phillips Kuparuk

The Prudhoe Bay facility processes crude from a North Slope oil transit line and is for the purpose of refining arctic heating fuel. It returns the remainder to the transit line. The fuel is strictly for heating North Slope operations.

Two plants are capable of processing about 7-8,000 barrels per day, with 1,200 to 1,400 barrels of arctic heating fuel as finished product. The remainder is reinjected into the transit line. Occasional batches of jet fuel are run, but 97% of the finished production is heating fuel.

The Conoco-Phillips Topping Plant also processes crude for arctic heating fuel in support of various oil company operations in the area. The plant processes about 14,500 barrels per day in order to produce 1,700 to 2,400 barrels of finished product. The amount depends on end use requirements.

Total Production

If we take the data from the DOG report and summarize it, we have an approximate total output statewide of around 131,000 barrels per day, close to the ISER estimate for 2008 at 127,000. That works out to about 2 billion gallons a year, or 2.1 if we include refined heating product for oilfield operations.

Approximate Capacity and Production - Alaska Refineries
Commercial Sales vs. Oilfield Operations

	Refining Capacity	Barrels Daily Production	Gallons per Year
Flint Hills, N. Pole	226,500	60,000	919,800,000
Tesoro, Nikiski	72,000	55,000	843,150,000
Petro Star, N. Pole Plus Valdez	66,000	16,500	252,945,000
	sum	131,500	2,015,895,000
BP, Prudhoe Bay	15,000	2,500	38,325,000
Conoco-Phillips, Kuparuk	14,500	2,050	31,426,500
		Sum	2,085,646,500

Figure 8

Alaska Prime Suppliers Sales Volumes (US EIA)

The Energy Information Agency (EIA) has produced source data in tables that titled "Prime Supplier Sales for Alaska".[32] This data incorporates estimated sales of fuel produced in Alaska as well as imports into Alaska from outside. Derivations from these tables have been reproduced elsewhere, including the State Division of Oil and Gas publications. These figures are sometimes referred to as Alaska's *consumption* of petroleum. This data is the result of surveys the Energy Information Administration sends to refiners and to distributors of fuel.

Figure 9 produces the Energy Information Agency data on Alaska Prime Suppliers. Their original tables are in thousands of gallons per day, whereas we have multiplied by 365, and again by 1,000 in order to arrive at annual gallon amounts. We can see that sales of motor gasoline are just less than 268 million gallons. Diesel is included in the category "Total Distillate and Kerosene, confidentiality requirements preclude us from seeing diesel separately.

[32] http://tonto.eia.doe.gov/dnav/pet/pet_cons_prim_dcu_sak_a.htm

Alaska Prime Supplier Sales Volumes (in Gallons 2007)	
Motor Gasoline	267,545,000
Kerosene type Jet Fuel	1,055,142,000
Total Distillate and Kerosene	310,505,500
Sum	1,633,192,500

Figure 9

The data reported in the federal estimate of motor gasoline and total distillates above are substantial underestimates, as we shall see. We can establish this by looking at the state highway fuel tax data, and the estimates of fuel used for electricity production and building heat provided by ISER in the following sections. The total supplier sales estimate of 1.6 billion is less than the refined product estimate in the previous section. It should be the other way around if primary fuel supplier data includes imports. (Unless Alaska exports from the lone refinery at Nikiski exceed imports by hundreds of millions of gallons).

Alaska Division of Tax Annual Reports

The state of Alaska produces data on fuel sales that are taxed. We can be confident that the data will be complete because it is not a voluntary survey. However, the largest sector in the retail fuel industry is not taxed – sales to international flights. The taxed fuel number is still necessary when we address question of the effect of fuel delivery methods on state taxes. As indicated earlier there is a disagreement between federal and state sources on the size of taxed fuel sales. We will present the state data now, and give the presumption of accuracy to the state where possible insofar as it is the closest to the subject matter and has the highest incentive for accuracy.

Figure 10 shows the list of motor fuels subject to tax that are reported by the State of Alaska Division of Tax in its annual report. The data are for fiscal year 2008, which runs from July of 2007 through June of 2008.

Taxed Fuels in Alaska FY 2008	
Motor Fuel Type	Gallons
Highway	369,568,110
Marine Fuel	115,536,050
Jet Fuel	142,874,628
Aviation Gasoline	14,822,878
Gasohol	388,300

Figure 10

In terms of taxed fuels, the highway fuels dominate the list at about 370 million gallons. It includes gasoline for automobiles and diesel for trucks – all highway use. Jet fuels subject to tax are second with about 143 million gallons, used in domestic flights. Marine fuels are third with 116 million gallons. Aviation gas, used by small single-engine piston aircraft is small by comparison but nearly 15 million gallons. Gasohol is 0.4 million gallons.[33]

Fuel sales not subject to tax are shown on Figure 11. These non-taxable sales indicate where the data on taxed fuels might not represent the industry as a whole.

Exempt from Tax
Heating Fuel
Federal, State, Local Government
International Flights (Jet fuel)
Exports
Power Plants and Utilities
Charitable Institutions
Bunker Fuel (#6 Fuel Oil

Figure 11

Aviation fuel sold to international carriers is by far the most important fuel industry component not included in the tax summary, and we know it to be a minimum of a billion gallons a year. Sales of fuel for heating oil and for electric power production are the next most important nontaxed components. We have a very rough estimate of 600 million gallons extrapolated from ISER work presented in the next section.

Military fuel use is also excluded. As an example, Eielson was quoted to have spent $12.5 million at $2.20 per gallon in the last fiscal year.[34] That works out to about 5.7 million

[33]The division did not report quantity of tax receipts nor imputed quantity of off-road diesel sales in the annual report. The tax is 2 cents per gallon.

[34]General Howie Chandler, Commander of Pacific Air Forces, quoted in Fairbanks Daily News Miner July 19, 2008 http://newsminer.com/news/2008/jul/19/funding-biomass-fuels-may-be-hurdle/

gallons. A full military survey was beyond the scope of this study. But the major Army bases are at Ft. Wainwright in Fairbanks and Ft. Richardson in Anchorage. The Air Force is represented at Elmendorf in Anchorage and Eielson at North Pole.

ISER Reports

The most recent ISER research pertaining to fuels has to do with pricing and community fuel use (ISER's Components of Delivered Fuel Prices 2008 and Alaska Community Fuel Use 2008). These reports cite Energy Information Agency data we have also cited here. Some is not in the form we seek because it includes all forms of energy.

Components of Delivered Fuel Prices 2008 (ISER)

This report cites a figure of 1,186 million BTUs of energy consumption per capita in Alaska[35], for example. The most recent EIA report has data for 2005 and the figure is 1,193.9 million BTUs per person.

ISER correctly infers international flight refueling is the main reason for Alaska fuel consumption being on the order of three times the national average (pg 3). That can be seen from our look at the Prime Suppliers data. For purposes of this study, the section of this report that is of most interest to us is the discussion of Alaska barge districts.

The road system logistics of retail fuel sales are fairly straightforward, similar to elsewhere in the U.S. Trucks deliver to gasoline stations and to local tank farms. Local trucks deliver fuel oil to retail consumers of fuel oil/diesel. We have rail delivery from North Pole to Anchorage and Nenana terminals. There is a pipeline from Nikiski to the Anchorage port, with a spur line to the International Airport. We have an additional pipeline from the Anchorage port to the Anchorage International Airport. However, we do not have a complete description of the industry off-road.

This ISER report does address the off-road petroleum industry, with an eye towards the high expense of retailing fuel in the bush. It does not detail two areas of interest though. The first is the far North Arctic region. The study was directed at regions with at least one Power Cost Equalization community.

The second area is flown fuel. Communities off the major waterways, with no road access, must fly fuel in. The largest statewide supplier is Evert's Air Fuel, and a brief overview of that industry was provided by interview[36].

Evert's Air Fuel is a wholesaler. It flies fuel to tank farms from the arctic coast at Pt. Barrow all the way south to Cape Yakutaga. It supplies fuel not only to landlocked villages off the road

[35] This figure includes energy from all sources including hydro and natural gas, but even accounting for that seems to indicate this figure is high relative to the Alaska Prime Suppliers EIA data. The BTU figure cited there is actually for the fiscal year 2004

[36] Interview with Dave Adam, Evert's Air Fuel Feb 24, 2009.

system like Anaktuvik and Nuixit, but also to villages that have access to barged fuel such as Ft. Yukon, when deliveries are made when the water is too low, or because the price was too high during the barge season.

The company distributes fuel in the range of 9-11 million gallons per year. It is an industry in the aggregate in the tens of millions of gallons per year.

Barged Fuel and Remote Alaska Communities

ISER divided Alaska into five barge regions: The Ice Free Southern Coast, the Kuskokwim River, the Yukon River, the Northwest and Kobuk, and the Arctic. Barging is a difficult and costly endeavor in Arctic conditions. Fuel to remote locations is often lightered off a larger ship into a smaller one before delivery to a local tank farm. Barges lying idle during freeze-up must have capital recovered in very short seasons. It is expensive and risky – this year for example distributors who bought and barged during high fuel prices are competing with flown fuel today paying much lower costs at current refinery prices.

The regions and descriptions are as follows:

Ice Free Southern Coast:

> From Southeast Alaska, along the Gulf of Alaska and out along the Aleutian Island chain. Year-round delivery of fuel. Crowley, Delta Western, and Petro Marine Services deliver fuel in this region.
>
> Fuel for this region may be shipped from refineries in Valdez or Nikiski; from the fuel terminal at the Port of Anchorage; or from refineries in Washington or California. It is either shipped directly to communities or to larger hub communities, where it is reloaded onto smaller barges. Sometimes fuel will be lightered directly off the barge into a smaller barge for delivery to a community, thus bypassing the fuel hub.

Kuskokwim River

> The Kuskokwim River Region includes all the communities on the Kuskokwim River and its tributaries, as well as coastal communities near the mouth of the river. Bethel serves as the regional hub, and almost all fuel delivered to the region is at least temporarily stored in Bethel. Fuel from Bethel storage tanks must be loaded into smaller barges to navigate the Kuskokwim River upstream of Bethel. Approximately four million gallons of fuel are shipped out of Bethel each year.
>
> Fuel for this region is transported from Anchorage on large barges and must be lightered before being unloaded at the Bethel fuel depot. Once at the Bethel depot, the fuel is loaded onto barges for delivery upstream or to surrounding coastal communities. Both Crowley and Delta Western have tank farms in Bethel and deliver fuel to the surrounding areas.

Yukon River

Nenana serves as the fuel hub for the Yukon River. Fuel arrives at the Nenana hub from refineries in North Pole, or is carried from Anchorage on the Alaska Railroad or by truck. From Nenana, fuel is barged both upstream as far as Fort Yukon and downstream to the mouth of the Yukon River. Crowley is the dominant fuel transporter in the region. Recently, Ruby Marine started competing on a small scale with Crowley.

Occasionally fuel is shipped from the mouth of the Yukon from the Bethel or Nome fuel hubs. Generally the more direct route from the Nenana fuel terminal is less costly, even for communities near the mouth of the Yukon.

Northwest and Kobuk

This region is defined as the area served by fuel hubs in Kotzebue and Nome and consists of Norton Sound, Kotzebue Sound and the Kobuk River. Nome's port can accommodate large barges and does not require lighterage, while Kotzebue's port is shallow and does require fuel lightering.

Kotzebue is the fuel hub for communities on the Kobuk River. The cost of barging fuel on the Kobuk is high because of difficult navigation and hazards. Most other communities in the Northwest region are coastal and present less navigational difficulty but have shallow ports.

Arctic

The Arctic Region was not studied by ISER. Fuel is subsidized by the Borough, and it is not a Power Cost Equalization community, the original focus of estimating community fuel use. But Crowley and Evert's Air fuel are the major distributors.

Alaska Community Fuel Use 2008 (ISER)

The methodology in the Community Fuel Use project was to survey. The project sent surveys to 30 communities that qualified for the Power Cost Equalization (PCE) program. Twenty three of the surveys provided complete information. On that basis, fuel consumption was estimated for 14 of Alaska's 27 census areas. (The ones containing at least one PCE community.)

This represents the best available data we have for diesel consumption by community, yet it leaves out Fairbanks, Anchorage, and Juneau. That would be the great majority of the population, and the relatively wealthier portion. We would expect fuel consumption to be higher both because income is higher and fuel less expensive. The 14 census areas included in the ISER study accounted for only 64.6 million gallons of fuel consumption. International flight refueling and road system use are not included in the Community Fuel Use Estimate due to the

location of the 14 census areas. The data collected is therefore more easily correlated to heating and electricity.

As we look at those communities, they ranged from about 1,500 gallons per household in outer Ketchikan where hydro is available and other fuel use is modest, all the way up to over 6,000 gallons per household in Aleutians West where there are no alternatives to fuel oil for either heating or electric, the environment is harsh, etc. Something on the order of 2,800 gallons annual usage per household looks to be an average in these PCE communities. Appendix 3 takes the Community Fuel Use estimates from this survey and attempts to extrapolate from it a statewide estimate, and it is discussed further below.

Reconciling Fuel Reports

Northern Economic Research Associates (NERA) conducted a proprietary survey of non-taxed jet fuel sales and estimated them at just over 1 billion gallons. We will set that as a minimum and interpret the above data under that criteria. The jet fuel component for international flights alone is on the order of a billion gallons for 2007, and the state's estimate of taxed jet fuel is 143 million gallons per year. So 1.2 billion gallons would be a conservative estimate for total jet fuels in 2007. (At the moment sales are off by 30% in comparison to last year due to the contraction of international flights.

We will also look more closely at the Motor Gasoline and Total Distillate and Kerosene categories from the Prime Supplier's report. We should combine these two and discuss total Alaska non-jet fuel production, but we want to understand what we are combining.

"Motor Gasoline" encompasses automobile gasoline (services snow machines, 4-wheelers, generators, and other small engines as well as cars), aviation gasoline (small airplane fuel) and marine gas. "Total Distillate and Kerosene" includes diesel for electricity production, fuel oil used in heating buildings, and diesel fuel used on highways, and for heavy equipment.

According to EIA's Alaska Prime Supplier Sales Volume data, the non-jet fuel sales in 2007 were about 577.5 million gallons. That is the estimated total for taxed automotive and highway diesel, plus building heat and electricity, electric power generation, military usage, etc. from the nontaxed sector.

From the state tax division data we can estimate total taxed fuel other than jet fuel at 500 million gallons in FY 2008[37]. The state data does not include nontaxed fuels; most importantly building heat and electricity. Seventy-seven million gallons for heating and electricity (577 million total less 500 million estimated taxed fuels) appears to be low. It seems we have a lot of product not accounted for. 77 million gallons is clearly not enough to produce the heating and electrical needs for all of Alaska outside the Southcentral natural gas region.

[37] The state data is for FY 2008 whereas the federal data are for calendar year 2007. So they overlap by six months and there can't be this much difference.

Since 77 million gallons is clearly not enough to produce the heating and electrical needs of Alaska consumers, the question is how much is it in actuality. We could extrapolate a statewide estimate of fuel use for production of electricity and building heat from the ISER community fuel use data. In the communities they surveyed the average was about 2,130 gallons per household after we subtract fuel use for transportation. We can try to project from this a statewide fuel use estimate by extending it to all populations not served by natural gas.

That attempt is made in Appendix 3, and it also requires consideration for the differences between demographics of households in the ISER survey vs. those that are not. Although some real caution needs to be used in this estimate, it is on the order of 300 million gallons. If we add that to highway fuels we are approaching a billion gallons of non-jet fuel.

If we add Highway fuel of 379 million gallons to 300 million gallons of heating/electrical fuel, along with 115 million gallons of marine fuel, 15 million of aviation gas, and finally the 1.2 billion in jet fuel sales – we have about a 2 billion dollar retail petroleum fuel industry in Alaska.

Temperature Data Analysis

What have we learned from studying the relationship between ambient air temperatures and fuel in this project? We did not have the choice of what data to analyze, as it was a matter of voluntary submissions kindly given by firms that had no obligation to do so. The most ideal data to collect would have been extremely expensive. It would have required taking temperature readings from dispensed fuel at locations all over the state over the period of a year.

Moreover, this temperature data collection would have to be taken simultaneously across suppliers at each point in time – a very costly enterprise. We are concerned ultimately with how retail temperatures might vary from supplier to supplier in ways that make price comparisons non-transparent for consumers. Prices are adjusting in less than a week's time to market conditions. The most level playing field in terms of gallon content is when temperatures are the same from supplier to supplier *within the period of time for which prices are stable enough to be compared*.

One of the study assignments was to determine the effect of temperature on gallon content as fuel moves from production to final retail sale. It is more complicated than "fuel cools from the refinery to retail end use". In the most general terms that is true, as fuels exit the refinery run at temperatures in the 90's or even over 100 degrees, but by the time fuels are being dispensed at retail they are generally below the sixty degree reference and in some cases dispensed at below – 30 F.

The main distinction it seems for fuel temperatures is whether they are stored above-ground vs. below-ground. Above ground tanks are exposed to ambient temperatures as low as -60 F, whereas below-ground tanks may see temperatures below freezing, but not anywhere near the extremes of above-ground tanks. Hence, motor fuels stored in below-ground tanks can actually warm compared to their state when stored in the larger above-ground tanks in the extreme cold.

But since motor fuels are stored similarly across retailers, it isn't much of an issue for price transparency.

Once fuels are in an above-ground storage tank, and given the manner of distribution in Alaska, they follow ambient air temperatures patterns so closely we can generally predict fuel temperatures with over 90% accuracy knowing nothing but ambient temperatures. In the above-ground storage tanks studied, when we have data on daily temperatures, we can see that the tanks have a "memory" of about a week – meaning a week's worth of temperatures influence the fuel. In the case of below-ground storage tanks, it is more on the order of a month.

When tanks have a "memory" of about a week, we are not going to see day-to-day variations of much significance unless there is some kind of coincidental convergence of events, and it would have to be at the refinery itself. For example, a storage tank at a refinery is nearly empty and at or near ambient in the extreme cold. A load is picked up by a truck and delivered. During the day the refinery is producing fuel that is added to the storage tank at the same time a Chinook wind brings extremely warm ambient temperatures. Trucks loaded later in the day could be expected to have somewhat warmer temperatures.

A truck could be left inside a heated facility overnight. In the extreme cold of the winter the fuel would have time to rise above that of fuel in an above-ground storage tank loading trucks the next morning. The more empty the truck, the faster the fuel would warm. Alternatively, fuel left in a truck overnight outside will have a chance to settle to ambient whereas that at the refinery will be somewhat warmer than ambient as newly produced (warmer) fuel is added to that stored. So we can envision temperature differentials in this way.

But what quantity of fuel could we possibly be talking about? It is a random affair as opposed to an individual supplier trying to systematically exploit temperature as a competitive advantage. It would require a heated facility large enough to park a fleet of trucks, or heating a fuel storage tank in order to systematically exploit a temperature advantage in this way – and we are aware of no circumstance like this. The only way to effectively accomplish this is to sell temperature compensated fuel when the competition is not.

Instead, the great bulk of fuel is produced, transported, stored, and distributed in the same manner from supplier to supplier. The further we get from the refinery, the less opportunity there is for temperatures to vary across suppliers. Outside Fairbanks and Valdez, there simply is not much opportunity for this. As we looked across correlations from different fuels stored by the same supplier in remote communities (the only data we had) – they were above 90%, and generally approaching near-perfection. Fuel temperatures were generally the same as a practical matter.[38] It is hard to imagine how temperatures can vary significantly and *systematically* across suppliers at retail.

[38] It should be remembered that the tolerance specifications for temperature compensation mean in effect we cannot even measure differences in fuel temperatures accurately enough at delivery to make a practical difference until fuels vary by more than a few degrees.

We did see some temperature variations in remote storage locations that were either significantly different from the other fuels, or from ambient by less than ten degrees. (There was one Jet Fuel reading in Dillingham that was more than ten degrees warmer than the other two fuels stored there). These again are not retail differences, and after the next stage in delivery these differentials would be moderated further due to the relentless impact of ambient temperatures on all fuels, ever more significant as it is transported and dispensed in smaller quantities.

We did see that both ambient air temperatures and stored fuel can have very large variation within a month – fifty degrees or more in the case of Flint Hills refinery truck rack loadings in some winter months (a fraction of that variation at the Anchorage rack as compared with the interior). But all retailers are facing the same temperatures. Since prices are also adjusting faster than the fuel can adjust to temperature we cannot say there is a lack of price transparency due to temperature variations.

We also saw significant variations in temperatures loaded at refineries in Cook Inlet vs. Puget Sound. But after a week or more of transporting by barge, lightering (if applicable), and placement into above-ground storage tanks subject to ambient – the result is the same as a practical matter. It is very difficult to conceive of a scenario where it leads to systematic differences in gallon contents when subsequently delivered by either vehicle tanker truck to end user, or to an underground tank and dispensed as motor fuel.

Benefits of Temperature Compensation

Introduction

The National Conference on Weights and Measures ATC Steering Committee has pointed to this primary benefit of automatic temperature compensation:

ATC would provide transparency in unit price vs. volume[39]

Further:

> Each of us must decide for ourselves if the benefit of transparency in the measurement system is worth the cost of implementation to the retailers and consumers.

It isn't just that perfect transparency is the most desirable outcome. Because measurement accuracy is subject to diminishing returns – the more accurate we wish to be, the higher the cost of any transaction. The smaller the transaction, the larger is this cost of accuracy. In a large wholesale transaction it is clearly worth the cost of one ATC meter. A 2% difference in volume

[39] http://www.ncwm.net/ppt/steering_committee_interim_report_2008.ppt

across ten thousand gallons is two hundred gallons, and the cost of one meter is being defrayed across two hundred gallon differences in each ten thousand gallon transaction.

In moving from wholesale transactions to retail transactions, there is an order of magnitude more meters dispensing ten gallons at a time rather than ten thousand and the cost of each meter is being defrayed across 2/10ths of a gallon differences. It can make sense – when fuel is extremely valuable, or when the difference in volumes is large.

We should probably adopt differential terminology for the two types of transparency. The first is transparency across *seasons*. The second is transparency across *suppliers*. The best exposition of these two types of transparency, but in a very technical economic fashion, was provided by Murphy and White (2009) in their contribution to the California study. The entire scope of estimated benefits to ATC in the California study were dependent upon that analysis. Each type of transparency (seasonality and supplier) was estimated to contribute about a hundred thousand dollars in benefits, in comparison to the millions of dollars in costs to accomplish temperature compensation at retail.

We should note here that if fuel were sold by weight instead of by volume, there would be no differences across seasons nor across suppliers on any given day in terms of the unit of sale. If everyone transacts in pounds of fuel, then it does not matter what the temperature of the fuel is. A pound is a pound no matter what the season is or the supplier providing it. But it is too impractical (costly) to sell fuel by weight.

Seasonal Transparency and the Murphy-Topel Approach

There were two benefits in the improvement of information to consumers from ATC in the Murphy-Topel analysis. The first was eliminating a lack of *seasonal transparency* – that when there is seasonal variation in fuel temperatures, consumers are led to either over-estimate or under-estimate the value of the fuel. When it is colder, the fuel has higher energy content and its value is underestimated. When it is warmer the fuel has lower energy content and the fuel is overvalued.

So consumers buy “too much” fuel in the summertime, and “too little” fuel in the wintertime (p 10). Also, in the summertime there is a transfer from the consumer to the supplier, but in the winter there is a transfer from suppliers to consumers. But on average, consumers do not misperceive the energy content of a gallon of fuel, even if the average temperature is substantially different from 60 F.

In the language of the layman, a consumer knows what kind of miles per gallon to expect out of his gallon of gas regardless of the average temperature of his environment. He may be incorrect about the wintertime vs. summertime mileage because fuel is hotter in the summer and colder in the winter, and therefore energy content is different. But on average there is no misperception.

It is argued that ATC would remove misperceptions about the energy content of the fuel the consumers are using.

The authors urged an understanding that this was a best case scenario. ATC may actually lead to a degradation of information content by causing consumers to misperceive that ATC guarantees the same energy content in all seasons. That is not true by virtue of the change in additives or refining characteristics over the course of a year. In places where gasohol is used as a winter mix, mileage is decreased, for example.

However, even in the best case scenario for ATC the authors estimated the benefits of eliminating a lack of seasonal transparency at about $89,000 per year for the entire state of California. This is an industry that is more than a hundred times larger than Alaska's. A proportional figure for Alaska would be less than a thousand dollars. The methodology could be adapted to Alaska, with larger potential variations in fuel temperatures – especially for those stored above ground and subject to much greater variations from ambient temperatures. If we do so the best case scenario for ATC benefits for highway fuels in Alaska is about $1,343.[40] For fuel oil it is about $5,377[41]

These numbers depend on an analytical framework that is a "best case" scenario for ATC as discussed in their paper. The fuel oil number for Alaska also relies on combining #1 and #2 fuel oil sales and using the seasonal difference in temperatures for #1 fuel oil, which are considerably larger than for those of #2. It also assumes zero variation amongst ATC fuel retailers, which is not exactly true due to calibration differences within legal tolerance limits. We should not place a lot of emphasis on the exact amounts, but rather note their magnitudes. They are indeed "vanishingly small" as noted in the Murphy-Topel work.

In terms of the layman, is the adoption of ATC going to eliminate any social problems that have arisen from gallons of gasoline having higher energy content in the winter rather than summer? Even for order of magnitude underestimates to the value of ATC, the answer is no. If the differences are so small that consumers are ignorant of it in the first place, it comes as no surprise that highly analytical mathematics bears that out.

This analysis ignores something important about the physics of fuel combustion: that regardless of whether consumers correctly perceive the energy content of fuel – internal combustion engines do not misperceive energy content. And if the consumer is buying fuel that does not get him as far as he thought, then his money does not go as far as he thought, and he will have less of it. Expenditures will have to be curtailed when money does not go as far as we think. Likewise, when fuel gets us further than we expect, we have more money on our hands than we planned. So there is actually another force at work ameliorating these numbers for

[40] See Appendix 2 for derivations

[41] See Appendix 2

social losses estimated by Murphy-Topel[42]. But the difficulty of estimating this adjustment to their approach when the numbers are so small to begin with is not worth the cost of inquiry.

Lastly, it was not recognized in the Murphy-Topel approach that there is actually some variation amongst net gallon retailers by virtue of differences in calibrations. ATC metering is calibrated within tolerances that allow for variations that depend on the flow rate of delivery. For example, the flow rates associated with motor fuel stations and home heating oil allow for variations that amount to the equivalent of around two degrees. In the California case this is 20% of the variation assumed between retailers under gross gallon delivery. Suffice it to say that this calibration difference makes the best case Murphy-Topel scenario of around $100,000 in benefits to California overstated.

Transparency Across Suppliers

Seasonal variation in "gallon" content under a gross gallon standard is an insignificant social problem. But a potentially significant problem for Alaska where ATC might make a difference is in transparency across suppliers at any given point in time.

The California study detailed this concern as follows:

> Energy Commission staff acknowledges that having no knowledge of fuel temperature at the time of a transaction creates a problem because retail fuel consumers cannot adequately compare the benefits or value of fuel prices advertised by two competing retail stations. If consumers seek the lowest priced fuel and if temperature variation is not taken into account in the advertised price per gallon, a consumer could potentially buy a higher priced gallon when they could have received a better value if they had knowledge of the net price of that gallon.

The central feature of any calculation of benefit in such a question is how much difference can be expected from one retailer to another in the temperature of fuel. If there is zero variation in fuel temperatures between retailers, then price transparency is by definition perfect. There is zero benefit to temperature compensation of fuels in terms of transparency across suppliers.

California, despite a great deal of resources dedicated to its temperature study and collection of data, never answered the essential question: how much different are temperatures likely to be for gasoline stations across the street from one another on any given day? We know how temperatures vary over the seasons, but price transparency across suppliers requires measuring actual temperature differences across suppliers on the same day at the point of the retail transaction. It does not matter whether these temperatures differ from 60 F. What matters

[42] This phenomenon is called an "income" effect. It causes demand to shift right in their analysis in the wintertime, and demand to shift left in the summertime, working against the underconsumption in winter and overconsumption in summer. The magnitude of the effect depends on the size of fuel purchases in the budget of consumers.

is whether they vary from each other. Moreover, although distant counties differed in average fuel temperature in a given month, it is stations convenient to one another that matter for competition in the marketplace.

We cannot answer this question with precision because we simply do not have the data to do it. But what we can do is compare in a general way what the difference is between the net gallon standard (no variance) and the gross standard vs. the permissive standard Alaska has at present. That is, we can compare legal regimes in a proximate way.

Comparing Variances in Gallons Across Regimes

There are three legal regimes possible with gross and net gallon retailing. The first is mandatory automatic temperature compensation. The second is a gross gallon standard. The third is a permissive regime where either temperature compensation or gross gallon retailing is permissible, although not at the immediate discretion of the retailer. Under the NIST Handbook 44 standard for example, once a vehicle tank meter is set to ATC, it must remain so for a full year.

With a net gallon standard, there are very small variations in the size of "gallons" between suppliers, strictly those within calibration tolerance. Gallons vary in volume, but not by weight (again, within tolerances). There are potential variations in density of fuel, and in additives, but these are going to be present no matter what standard exists. The question that needs to be addressed in deciding whether mandatory ATC is worth the costs is whether variations in gross gallon deliveries across suppliers on a given day are significant enough to warrant encumbering mandatory ATC costs. The question for a permissive standard is whether it is superior to either one of these, in terms of transparency and equity.

Earlier the NCWM recommendation was mentioned – that If an ATC regime were adopted, it should be mandatory. A one-year phase in period of permissive should precede the final mandatory state. Alaska is simply out of line with what the NCWM would recommend were ATC to be used here. It should be going one way or the other, not continuously permissive.

Sources of Temperature Variance Amongst Gross Retailers

The temperature differences between fuels from different suppliers on any given day is unknown. Yet it remains the principle claim to the benefits of temperature compensation. The California study posed this as a benefit to temperature compensation but collected no data to establish the degree to which temperatures varied amongst suppliers on a given day. Murphy and Topel (2009) made a reasonable inference that temperature variations among suppliers on a given day would probably not exceed temperature variation through the season in California.

Their analysis then involved an analytical derivation for the loss in "consumer surplus" due to consumers' misallocating spending when they do not know the energy content of gallons varies from supplier to supplier.[43] In that analysis, consumers have an idea about the energy content of a gallon on average. But from supplier to supplier, temperatures can vary. A supplier with hotter fuel than average is supplying a lower value to consumers. The consumer would not normally purchase this lower valued item at the prevailing price.

But since consumers are merely shopping on the basis of price comparisons and are unaware of the differences in energy content, they are sometimes led to buying fuel that is warmer than average. So they suffer a loss in value relative to the case when they have perfect knowledge.

This half of the analysis was originally posed in the California study, and it was amended through the work of Murphy and Topel (2009) to recognize the corollary: there are also firms that are supplying colder fuel than average, and these represent a better value than the consumer expects on average. If the consumer had perfect information he would be willing to transact at a higher price for these gallons, and this is a gain in consumer surplus relative to the average.

So these gains and losses are offsetting to a degree, but there is still some inefficiency in market transactions. Temperature compensation would remove that inefficiency. But it turns out to be so small (in their words "vanishingly small") that almost no cost is worth bearing such an insignificant gain. In their case, temperature differences were assumed to follow a uniform distribution with a total range of ten degrees variation across suppliers (plus or minus five degrees from an average).

In their analysis they were considering ATC for gasoline stations. In that case, fuel is stored underground and the temperature variations are small over the course of a year – twenty two degrees or so the entire year. By comparison, Alaska underground storage tank temperatures varied by thirty degrees over the course of two years in the NCWM data set. But in the case of above-ground storage tanks in Alaska, the variation can be more on the order of a hundred degrees from the absolute minimum to maximum over the year, although differences in average monthly rack temperature are more like forty degrees.

Even within a month, fuel temperature variations can be extreme in Alaska. The largest difference between any minimum and maximum #1 fuel oil temperature at the North Pole Flint Hills rack in any particular month was in February of 2008, and it was an eighty degree difference. But ambient temperatures also varied by 116 degrees. Prices move in less than a week's time, so in order to make price per gallon measures meaningful, and speak about differences in value we need to be discussing temperature variations in fuel across suppliers on the same day.

[43] Consumer surplus is the idea that consumers receive more in value from the purchase of a product than they pay in price. People understand that when a good is put on sale they receive an extra benefit if they would have purchased the item at the old price anyway: consumer surplus is larger. On the other hand if the price increases from its previous level they may still purchase the good, but they are not as well off as before on balance. Consumer surplus is lower.

It is also relevant whether these differences are random. When differences are random then on average there is no difference between particular suppliers. Sometimes one is higher in temperature, sometimes the other, but usually close to one another or no difference at all. If some retailer are systematically above the others (if he heats his fuel somehow for example), then there are always consumers getting lower value from these specific suppliers, and firms that are providing that lower value are gaining a competitive edge. The market is working in the opposite direction from what society desires. We desire market forces working to encourage higher value, not lower value.

In this case, where the lower value is provided and consumers do not know the difference, the market result is that firms providing the higher value either adopt the same approach, or they are competed out of existence. This is what happened in Canada. Nearly all retail gasoline stations eventually adopted temperature compensation. The long run result was essentially the same level playing field as prior to the ATC innovation, but at a slightly higher cost per gallon. (Bearing in mind the slight benefits to temperature compensation suggested in the Murphy-Topel analysis)

Where fuel is stored differently – (e.g. above vs. below ground), and where ambient temperatures are most different from refined temperatures we will find the largest temperature spreads from supplier to supplier. For example, the Petro Star refinery has underground storage in Fairbanks at the Sourdough facility, whereas fuels can be drawn from the Flint Hills rack, which is above ground storage. We know from the NCWM data and straightforward physics that fuel stored underground, although it follows a seasonal pattern, is moderated relative to ambient.

In Alaska we have learned that fuels adjust very quickly to ambient air temperatures. It is in fact a problem for #2 diesel and #4 bunker fuel – they need to be delivered before gelling[44], and stored below ground or heated above ambient at their final destination. As we look at refinery rack temperatures we do see that #2 diesel and #4 bunker fuel are exceptions to the very low winter temperatures for gasolines and #1 fuel oil. The lowest temperature seen for #2 fuel oil in the sample was 32 degrees, whereas other fuels were seen in the -20's or even -30's. Bunker fuel (#4) was never cooler than 84 degrees. For these fuels there will be much less variation amongst suppliers than for gasoline or #1 fuel oil.

For those fuels with a greater variation in temperatures, what we do know is that fuel temperatures from suppliers purchasing from the same source and stored in the same manner will for practical purposes be the same. The largest potential differences are in wintertime when some suppliers draw fuel from a recent refinery run that is significantly above ambient and others have stored fuel in a truck or tank that is at or near ambient. There are refineries in North Pole, Valdez, and Nikiski. So these are the limited places where the largest temperature differentials between retailers could occur. We do not expect such differentials in places distant from refineries. The Anchorage/Wasilla area (largest population center by far), all of Southeast, and all of remote Alaska is not subject to this kind of differential.

[44] In the case of #2 fuel oil there are additives that help prevent gelling at low temperatures. The problem is apparently more significant in the dispensing mechanism rather than in the tank itself.

How maximal could these differences be as a practical matter? We cannot go by the difference between the rack temperature and ambient because the moment a truck leaves the rack, the temperature of the fuel is adjusting to ambient in accordance with some established heat transfer equations:

$Q = [1/(1/h_1 + R_w + 1/h_2)]\ A(\text{Delta T})$

Where Q = total cooling power in watts

h_1 = heat transfer coefficient of the fuel

h_2 = heat transfer coefficient of air

R_w = thermal resistance of tank wall

A = surface area of tank

Delta T = temperature difference between ambient and fuel

We can see that the cooling power is proportional to the difference in temperatures, which means that the larger the differential we would like to pose, the faster the fuel is cooling. A fuel truck carrying from a few thousand to ten thousand gallons has a large surface area relative to volume by comparison to the tank farms considered in the statistical work. As volume diminishes, surface area becomes proportionately larger. So we have to conclude that fuel in a local truck is responding even more quickly to ambient temperatures than what we see in tank farms.

Heat transfer formulas also incorporate circulation and fouling – the more the fluid is moving, the faster the transfer of heat. Fouling of the wall surface impedes heat transfer. A truck moving in traffic will cool its fuel faster than one at rest. Once the truck starts delivering loads, the volume diminishes relative to surface area and the amount of circulation also increases. Even if a fuel truck begins the day at relatively warm temperatures, by the end of the day after a number of loads have been delivered, the residual fuel should rapidly be approaching ambient.

Some trucks are being emptied every few hours, if they are servicing school buildings or a hotel, whereas other trucks may take all day or into the next if servicing 100 gallon to 300 gallon loads. So temperature can vary for an individual supplier, not just between suppliers. One large delivery taken straight from the refinery storage tank will have a warmer average temperature than the last load of twenty 200 gallon deliveries.

Wintertime temperature variations work both ways: ambient temperatures can rise above the temperature in a tank holding hundreds of thousands of gallons. The temperature of the fuel in a truck with a partial load – or one parked inside a shop for the night - can be above the temperature of fuel currently being loaded at the refinery rack. This is especially true when the refinery has produced a large volume of fuel in the weeks before and stored it above ground, as opposed to having a short lead time between refining and distribution.

What we have to pose in order for temperature differentials to be significant between suppliers is a situation that is not sustainable for any length of time unless there is something fundamentally different about the way a supplier is moving fuel from the refinery to the end user. It would be very difficult if not impossible to plan so perfectly that weather, loading and delivery, the refining schedule, etc. were all incorporated into planning in a way that made fuel temperatures for one firm significantly higher than another throughout the year.

The least expensive way to accomplish such a thing is to deliver temperature compensated fuel. It is equivalent to warming fuel to 60 F, but far cheaper. That is not to say this is the intent of those practicing it. Nevertheless it is equivalent to doing so under a permissive standard. We might remark that one of the claims in support of temperature compensated fuels is to eliminate the potential for firms to warm their fuel by leaving trucks indoors overnight. But temperature compensation is a more efficient means of accomplishing the same thing when net gallons are sold alongside gross gallons in the marketplace.

Case Study

The only data set we have that provides daily temperature observations on fuel is the Doyle sample, and for purposes here is quite valuable. We do have to take care with generalizing too much with the sample and will treat it as a case study. Because the data set has various fuel temperatures on given dates we can compare the fuel temperatures to ambient and also to the 60 F standard. These are bulk fuel deliveries of jet, unleaded regular, unleaded supreme, and diesel.

The Murphy-Topel analysis can be utilized to compare the loss in consumer surplus either way vis-à-vis a net gallon standard where there is no variation in energy content of gallons. We are proposing in so doing that variations amongst suppliers in a gross gallon standard are no more than the variation we observe between the refinery rack and ambient. We are also proposing that the variation between a 60 F net gallon retailer and a gross gallon retailer is no more than the difference between 60 F and ambient.

First, we look graphically at the loaded fuel temperatures vs. same-day ambient minimums and maximums. Note that for the most part the fuel temperatures are within this range, with the exception of the most extreme cold ambient temperatures in the sample, occurring in January and February. Note the sixty degree reference temperature horizontal as well: it is clear that the variations of fuel temperature from the sixty degree reference are a lot larger than the variation from ambient temperatures.

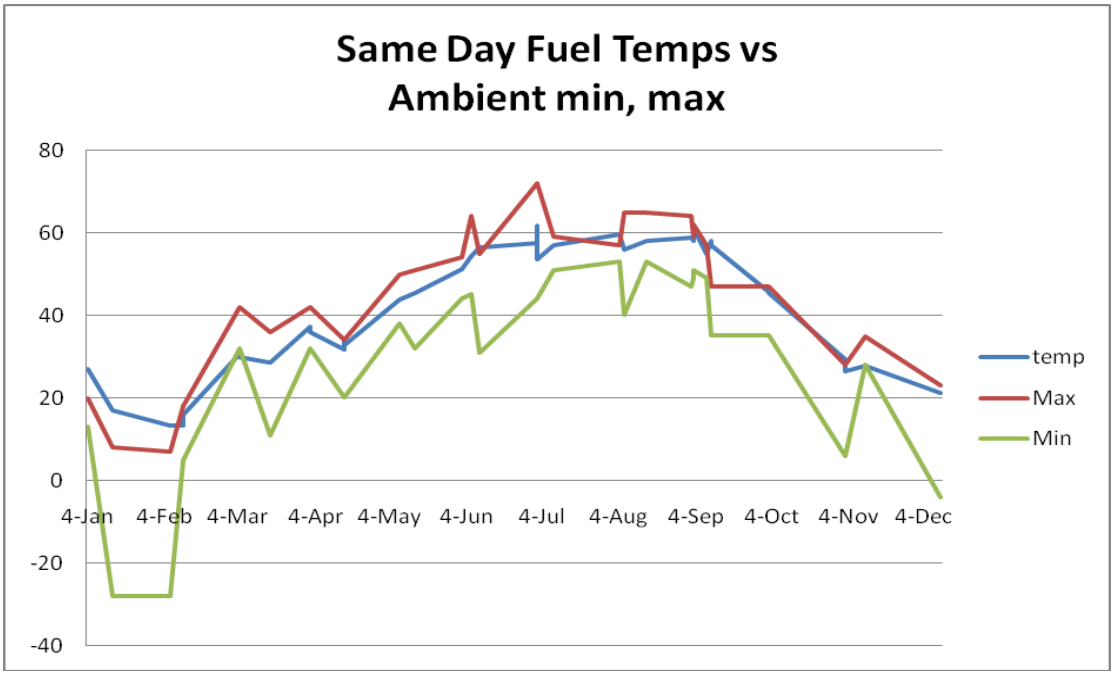


Figure 12

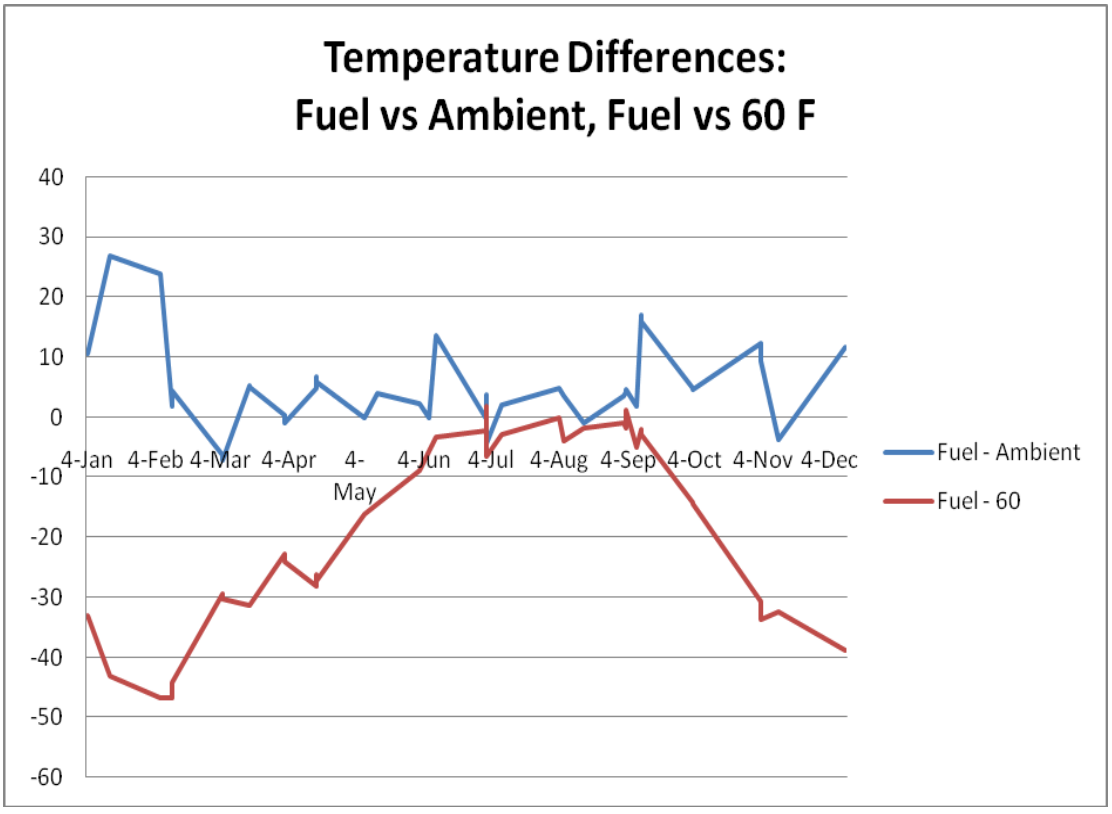


Figure 13

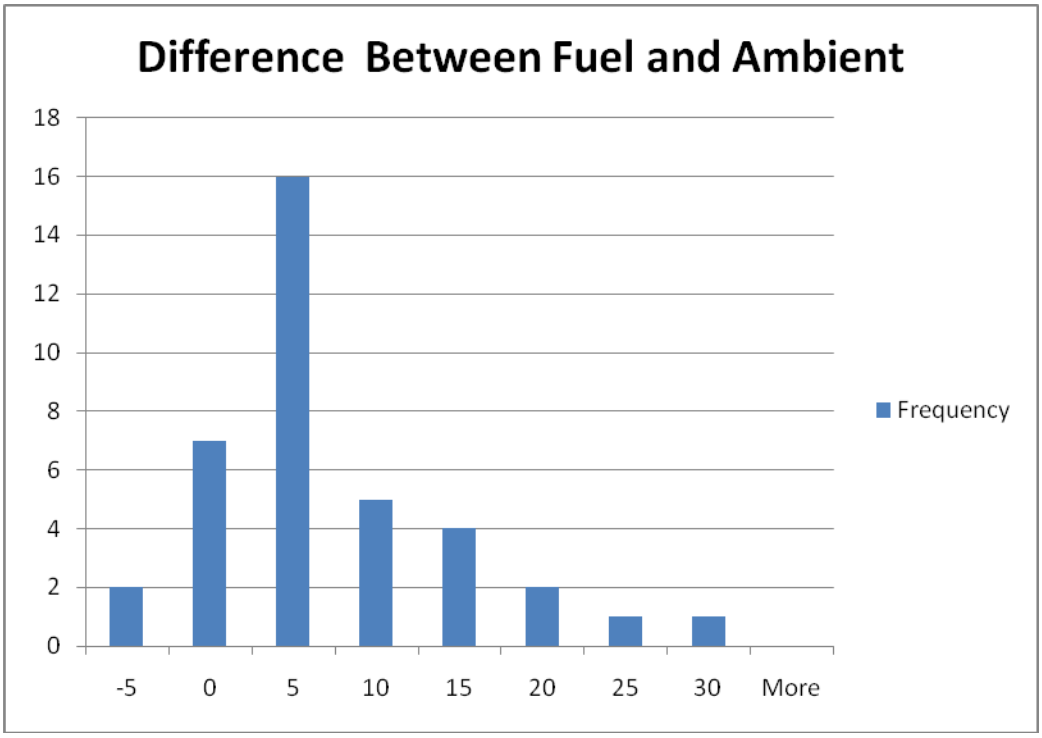


Figure 14

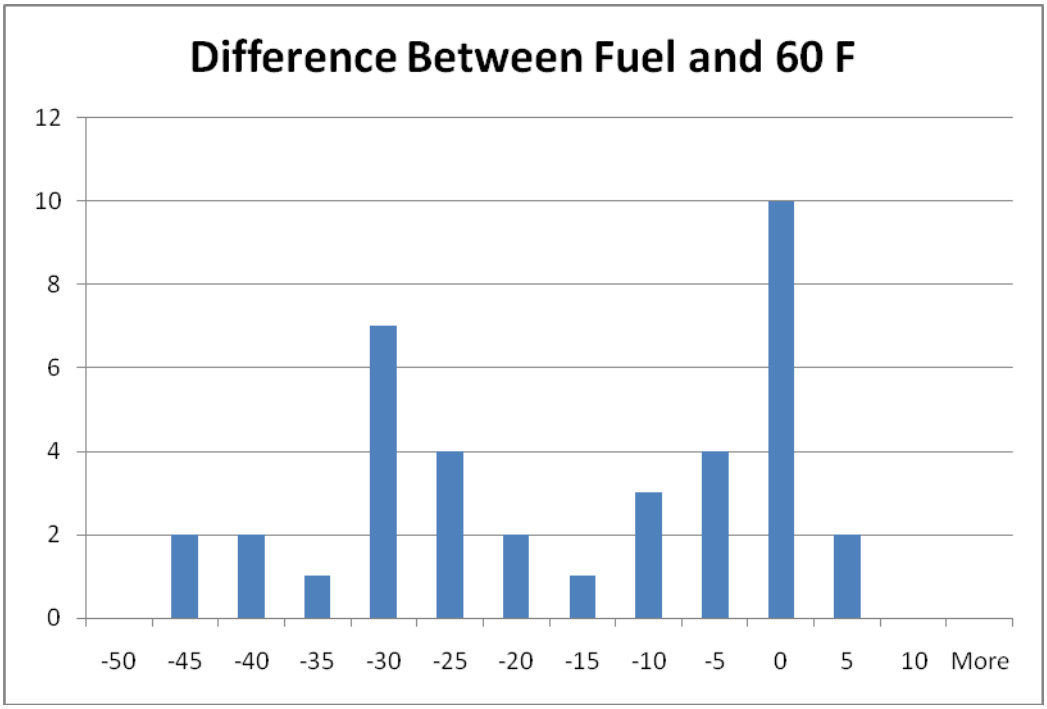


Figure 15

If we look at the distribution of temperature variations from ambient, we see that on average, fuel in this sample is about five degrees warmer than ambient, and the majority of loadings were within a five degree deviation from that mean difference. If we look at how loadings differ from the sixty degree reference temperature, we see that the majority were more than five degree difference, and the maximal differences were considerably larger.

What we can see from this is the extent to which the energy content of a gallon can differ from supplier to supplier when we have a gross gallon standard vs. a permissive standard (with some retailers delivering net gallons). Under a gross gallon standard, random events such as the refinery production schedule, the profile of the firm's deliveries, etc. make for differences in retail gallon energy content that are not large on average. But we guarantee large variations amongst suppliers under a permissive standard, and it is one that is not random. It is one that will drive the market towards long run net gallon equilibrium whether it is efficient or not.

Consumer Loss calculations from Temperature Variations

We can do a little better than the Murphy-Topel methodology to arrive at the "social cost" of having a gross gallon standard vs. a permissive standard for fuel oil sales. They took a shot in the dark at what the fuel temperatures would be across stations at any time whereas we actually know the temperatures of the loaded fuel each day in this case study, along with ambient temperatures. We also know that the temperatures measured in the sample were loadings received by a retailer, not delivered to the consumer. So in the case of above-ground storage prior to retailing, they will settle closer to retail. This also means that the retail temperature will be even further from the 60 F standard on average because fuel is about five degrees warmer than ambient when purchased wholesale in this sample.

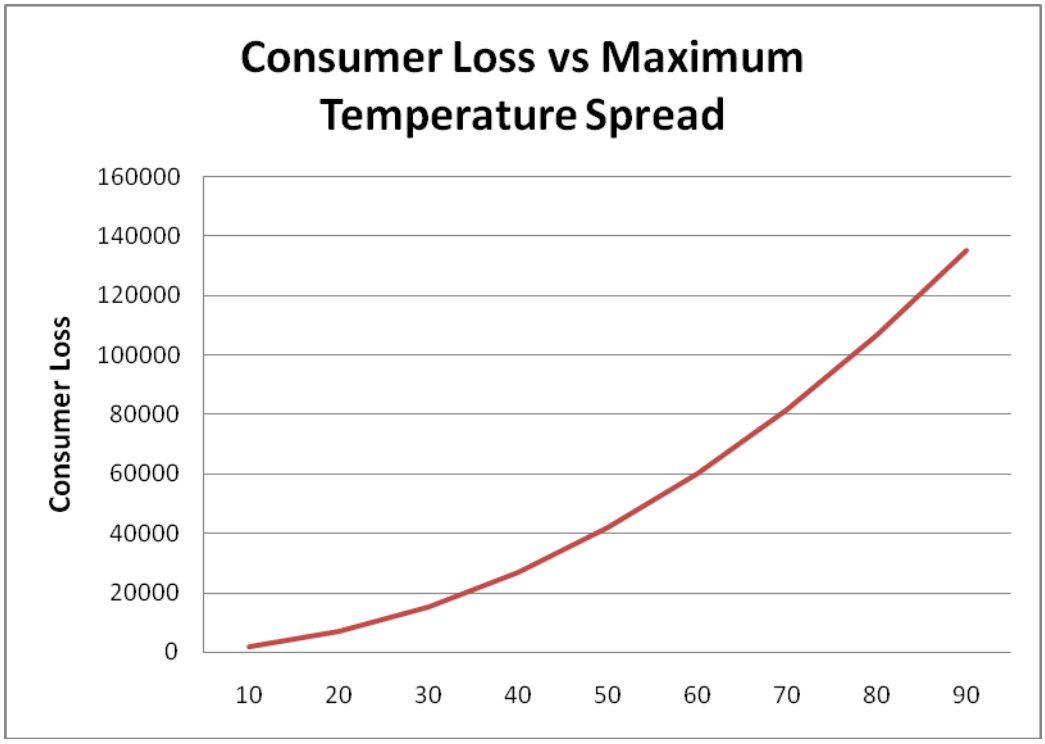


Figure 16

Figure 16 is reproduced from Appendix 2 in order to illustrate calculated consumer losses from effective variations in temperatures of fuel and energy content across suppliers. The calculations are based upon a $.75 billion dollar industry and would increase or decrease proportionately with the price of fuel. Note that for the kinds of maximum temperature spreads reasonably expected given our data, benefits from mandatory temperature compensation are in the thousands or tens of thousands.[45]

These calculations also assume that the temperature differences are random between retailers and that there are no systematic differences in their gallon contents. More will be said on this presently, because if there is a systematic difference between retailers there is another transfer or consumer loss that becomes important to measure.

The temperature variation in a permissive regime increases dramatically. For example, the fuel in two separate vehicle tank trucks may measure 20 degrees and 25 degrees respectively, a difference of only five degrees. A separate truck delivering a net gallon would have the temperature of the fuel set at 60 degrees, a much larger difference. That increased variation increases the losses, and since they are nonlinear in temperature spread, the amounts quickly rise above $50K. For temperatures seen at the Flint Hills rack in North Pole, variations are potentially as large as 90 degrees (rack temperature of -30 F versus the net standard of 60 F). Consumer surplus losses are on the order of $140,000 for this kind of variation.

[45] The assumption of uniform distribution for temperature variations is also clearly a best case for ATC since we can see that temperature variations are more likely to follow a bell-shaped curve about the mean. Small variations are much more likely than large variations from the mean.

A great deal of caution needs to be taken here, in understanding that the numbers are for illustrative purposes only. There are a number of factors that would make a difference. We have not actually sampled the differences in temperatures between deliveries. There will be differences between the interior of Alaska and the Kenai peninsula. We have applied the methodology to the entire fuel oil sales estimate for Alaska, and in many areas differences amongst gross gallon suppliers will be insignificant – at any distance from refineries.

What we draw from this example is that the benefits of temperature compensation in terms of reducing market inefficiencies are still very small to begin with. (Alternatively that the costs of not having temperature compensation at retail are low). Secondarily, whatever benefits there are to temperature compensation occur under a *mandatory* regime, not a permissive one. The introduction of permissive ATC at retail actually introduces the *largest* possible differences between the "gallons" of various retailers. Thus, between the three possibilities – mandatory net gallon, mandatory gross gallon, permissive – the worst case scenario is the permissive standard, by a considerable margin.

In Appendix 2 we work out a much more significant issue that was mentioned earlier – that when temperature variations are not random, there is an additional measure of consumer loss that is important. This measure is something that is most significant in the initial introduction of permissive ATC in a cold state: a transfer from consumers to ATC retailers that is potentially in the millions of dollars. It is something that ultimately vanishes in the long run as all retailers as a whole adopt temperature compensation.

The size of this transfer depends on the industry size itself, the amount of fuel dispensed net vs. gross, the pass-through rate, the adjustment of consumer perceptions, and the elasticity of demand. But this transfer is far more important, by order of magnitude, than the inefficiency from random variations in fuel temperatures across suppliers. It becomes an equity and transparency issue because under random variations amongst suppliers there is still a level playing field across all retailers and consumers. Nobody can exploit random differences. But when there are systematic differences amongst retailers then equity and transparency are diminished.

Costs of Conversion to ATC

Introduction

Calculating the costs of conversion in Alaska presents some real challenges. The methodology is straightforward conceptually but there are a number of unknowns that make estimation difficult. The costs depend highly on what kinds of assumptions one makes about these unknowns as well as the manner in which conversion takes place. The least costly is gradually over a long period of time and in conjunction with the existing inspection schedule and maintenance/operations schedules of firms in the industry. The most expensive is a short conversion schedule requiring more labor and travel, and less ability to fit retrofitting and calibration into the existing inspection route schedule.

There are one-time costs of conversion associated with retrofitting dispensers at gasoline stations or vehicle tank meters. There are initial calibration and inspection/certification costs. There are also annual costs in the future for maintenance and inspection. We can adapt numbers from the recent California study to the retrofits, and these numbers were also verified with more than one supplier. But the retail fuel industry in Alaska is very different from that of California, especially in bush Alaska.

Alaska has a higher proportion of older equipment that is more costly to retrofit. In fact, the more remote the location and the smaller the throughput, the more likely we are to encounter both "informal" fuel transactions and unregistered devices. Transportation and lodging costs for labor doing retrofits are also much higher. Many remote locations require airfare or ferry transportation to do a retrofit on just one or two dispensers rather than fifty or more.

Initial calibration and certification of newly installed meters must be performed before they can be placed into service. At present the State of Alaska is the only one doing calibration and certification although they can be done by an independent firm that owns the proper equipment. The tests can be done at a regularly scheduled inspection, and there are routes that are designed for economy of inspections. Requesting a calibration test outside of this schedule can be extraordinarily expensive in Alaska. ATC meter calibration testing requires a great deal more equipment, necessitating a truck and trailer being shipped to locations off the road system.

In remote locations, the cost of adopting the more sophisticated ATC metering can be prohibitively expensive. In addition, there is the problem of the downtime associated with equipment failure or the inability to comply. In the California study this was recognized and about 200 locations were identified where the adoption of mandatory ATC essentially threatened the supply of fuel for the area. Their proposal was to place a tax on the urban fuel sales in order to finance the adoption of ATC in these more remote areas. But it begs the question of how much effort it is worth to impose mandatory ATC in the first place if extraordinary means are required to accomplish it.

Retrofit Kit Component Costs

There are a range of ATC options from a minimalist retrofit doing no more than that required to fulfill the law, through units with components that track point-of-sale transactions, inventory, and invoicing on-board a tanker truck or inside the store.

Before discussion of the variation in these costs we introduce a simple diagram of a fuel dispenser and its components (Figure 17). The entire unit is referred to as a dispenser. Inside the cabinet of the dispenser are meters that spin as fuel flows through system piping. The meter is connected to a register that displays the quantity of fuel metered. The register might be electronic (digital), and it might be mechanical (analog).

The illustration shown appears more like a gasoline station dispenser, referred to as an "RD", or retail device, in the industry nomenclature. But the principle components are essentially the same for a truck mounted measuring and dispensing unit; there will be a meter that spins as fuel

moves through it, and this will in turn engage the register. What temperature compensation does is change the ratio of turns or spins per unit movement of the register.

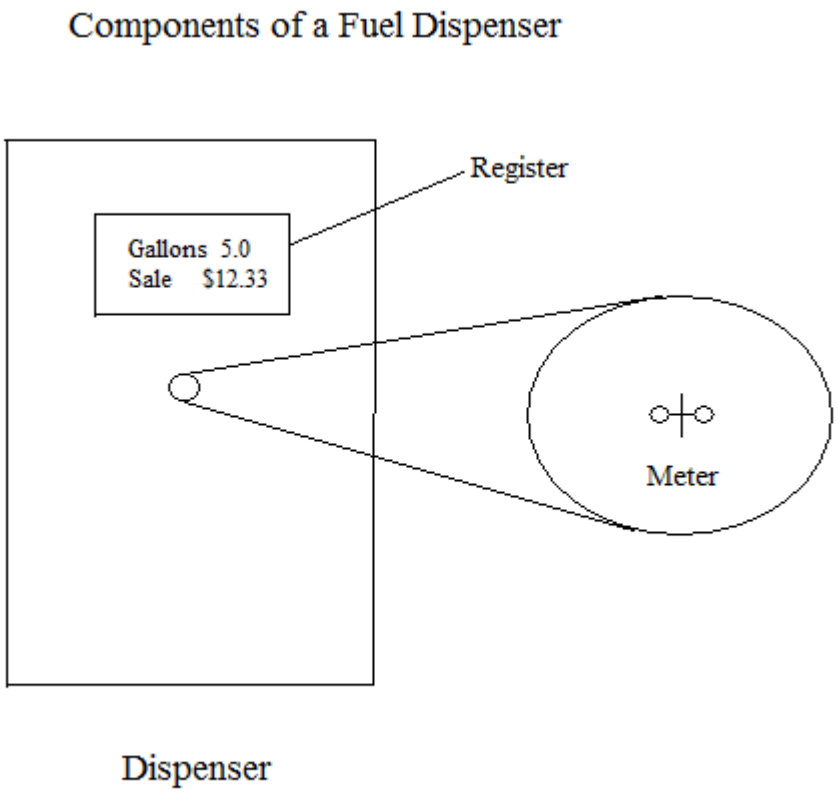


Figure 17

Retrofits vary in cost depending on the number of products, the capacity to blend mid-grade fuels, and in the case of mechanical dispensers the number of nozzles. It appears that retrofits of mechanical registers require replacement with digital registers for RD motor fuel dispensers. In the case of vehicle tank meters, they are not required, but in the long run it appears the more cost-effective solution is conversion to electronic registers.

Retrofit costs for gasoline station (motor fuel) dispensers according to various specifications are illustrated in Figure 18. As can be seen, the kit costs vary from a low of about $1,400 for a dispenser that already has an electronic register up to a high of about $4,000 for a dispenser with a mechanical register and two fuel types. (Mechanical registers must be replaced with electronic registers for RD units). These costs were obtained from the California study.

Automotive ATC Retrofit Kit Costs
by Dispenser Attributes

Fuel Types	Mid-Grade Blending Capability	Electronic or Mechanical	Nozzles	Estimated Costs
one	no	Electronic	NA	$1,422
two	no	Electronic	NA	$1,700
three	no	Electronic	NA	$2,042
three	yes	Electronic	NA	$1,700
four	yes	Electronic	NA	$2,426
one	no	Mechanical	one	$3,183
two	no	Mechanical	two	$3,997

Source: California Energy Commission (2009) p 60

Figure 18

In the case of vehicle tank meters, price quotes were obtained from several sources (IDEX, Alaska Petroleum Equipment, Midwest Meter). In discussions with both suppliers of metering equipment and those with experience in their application, it appears that conversion of mechanical systems is problematic for a number of reasons. If the mechanical temperature volume compensator (TVC) fails, there is no field repair, and it will have to be replaced. The electronic TVC and register are both field repairable. The electronic register should require less maintenance. Although the mechanical system may be less expensive to retrofit initially, it is the higher cost in the long run.

It appears that the minimalist conversion kit for a vehicle tank dispenser is about $1,725, excluding labor, shipping, and calibration, but can vary up to about $3,725. Replacing an existing system that has a mechanical register with an electronic register and temperature compensating capability begins at about $4,200. The high end units with the capability of metering several products and on-board invoicing can cost an additional $4,000. Simply purchasing a new meter with electronic register and printer will run about $6,500 to $7,000.

Dispenser/Meter Data Sets: Number of Conversions

There are two data sets we have available for estimating costs of conversion. The first is the route list for “RD” (retail devices) that dispense fuel at automotive gasoline stations or marine fuel locations. The second data set is the list of vehicle tank registrations. In the case of the RD data set, we do know if the register is mechanical or electronic. We also know that 100% of them will have to be converted. There appear to be 375 locations, and something on the order of 1500 dispensers to convert. In the case of vehicle tank meters, there are about 486 meters

of which only 53 are ATC. So the majority (433) will have to be converted under mandatory ATC.

We do not know the profiles of RD dispensers in terms of the number of products per dispenser at any location, the capability for blending, or the number of hoses per dispenser. What we know is the total number of "product lines" at each location. If a dispenser has two registers (one on each side) and three grades of unleaded available to the customer on each side, then it has six product lines. If it is an older dispenser with one mechanical register and one grade of unleaded plus diesel, it has two product lines.

Reasonable approximations may be made in most cases – for example if it is a Tesoro station in downtown Anchorage with 36 product lines then we are speaking about a case of most dispensers at that location having three products per side of the cabinet and electronic registers in each dispenser. There might be four meters and there might be six depending on whether there is midgrade product blending.

On the other hand, if there is one product line in one location then there is obviously only one dispenser. If it is a mechanical dispenser at one location on a road system with two products, then it is most likely still one dispenser. Generally speaking when we are in an urban environment the number of product lines per dispenser is higher, and in rural areas it is lower. We know that dispensers with mechanical registers have at most two product lines, so when there is a mix of mechanical and analog meters at a location we can infer the number of dispensers when the total number of product lines at a location is low.

In the case of vehicle tank meters we have a mixture of temperature compensated and non-temperature compensated, as the law presently allows for voluntary temperature compensation. As of October 2008 the profile by region is shown in Figure 19. In total, about 85% of the meters were non-temperature compensated. Slightly more of the medium meters were temperature compensated (86%) than the larger meters (81%).

We cannot say what volumes of fuel are moving through either one despite knowing the proportions of registered meters. The jet fuel metered by International Aviation Services, Inc. (IAS) at the Anchorage International Airport alone (close to a billion gallons in 2008) was delivered net. Additionally, before January 1 of 2009 the practice of distributing fuel through gross meters but invoicing net was practiced by at least one firm in the interior. Moreover, firms with some trucks having gross meters and some net can choose which trucks deliver the higher volume deliveries or which trucks deliver in the coldest time of the year.

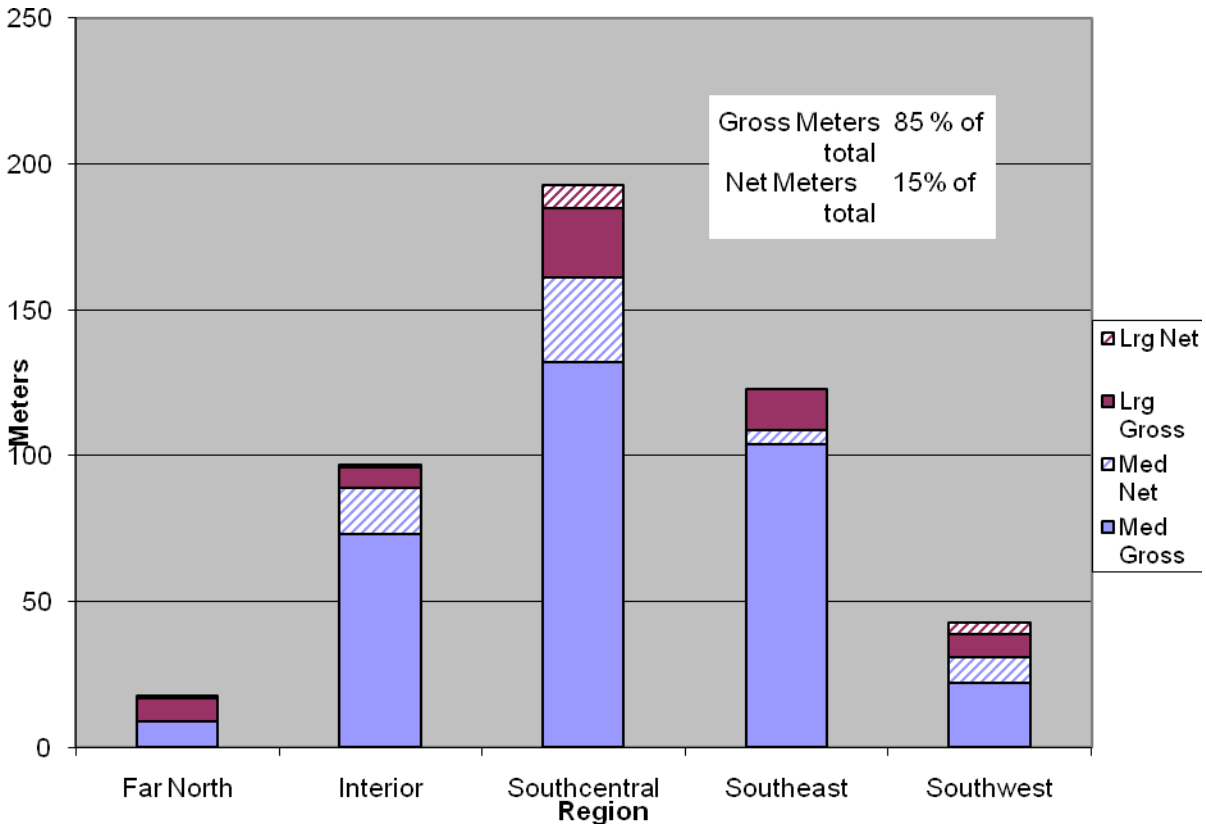


Figure 19

The differences in regional proportions of gross vs. net are significant. The Far North has the highest percentage of gross meters whereas the Southwest has the lowest. The Interior again has one firm metering gross but delivering net, and if the 21 gross meters for that firm were put into the category of net, then prior to 2009 the Interior would have had the lowest proportion of gross meters at about 60%.

Area	Percent Gross
Far North	94.4%
Interior	82.5%
Southcentral	80.8%
Southeast	95.9%
Southwest	69.8%

Figure 20

Cost to Convert

In converting Retail Devices (RD) units to temperature compensated devices, a simple and economical approach was developed. There are really three classes of costs. The first is the cost of the components involved in the conversion, such as the TVC unit and certain adaptors. The second is the labor involved in the on-site field work. The third is transportation, lodging, incidentals, and mobilization between locations. All three of these have variation depending on assumptions that are made.

In more remote Southeast Alaska the conversion concept involved the use of a two-man team traveling with truck and equipment via ferry, working systematically between locations, beginning in Bellingham and working north. The ferry trips between locations such as Ketchikan, Kake, Sitka, Hoohah, and Wrangell, Haines, and Glacier Bay area consist of shorter legs between locations instead of multiple longer trips from any point of origin.

In the case of Juneau-Douglass there are enough conversions to support a separate team staying longer term, and possibly Ketchikan as well. But any individual trips beyond these involves less than ten dispensers in a single location, and in some cases just one. Separate trips would raise costs considerably. Although they do not add a great deal to the Alaska total proportionately, they can in some cases double the cost of conversion per dispenser in a remote location.

The use of ferry transportation was assumed for the continuation on out to Dutch Harbor, including Yakutat, Cordova, and Kodiak, except that the point of origin was assumed to be Whittier. Other remote locations such as Barrow, Ft. Yukon, Nome-Teller, Kotzebue, and Bethel have no choice but airline transportation. Both ferry and airline rates were quoted, but ferry rates differ according to season.

In the case of the major population center for the state – Anchorage and the road system through the interior and Kenai Peninsula – we do not have ferry or airline transportation. But all locations including the road system and the Southeast/Southwest areas already discussed have mobilization expenses between locations.

It was decided that a fixed amount per location would be used, with additional amounts where logistics warranted – greater distances between locations, the absence of a truck, etc. Mobilization between locations of $50 was assumed in the low cost scenario. Road system mileage was considered separately.

In the California analysis the source of variation between the low and high scenarios was a combination of two forces – the wage rate and the hours per conversion. Due to the technical nature of ATC dispenser conversions, a high wage rate was assumed there. The “fully loaded” wage rates of between $60 and $70 per hour were assumed for the low and high end, respectively. The hours per conversion were estimated between 1.5 and 4 hours for the low and high end scenarios. It resulted in an estimated range of $9.0 million to $27.9 million for installation.

For Alaska we need to make some adjustment for a higher wage rate, and also the recognition that there will probably be more overtime. In looking at the remote areas in particular, there is either going to be more overtime or more lodging expense because at the median number of hours per dispenser suggested by the California study, a small amount of overtime per day is required just to achieve three dispensers per day.

According to the most recent Bureau of Labor Statistics data, the wage rates in Alaska for Installation and repair technicians are about 18%-21% higher than California, measured at the median and mean, respectively[46]. So whereas California was assuming "fully loaded" wage rates ranging from $60 to $70, Alaska's numbers adjusted for this wage differential would be somewhere between $70 and $85. California did make a generous assumption about the wage rate relative to the California average so there is not much worry this is an understatement.

Logistically, mistakes in Alaska are far more expensive than in typical urban settings. You don't have choices of spare parts on shelves or tools convenient to where you are working. Ordering items is expensive and can take days or more. A truck broken down on Prince of Wales Island logging roads or a part that does not work in Unalaska is a completely different situation. The seasons for working outside are short, and productivity in the cold is lower, even when it is not extreme cold. Coastal areas have rain. The interior has snow.

For purposes of this study we will adopt a $75 per hour wage rate but it is probably not wise to adopt the low value of 1.5 hours per conversion and work; it is more like 2 hours at the minimum end. At the maximum end the 4 hours per dispenser was retained.

An equation was developed that linked average RD retrofit costs from the California study.

Cost = $2,000 + $1750 additional for mechanical + labor, room, and board

A "fully loaded" labor rate of $75 per hour was used here in the minimum scenario. A two-hour conversion minimum was assumed. A total of $182 per day for lodging, meals, and incidentals was used based on a survey of room rates and on the state employee per diem rate. Mobilization between locations has to be factored in, and an average of $50 was used. In the high end scenario, a four hour conversion was assumed, with the $85 "fully loaded" labor rate. Also, an $85 mobilization cost was used. In both cases airline and ferry prices were used. But the total travel costs were doubled in the high end.

The results were a cost range of $4.3 million to $5 million to convert existing RD units to temperature compensated units. But there were substantial differences by location, of course. Costs ranged from about $2500 per dispenser to over $6,000 depending on location under the lower scenario, and as much as $6500 per dispenser in the high scenario.

In the case of vehicle tank meters, each company contacted provided different kinds of data. For example, Alaska Petroleum equipment gave some examples of conversion parts, but does

[46] http://www.bls.gov/oes/current/oessrcst.htm

not do installations. IDEX provided some rough retrofit component costs. EEI in Canada provided initial calibration and inspection fees, which they are certified for in Canada. Midwest Meter provided low and high retrofits components and since it does installation and calibration simultaneously at its facility, provided those costs as well.

Estimating the low and high scenarios is not a matter of assuming all conversions are the least expensive components on the low end and the most expensive on the high end. It is going to be a mix, and companies will decide on the type of conversion to choose. More than one method of computing costs was undertaken, and the results were similar. Each assumed though that the travel expenses are duplicated as opposed to having the same team convert both vehicle tank meters and motor fuel dispensers.

The estimates for conversion of the non-temperature compensated vehicle tank meters to temperature compensation-capable meters is $2 to $3 million dollars, exclusive of calibration testing. It is assumed for this study that the retrofits are introduced in a schedule that is consistent with the current route calendar, which is the most conservative cost assumption one can make. That is, no special trips are made for calibration and testing of an isolated set of dispensers. Alternatively, the installation is performed by companies that have the capacity to calibrate, inspect, and certify.

Estimates for RD (gasoline station) dispensers vs. vehicle tank meters retrofits in Alaska are presented in Figure 21.

Estimated Retrofit Costs for RD vs. Vehicle Tank Meters

	RD Low	RD High	Vehicle Low	Vehicle High
Retrofit Costs	$4,272,519	$4,995,833	$2,072,750	$3,137,867

Figure 21

Calibration and Inspection/Certification

Before a meter is placed into service it must be calibrated to certified standards either by the State, or by someone with the proper equipment and qualifications. From discussions with the state weights and measures staff, and with a Canadian corporation performing tests, non-ATC calibration tests can be done with as little as a 1-5 gallon draw whereas calibration tests for ATC require a minimum of 20 gallons. The fuel temperature must be stabilized first in order to obtain an accuracy measure.[47]

As a consequence the testing equipment leaps from a hand-held 5 gallon test measure to much larger devices, such as a slide-in unit that fits into a pickup truck for $15,000. Several more of

[47] This seems to raise the question about the variability of ATC deliveries in small retail quantities – whether it is slightly beyond that of the tolerance specifications mentioned elsewhere in this report. For if satisfying those tolerance specifications requires a preliminary flow of fuel this large first, then it seems logical that without the preliminary flow the delivery would be a slightly different quantity.

these units would need to be purchased by the State for initial certifications and subsequent inspections. So there are some additional capital costs for the state whether they are doing the initial calibrations, or whether it is a consequence of subsequent inspections.

It is not clear if the California study addressed the initial calibration/inspection or certification in their report. Inspections thereafter were certainly addressed in the "recurring annual costs" discussion as an increment on top of non-ATC costs. When a new meter is installed, 100% of the costs for calibration/inspection/certification are incurred. If the installation is coincidentally at the time of a periodic inspection for the existing meter, then there would have been an inspection anyway. So the only increment to cost is whatever an ATC inspection and calibration would cost over and above the existing meter.

But if the meter is installed and inspected/calibrated/certified outside the periodic inspection schedule, then the entire cost must be counted, not just the increment for ATC vis-à-vis a non-ATC meter.

In the case of vehicle tank meters, estimates were obtained for both installation and initial calibration/certification as well as costs of complete post-installment inspections and certifications. These can be accomplished for around $300 - $400 per meter. Installation and calibration/certification would add from $130,000 to $173,000 to the equipment costs for retrofitting the existing non-ATC vehicle tank meters.

Recurring Annual Costs

The California Study provided some estimates of recurring annual costs due to adoption of automatic temperature control devices in gasoline service stations. We can adapt these to Alaska with some reservations. First, the kinds of costs were from increased maintenance expenditures on ATC devices vis-à-vis non-ATC. The second was that replacement of some portion of dispensers occurs naturally in the industry, and this will continue except at somewhat higher costs due to ATC dispensers being more expensive. Finally, there are increases in periodic inspection costs.

Additional maintenance costs for ATC devices were estimated, at the low end, to require a service technician spending 8 hours of time at 10% of service stations replacing 25% of the initial costs of ATC components at each of these stations. (An estimate of 20% more cost for rural locations). This estimate was based on a 2.5% failure rate for ATC related equipment.

The higher maintenance scenario assumed 20% of the retail stations requiring a service technician spending 16 hours of field time replacing 50% of the initial costs of ATC components at those stations. The implied average failure rate was 10% per year for ATC related equipment. The fully-loaded wage rate was also assumed to be $70 rather than the $60 assumed in the lower maintenance scenario.

The assumptions above were the best the staff could do without data from Canada where ATC devices are nearly universally deployed. What is probably the most straightforward thing to do

is see what proportion of initial retrofit costs these amount to and adapt them to Alaska. The low cost scenario looked to be about 3% of initial retrofit costs, and the higher about 9% in the case of California. In very rough terms the estimates adapted to Alaska look to be about $128,000 to $450,000 per year in the case of RD units and $62,000 to $188,000 in the case of vehicle tank meters.

In the California study (pg 68) the implications for failure of ATC components was discussed. It is somewhat unclear exactly which types of problems result in “error” being displayed on the register resulting in the dispenser being incapable of functioning until a successful power-cycle is achieved vs. errors where the dispenser continues to operate, but as a gross gallon meter. In short, which ones end fuel dispensing altogether vs. which end net gallon metering and return to gross.

The costs of dispensers being inoperable becomes a more important social burden than the direct costs of maintenance as we move further into bush Alaska. In some places, there is actually only one dispenser. Inoperability means no fuel. So the cost is whatever economic activity cannot take place, which is an order of magnitude more important. Where there are a limited number of dispensers, inoperable dispensers are an inconvenience and there are additional costs from inefficiency of economic activity (longer travel to dispenser, more time, etc).

The second category of cost we can adapt numbers to is the ongoing replacement of existing dispensers. Each year, some portion of dispensers is replaced due to age and wear. ATC devices add incremental costs on top of existing replacement costs. In the case of California these amounted to 4% to 6% of the original retrofit costs. If we simply adapt these numbers to Alaska, we have estimates that range from $170,000 to $300,000 in the case of RDs and $83,000 to $188,000 in the case of vehicle tank meters.

Appendix 2 to this report explains the calculations in greater detail.

Recurring Maintenance & Replacement Estimates

	RD Low	RD High	Vehicle Low	Vehicle High
Retrofit Costs ->	$4,272,519	$4,995,833	$2,072,750	$3,137,867
Maintenance 3%	$128,176	$149,875	$62,182	$94,136
Maintenance 9%	$384,527	$449,625	$186,547	$282,408
Replacement 4%	$170,901	$199,833	$82,910	$125,515
Replacement 6%	$256,351	$299,750	$124,365	$188,272
Total 7%	$299,076.35	$349,708.31	$145,092.49	$219,650.71
Total 15%	$640,877.90	$749,374.95	$310,912.48	$470,680.10

Figure 22

The last category of recurring costs associated with ATC metering is the incremental costs of periodic inspections undertaken as a regular part of state weights and measures duties. It is clear this was adequately addressed in the California study, and their discussion matches the estimated incremental time required for testing ATC vs. non-ATC from discussion with Alaska weights and measures staff.

In the California study, the amounts were given on a per-station basis: about 10% to 20% per station. Since the maximum registration fee is $1,000 in California, the recommendation was to increase that amount to $1,200 in anticipation of higher inspection costs. In their case, these are county-level costs incurred by inspection agencies that must justify their inspection fees on the basis of costs incurred.[48] The amount of time required for each test presently was estimated at 12 minutes, and expected to approximately double. We adopt the same increment to costs as far as time is concerned. But given the increased requirements for equipment, we should also expect higher transportation costs off the road system in Alaska. The amounts range from $37,500 to $75,000, but we should expect the upper end.

In the case of vehicle tank meters, the same 10% to 20% would result in about $34-$68 added to average inspection costs, using data from Canada. This would add some $15,000 to $30,000 in periodic inspection costs, excluding higher transportation costs. So the upper end is more likely.

[48] Alaska charges a registration fee of $19 per retail device whereas in California it is determined by counties, with a maximum of $1,000 under state law. Only one California county example was given at $100 per station plus $20 per dispenser. Discussions with Alaska Weights and Measures Staff indicates Alaska fees do not cover expenses fully as in the case of California counties.

Effect of Temperature Changes on Volume or Price per Gallon

In studying the effects of temperature on fuel we are led to an understanding of how quickly fuel adjusts to the temperature of its environment before it is retailed. We also can see that it is more complicated than fuel cooling from the refinery to the end user in Alaska. In the case of underground storage of highway fuels for example, fuel that has adjusted to an extremely cold ambient air temperature, when placed in underground storage, has a chance to warm up some before delivery to the consumer.

We can see that all refineries do not operate with the same lead time between production and the loading rack. A short enough lead time will result in temperatures that have not completely adjusted to ambient air at the time the truck has been loaded. In the case of #2 fuel oil produced in the interior at Petro Star, the fuel rarely leaves the refinery at less than 60 F, whereas subzero temperatures for automotive fuels at the Flint Hills loading rack are not unusual in the winter.

Fuel that has been delivered by rail to the Anchorage rack from Fairbanks has already adjusted to ambient air temperature before it is further distributed. Fuel that has been delivered to remote tank farms by barge will have adjusted to ambient air temperature before it is retailed – but the temperature at purchase will vary depending on whether it was loaded at the Port of Anchorage, the Nikiski refinery, the Petro Star Refineries or Puget Sound.

Method of Volume Adjustment

The most precise method of volume correction for temperature according to fuel type involves more than one step. ASTM International (originally known as the American Society for Testing and Materials) produces convenient tables that may be used to first convert an observed American Petroleum Institute (API) gravity measurement at a given temperature to “API Gravity at 60 F”.[49] From there the volume correction is established with a second table given the temperature and API gravity at 60 F. (There are computer programs based on the ASTM tables as well).

API gravity is a measure of how heavy petroleum if relative to water. If it floats on top of water then it is lighter, and has a higher API gravity. In wholesale transactions, both gravity and temperature are given, along with the gross and net gallon readings. The calculations can thus be verified using the petroleum measurement tables.

There are less exact means of correcting volume to 60 F that rely on assumed API values for various products. There are “Coefficients of Expansion” (CoE) that appear in various trade or government publications that may be used as approximations. For example Butcher (2006) cites CoE values of gasoline at 0.00069/°F and diesel at 0.00050/°F. That is to say, each one degree reduction in the temperature of gasoline results in a change of volume by a factor of 0.0007.

[49] ASTM-IP Petroleum Measurement Tables 5 and 6 are described here.

What is usually cited more often is that as gasoline cools by 15 degrees, it shrinks by about 1%. This can be seen by multiplying 15 times 0.00069, which is equal to 0.0103 (about 1%). We may use these for illustrative purposes to produce some simple charts or tables demonstrating the effect of temperature on volume, and therefore price per gallon.

Since data was obtained from various Alaska sources, and some of it included actual API values[50], they can be used to obtain actual CoE figures derived from the Petroleum Measurement Table calculations. These were 0.00052 for Jet Fuel/#1 Diesel, 0.00048 for #2 diesel and 0.00062 for gasoline.

Figure 23 illustrates the volume correction factors for the two major types of fuels – diesel #1 (or jet fuel or heating oil) and gasoline. These factors have again been calculated for observed gravities of fuel produced in Alaska. At 60 F there is no volume correction factor for either. For diesel, it reaches a 0.99 correction factor (shrinks by 1%) at about 41 degrees. For gasoline it occurs sooner, at about 45 degrees. Diesel reaches a 0.98 correction factor (shrinks by 2%) at about 22 degrees. For gasoline the 0.98 correction factor is reached at 28 degrees. At forty below zero they are roughly five and six percent smaller in volume than gross gallons respectively.

[50] These were from the Doyle data set. It contained invoices with API values from the Nikiski refinery

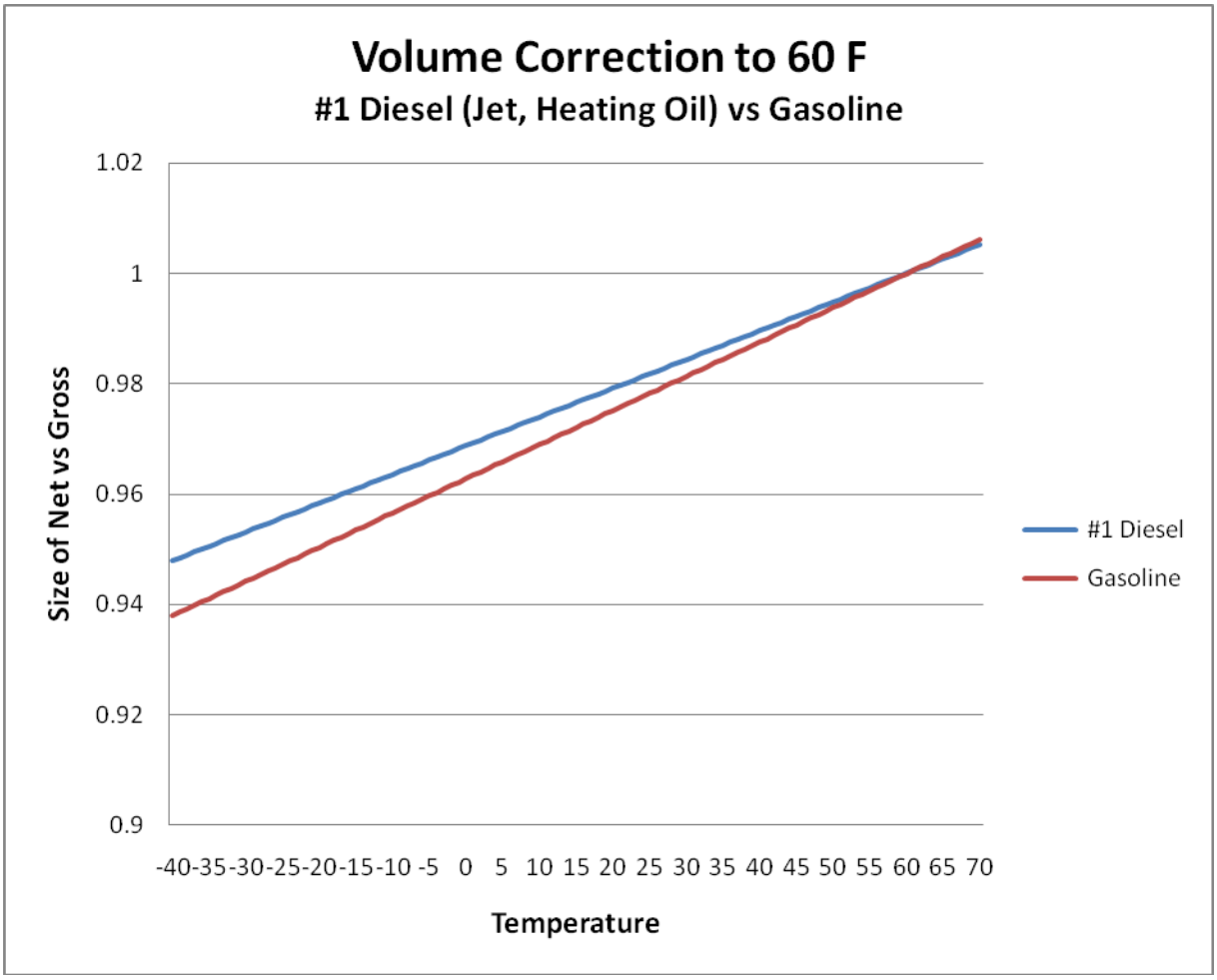


Figure 23

For any given "price per gallon" we can see what happens to the effective price on an equivalent basis when we change from gross to net gallons. This is more in line with the way consumers are shopping for something like fuel oil. They simply compare prices. It is the same information as in the previous figure, but consumers are confused by the difference between gross and net gallons. There is only one "gallon" in the minds of the vast majority of consumers.

In Figure 24 we show the effective price differential when switching between gross and net gallons in the case of diesel, or fuel oil. At sixty degrees the prices are the same. At about 41 degrees the net gallon is 1% more expensive. At 23 degrees it is about 2% more expensive. At 4 degrees it is 3% more expensive, etc. At the very lowest temperatures observed in the data set for fuel sales at the "rack" (-36.2 F) the difference is 5.3%. At the very highest temperature observed for fuel oil at the rack (83 F), net gallons are about 1.2% cheaper. In bush Alaska, sales metered from small above ground tanks can conceivably be as low as -40 F or lower, in which case the difference would be about 5.5% or more.

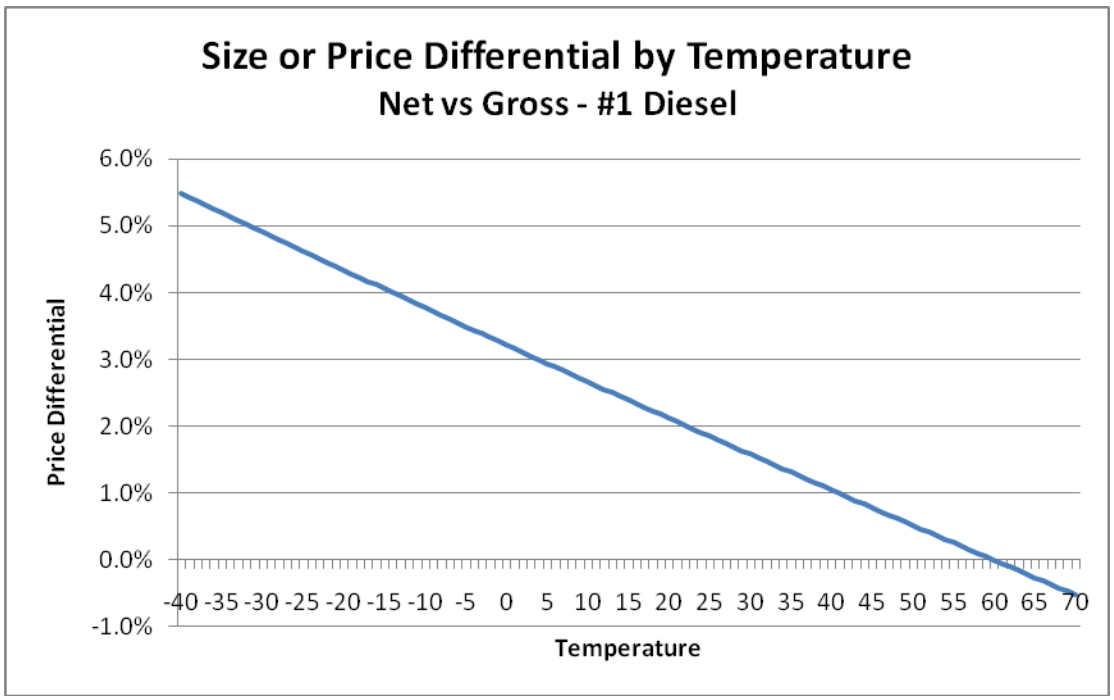

Size or Price Differential by Temperature
Net vs Gross - #1 Diesel
Price Differential
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
-1.0%
-40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70
Temperature

Figure 24

For gasoline, which responds more readily to temperature, the results are a little stronger, and are shown in Figure 25. By 44 degrees the price difference is 1%. By 27 degrees it is 2%. It reaches 3% at 12 degrees and 4% by -4 degrees. The lowest "rack" temperature observed was -34 F and at that temperature the difference was 5.8%. At forty below and colder, the difference is 6.2% or more.

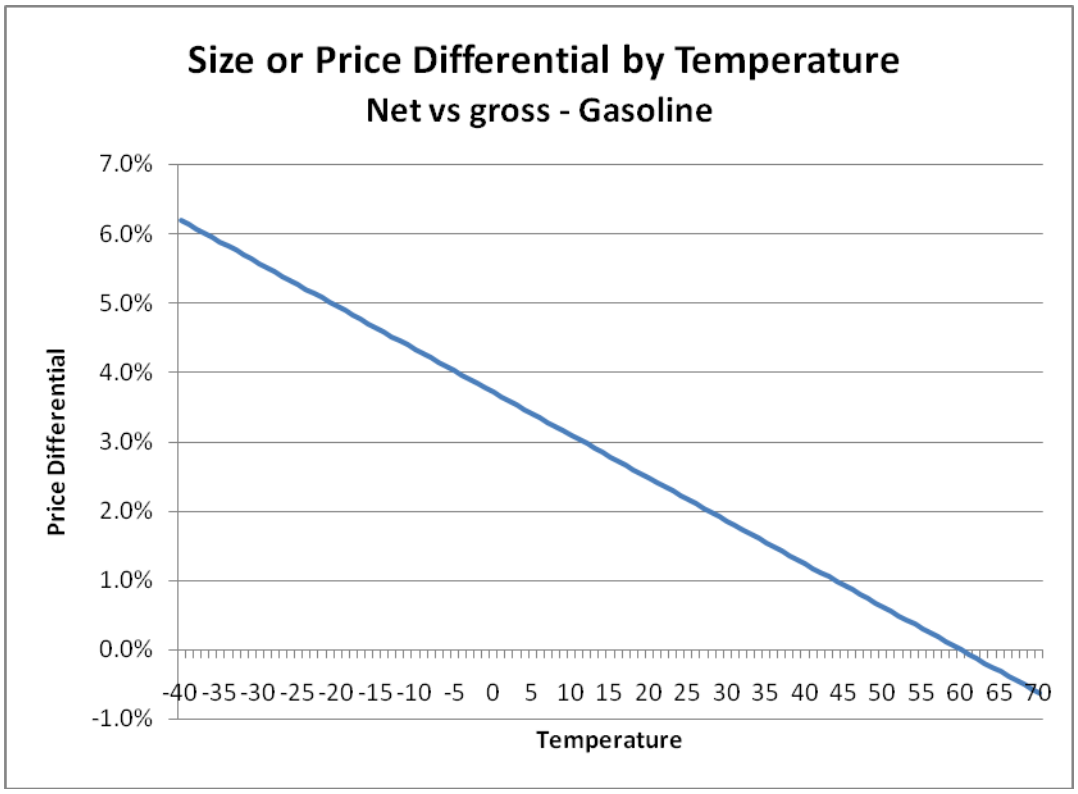


Figure 25

A retailer may look at this in a somewhat different way, but it is nevertheless the same proportion. Retailers are generally buying on a net basis at wholesale. If the temperature of the fuel is – 20 F when they purchase it and also – 20 F when they sell it, then there is a 5% difference between "gallons sold" (gross) and "gallons purchased" (net). Not because the temperature of the fuel has changed, but because the units of sale are different from the units of purchase.

With these kinds of differentials it is clearly a significant matter for both consumers and retailers. We do not have survey results for fuel oil distributors in Alaska, but the lessons from gasoline marketers nationwide is instructive. Convenience stores are the largest distributor of gasoline in the U.S. The National Association of Convenience Stores (NACS) in a 2008 survey found that 32% of consumers would go out of their way in some minor manner to save a penny a gallon,

and about a third would travel more than ten minutes out of their way to save three cents per gallon[51]. Price was the most important factor for 73% of respondents.

Retail margins on gasoline have been steadily declining over the last decade, and are around two cents per gallon in the 2008 National Association of Convenience Store survey.[52] So clearly even minor differences in temperature from the 60 F benchmark are going to be significant for retailing gasoline.

We do not have survey results for fuel oil firms in Alaska, and the most recent comprehensive study by ISER (2008) was incapable of identifying retail margins on fuel. In the case of convenience stores the profit on food and beverages sustains them in a manner allowing for intense fuel price competition. So the NACS data are not applicable.

Nevertheless a 1% difference in price at $2.50 a gallon is 2.5 cents – enough to make a $7.50 difference in a 300 gallon tank delivery. At a temperature of -20 F and at a price of $2.50 the difference is $32.50 in a 300 gallon fill-up. Fuel oil sales are primarily in the colder months so this is the kind of range that would be relevant.

In a survey of prices across six firms in Fairbanks on the same day of delivery on December 16 2008, the widest spread for five firms delivering net gallons was $2.28 to $2.32 for a 300 gallon delivery. The sixth firm had the lowest price overall ($2.22) and was also a firm delivering gross rather than net gallons.

With a normal average December temperature of -6 F, the price differential is 8.2 cents on net vs. gross gallons. The price differential for the firm selling gross gallons is actually about twice that suggested by the posted price differential. Clearly, the difference between gross and net gallon invoicing to consumers is at a level in Alaska that matters to a great number of consumers – if they know what the difference is between a net and gross gallon. But in surveying consumers, as is discussed elsewhere in the report, consumers are nearly universally ignorant about the difference.

Consumer Awareness, Product Labeling, Signage and Invoicing

Introduction

One of the issues brought up in the NCWM debates, and in studies pertaining to temperature compensation, is the matter of labeling and consumer awareness. At the crux of this issue is the desire to ensure consumers are making fully-informed decisions about purchases when comparing products across retailers. It is our opinion that this is the most important, yet least explored matter in temperature compensation of fuels.

This is not an ancillary topic, but rather absolutely essential in computing the costs and benefits of legal regimes. There are three possibilities: mandatory net, mandatory gross, and

[51] http://www.nacsonline.com/NACS/News/Campaigns/GasPrices_2008/Pages/TopEconomicConcern.aspx
[52] http://www.nacsonline.com/NACS/News/FactSheets/Pages/MotorFuels.aspx

permissive. The benefits and costs depend precisely upon the consumer's awareness about what is most essential to them: the cost per gallon when measured on an equivalent basis.

Elsewhere we have discussed that the most important issue to consumers in the selection of a retailer for a fuel transaction is price per (equivalent) gallon. The impetus for this study was the lack of transparency in price per equivalent unit. Ostensibly the motivation of labeling, signage, and invoicing requirements is to effect transparency and full information for consumers. The energies put into the matter seem to have lost focus due to the physics involved. The moment attention is diverted from what consumers want (price per equivalent gallon), the objective is lost.

Consumers do not desire to know how gasoline or fuel oil is produced. They do not desire to know whether the fuel came from barrels on the North Slope, from Cook Inlet, or were produced and refined from out of state. They do not need a physics lesson when they are purchasing milk, bread, or fuel. What they need to know is price per equivalent gallon. They need the capacity to make comparisons across suppliers on this basis. None of the suggestions we have seen in the literature and in the regulatory or statutory environment seem to retain focus on this point.

To be fair, in large degree this is because requiring a posting of prices on an equivalent basis means that either gross gallon retailers must compute net gallon prices, or else net gallon retailers must post gross gallon prices. But because temperature varies nearly continuously, either one necessitates nearly a real-time variation in product pricing and display. If this cannot be done, then it points to the necessity of a single standard, and that labeling or signage or invoicing are all really red herrings in the objective of informing consumers.

In the case of the California (2009) study, we find the technical problem associated with the permissive approach (pg 94):

> Any attempts to increase the level of information to include net and gross gallons would pose some difficult and problematic issues. Although the ATC retrofit kits possess electronics and software designed to monitor fuel temperature and adjust the volume dispensed to consumers, **there is no current capability for this system to convey the two different forms of measurement to the cash register or POS equipment**. It is possible that, over time, POS and ATC retrofit manufacturers could collaborate to enable this exchange of data, but the initial expense of this software and some electronic modifications is unknown.

This (price per equivalent gallon) is the only thing important to consumers – and it appears technically infeasible at present.

Existing Regulations Governing ATC in Canada and the NIST

In the case of Canada, it is a permissive regime. Retailers can dispense either gross or net gallons. Retail fuel dispensers have a label affixed: "Volume Corrected to 15^0 C". Receipts do not appear to have a requirement. Does this labeling provide anything that allows a consumer

to compare prices across retailers? The answer is that it clearly does not. Because even if the consumer is a petroleum engineer with a calculator, the information necessary to compare prices on an equivalent basis for a gross vs. net retailer is the temperature of the fuels along with a fuel expansion coefficient.

A reasonable guess can be formed when ambient temperatures are at either extreme highs or extreme lows, but even perfect knowledge of the fuel temperatures is insufficient to make the pricing calculation. We must also consider that the posted price visible from the road does not indicate whether or not the volume has been adjusted, the consumer making a decision to pull into a station for a purchase would need to know by experience, or guess, whether two particular retailers are dealing in gross or net gallons. In short, the Canadian requirement does not serve the ostensible objective: to effect transparency in pricing.

Note that if Canada had a mandatory ATC retailing regime, the label on the dispenser would be irrelevant. There is no price-discriminatory consumer information gained in posting. Likewise if the legal requirement is for gross gallon delivery – there is nothing gained by posting that either.

In the NIST Handbook 44, 2009 version, there are two pertinent requirements regarding signage, labeling or invoicing, and they pertain to vehicle tank meters:

> **S.5.6. Temperature Compensation for Refined Petroleum Products.** – If a device is equipped with an automatic temperature compensator, the primary indicating elements, recording elements, and recorded representations shall be clearly and conspicuously marked to show the volume delivered has been adjusted to the volume at 15 °C for liters or the volume at 60 °F for gallons and decimal subdivisions or fractional equivalents thereof.

> **UR.2.5.2. Invoices.** – An invoice based on a reading of a device that is equipped with an automatic temperature compensator shall show that the volume delivered has been adjusted to the volume at 15 °C for liters or the volume at 60 °F for gallons and decimal subdivisions or fractional equivalents thereof.

It is worth noting that for testing purposes there is a requirement that the retail device be able to show either gross or net readings, but not at the same time.

We have several observations regarding these requirements. First, consumers make their purchase decision for fuel oil based on a "price per gallon" quote *prior to invoicing*. For example, in the case of a home heating oil customer this is accomplished by phone. In the case of a school district or other large entity taking bids on a large delivery, it is based on the submitted bids.

Either way these NIST requirements provide nothing of value to the consumer. NERA conducted a survey of fuel oil retailers in December 2008 in Fairbanks. Of six retailers contacted, not one receptionist knew whether the firm sold gross or net gallons, and further inquiry with management was required to clarify. In one case, the telephone number was a cell phone exchange that reached a management level staff, and it was the only case the question

could be answered. Moreover, two of the receptionists volunteered that they had never heard the question before.

One of the alleged consumer benefits of temperature compensated gallons is that consumers are guaranteed the same energy content in every transaction. If that is a priority of consumers, then why has this question never been asked of a receptionist? Why is it that receptionists, whose primary responsibility is providing pricing information and arranging delivery, were not even aware their company was delivering net gallons? These are fair questions. Regardless of the answers though it is clear that the legal requirement for invoicing has had zero impact on the objective of price transparency.

A second small survey of consumers was conducted after newspaper, radio, and television coverage was conducted regarding this study. The coverage was in January and was not extensive, and the survey was conducted in March. Twenty random home fuel oil customers were reached. One question was asked, but phrased differently for two sets of ten respondents: did they know what the difference was between a gross and net gallon? Did they know what a temperature corrected gallon was? Not one in twenty knew. (One did guess that the answer had something to do with how much product is lost along the chain of production between bringing the oil out of the ground and final delivery of the refined product.)

Obviously these are very small samples, but there simply is no value in conducting large ones. It is of little value to determine precisely the amount of consumer ignorance – whether 80% or 90% or 99% – when we are dealing with such high proportions.

NERA also interviewed two smaller air services in Fairbanks in December of 2008 – Warbelow's and Guardian Flight. In the case of Warbelow's, the owner indicated that he had been "fooled for years" on gross vs. net gallon pricing, despite having received invoices labeled under the NIST requirements. In the case of Guardian, the chief of flight operations had never heard of gross vs. net gallons. If individuals who are professionals in the industry do not know the difference between gross and net gallons – when it is the largest single component of their operations costs – then the invoicing is obviously useless in conveying anything of value to the common consumer.

When NERA interviewed the Manager of Policy Development and Promotion at the Alberta Motor Association in December of 2008, it was clear that the net effect of temperature compensated metering was not understood. The impression was that through the year there was no difference on average between gross and net gallons. Here again, if a professional motoring consumer advocacy group does not correctly understand the differential between net and gross gallon content in a cold climate, then how can common consumers be expected to understand?

One of the more revealing sets of interviews NERA conducted in December of 2008 was with the Alaska Airmen's Association principals. Written comments to the State of Alaska by one of the fuel retailers had asserted that provision of net gallons to air customers was necessitated in order to properly compute weight and balance. Yet, these principals had never heard of a gross vs. net gallon. A notice was posted in their newsletter, which read in pertinent part:

> A study is being conducted on the effect of **Automated Temperature Compensating Devices** used for sale of refined petroleum retail products on all affected public entities. A public meeting is scheduled for January 12, 2009, Board Room, Dena'ina Convention Center, 600 West 7th Avenue, 2;00pm - 5:00pm. This is an independent study for the State of Alaska analyzing the cost and benefits of using gross gallon vs. a net gallon as the method of sale.

It was with some urging that NERA requested any language indicate directly that one "gallon" was generally smaller than the other, given Alaska temperatures. The response was that the Association had to be "careful" – that the primary fuel retailer was a corporate sponsor to the Airmen's Association. Furthermore, although a price survey appears on their website, no acknowledgement of the distinction between gross or net gallons is made.

The result of this newsletter announcement was one contact to NERA – from a fuel retailer. We could draw different conclusions from this result, but there really is only one reasonable one: no information of value is transmitted to consumers when we skip what is important to them: price per gallon. When we begin discussing fuel expansion, temperature compensation, net vs. gross gallons – we are immediately lost in a maze of trade terms, physics, and potentially obfuscatory red herrings that the consumer is not going to be capable of condensing into the one thing he needs: price per gallon.

The State of Alaska has also undertaken major fuel price studies, e.g. ISER(2008), without acknowledgement of the distinction between gross vs. net gallons. Here again we have professional researchers in arguably the premier social research organization for the State of Alaska that are unaware there are different retail gallons in Alaska. Yet size of gallon and price per gallon are exactly the same thing – for example a 2% smaller gallon vs. a 2% higher price.

NERA furthermore conducted interviews of two school district purchasing agents (Gateway, and Fairbanks North Star Borough School districts); neither of them knew the distinction between net and gross gallons or alternatively the temperature compensation of fuels. Bidding documents did not specify which gallons to deliver, and as a consequence the invoicing requirements have no effect on pricing transparency precisely where it actually matters: when comparing bids.

Conclusion

Enough surveying and interviewing was done to establish decisively that existing invoicing requirements and labeling of dispensers do not fulfill the objective of price transparency – not in Canada, and not in Alaska, where permissive regimes exist. In either case sales have been ongoing for more than ten years.

Moreover it is logically inescapable that current or major proposed regulations governing labeling, invoicing, or signage are irrelevant when there is a single standard either way: gross vs. net. It is true that under a gross gallon standard, there are variations in temperature and

therefore content from one retailer to another. But the extent of this variation has never been documented anywhere in a way that lends itself to cost-benefit analysis.

Generally speaking, in social policy it is unwise to adopt known costs when benefits are unclear. The burden of proof in accepting costs is that the expected benefits must be larger. The one thing that has been demonstrated unequivocally in the case of temperature correction for fuels is that the permissive regime introduces insurmountable problems in price transparency amongst retailers in a way that is absent in either mandatory approach.

Without an effective capacity to simultaneously translate gross prices into net, or vice versa across retailers, consumers gain almost nothing through labeling, signage, or invoicing requirements. Pricing information on an equivalent basis has to be determined *before the purchase decision has been made*. It is for this reason that the State of Alaska is taking the correct approach to a single standard regardless of what that standard is, when the objective is price transparency and equity across the marketplace.

Inventory Control

One of the advantages or rationales for temperature compensated sales posed by suppliers is the amelioration of inventory loss from fuel shrinking in the cold. It is quite true that shrinkage introduces a problem of inventory tracking for suppliers that requires they monitor the temperature of their stored fuels. In Alaska, there is a requirement for reporting monthly inventory of taxed fuels, and indeed these are purchased on a net gallon basis and invoiced on a gross gallon basis through retail devices at automotive gasoline stations. A specific line item for fuel loss from temperature changes is provided in these tax forms for suppliers tracking inventory by gross gallons.

It is easily shown that the method of invoicing customers and the inventory control problem are independent. Fuel shrinks in the cold regardless of how you invoice it. Whether inventory is kept by gross gallon, or inventory is kept by net gallon, exactly the same information is needed to perform inventory reconciliation – the volume and temperature of the fuel. It is true that there are some small efficiency gains in tracking every single sale on a net gallon basis.

But the claim that net gallon sales of fuel are required in order to solve an inventory loss problem has no more merit than claiming losses from handling, vaporization, and fuel sump draining require sales of smaller gallons. They are all problems, yes – but not ones that necessitate selling smaller gallons. The price of the fuel must incorporate all costs to the retailer, and these are just some of them.

So long as suppliers face the same ambient temperatures, they face the same potential losses while fuel is stored or transported. The key advantage to selling on a net gallon basis is realized when competitors are selling on a gross gallon basis. It isn't because fuel losses are minimized. This gain over competitors exists whether fuel expands, contracts, or stays at exactly the same

volume. The retailer selling the smaller volume gallon has the competitive edge in all three cases so long as the consumer does not know the difference.

It has been argued that although retailers can sell smaller volume gallons to rectify the problem of fuel shrinkage in the cold, charging a higher price is either not possible or will cost consumers too much. But isn't selling more, smaller gallons the same as selling less, larger gallons at a higher price? All gasoline stations in the United States, including Alaska, have these exact inventory control problems and incorporate losses (or gains) into their pricing structure, consciously or not, through market forces. If the aggregate quantity of fuel is reduced from shrinkage in a marketplace, the market price rises whether a specific retailer is consciously factoring this in or not.

In this section we investigate the accounting of inventory control along with profit and loss accounting. It is important to do this to demonstrate that buying and selling on the same unit basis is not necessary to properly control inventory.

Accounting of Inventory Control

There are many reasons to monitor inventory. It is an indispensable planning tool for management. Inventory control detects and prevents, or allows for mitigation of, losses from theft, spills, etc. Firms that pay motor fuel taxes in Alaska are required to produce a monthly inventory reconciliation on the Alaska Motor Fuel Tax Return.

In order to do inventory accurately the operation needs to be shut down while the inventory is taking place. Fuel cannot be flowing while an inventory is being conducted. For example, it may be a monthly exercise on a Sunday at midnight or some routine that does not interfere in normal operations.

Whether inventory control is for a gasoline station or a fuel oil retailer with a tank farm the accounting methodology is basically the same. The inventory reconciliation form from the motor fuel tax return is shown here for illustration:

	Inventory Reconciliation	Gallons
	1) Beginning Physical Inventory	
	2) Receipts	
	3) Disbursements	
	4) Gain (Loss)	
	5) Transfers	
	6) Ending Physical Inventory	

Figure 26

Essentially the inventory control in short form is:

Ending inventory = Beginning Inventory + net gain (loss)

Where items 2) through 5) above establish the net gain or loss in the case of a retail service station. One of the values of exploring this particular form is that retail gasoline stations in Alaska, as elsewhere in the U.S., are largely (but not exclusively) invoiced by suppliers on a net gallon basis, but retail on a gross gallon basis. To pose that this is an intractable problem when it is done monthly by every gasoline station in Alaska is untenable.

Receipts and disbursements are straightforward enough – and more will be said on them below. Losses occur during handling, transportation, and storage. The largest of these, according to the largest retail distributor of fuel in the state, is sump drain losses.[53] Transfers would be fuel acquired for one purpose but used for another (e.g. jet fuel sold as diesel). But one item in particular draws our attention, in 4, above: Gain (loss) that is specifically sanctioned by regulation:

15 AAC 40.310 (a)(5) “losses of volume due to temperature changes of fuel”.

Inventory can be calculated either way by a firm – gross or net. So long as both volume and temperature can be observed, all of the information necessary to make the calculation either way is known. Wholesale transactions are generally invoiced on a net basis, but both net and gross gallons are recorded with the transaction, so receipts are known either way. A retail service station can choose to enter inventory into its ledger as gross gallons, or as net gallons. But it makes no sense to enter receipts as net and disburse as gross or vice-versa. This was an important observation by Ross Anderson (2008, 2009) Director of Weights and Measures for the State of New York, along with retailers before the California Commission and in other hearings before Congress.

The context in which the comments arose is the near perennial accusation that service stations in warm states buy net gallons and sell gross as a means of profiting. Since warm states have temperatures greater than 60 F, the accusation amounts to saying gas stations are selling gallons that they did not purchase.

This is really a red herring in the first place, since it would be irrelevant whether gasoline stations did this or not. If someone is selling a product they obtained by gift, by discovery, or as manna from heaven it is their right to sell it at whatever the market will bear. But it is somewhat odd that the myth persists despite being relatively easy to disprove in the inventory control context. It is also worth demonstrating that it reflects a complete lack of understanding of how businesses work and how profit and loss accounting is performed.

The easiest way to show this is to begin with zero inventory, and have the firm sell all of its inventory. Assume a retail station receives inventory of 10,000 net gallons delivered at 93 F, so that the gross gallon delivery is 10,200. The temperature stays constant at 93 F throughout this exercise. Let’s just try to do the monthly inventory in accordance with the logic of the hot fuel inventory fraud myth:

[53] International Aviation Services at the Anchorage International Airport – nearly a billion gallons in 2008.

The Hot Fuel Inventory Fraud Myth		
Initial Inventory	0	
Receipts	10,000	gallons (net)
Disbursement	10,200	gallons (gross)
Ending Inventory	-200	

Figure 27

The firm enters into inventory the 10,000 net gallons as the theory goes, and then sells 10,200 gallons gross, also in accord with the theory. All of the fuel bought has been sold. There is no gain or loss of fuel. No spills, no transfers in. If we follow the logic through to its implied result, at the end of the month the firm reports a -200 gallon balance to the state tax authority. Now, consider that this is actually a cumulative phenomenon, occurring every month. Firms across the U.S. in "hot fuel" states ought to have inventory balances in the high billions of gallons (negative) by now.[54]

Obviously, this is an impossible situation and defeats the purpose of doing inventory control in the first place. The units of measure for receipts and disbursements must be the same. According to the testimony referred to above, gasoline stations under the jurisdiction of the respondents do inventory on a gross gallon basis, but it could also be accomplished on a net gallon basis.

An alternative but equally ridiculous story is that firms enter into their monthly accounting filings with state tax authorities a gain in inventory from the clever trick of "net in gross out" accounting. The problem with this story is that, as we just showed for the state of Alaska, it is permissible to enter gains or losses due to *temperature changes* – but there has been no temperature change. This is instead a change in the definition of units between lines in an accounting form for the same month, which is impermissible.

Profit and Loss Accounting

It is also worth dispensing with additional myths in this arena, pertaining to the way businesses do their accounting, and how inventory control is in reality separated from the accounting of profits and losses. When a retail firm receives a delivery of fuel it will have a truck manifest, and an invoice seen in simplified form on Figure 28.

[54] Because Mr. Anderson in his comments above to the California Commission did not work out an example, he deduced that "if retailers were buying net and selling gross they would be amassing surpluses." It was correct to deduce that inventory reconciliation would be a problem, but did not have the direction correct.

Truck Manifest		
Gross Gallons	Temp	Net Gallons
10,200	93 F	10,000

Invoice		
Net Gallons	Unit Price	Total Due
10,000	$2.00	$20,000

Figure 28

The firm knows what it has received in both gross and net delivery, but it is invoiced in net gallons. The firm has an accounting of all the costs that go into the sale of this fuel, and a simplified cost of goods sold is illustrated with a profit and loss statement here:

Cost of Goods Sold	
Fuel	$20,000
Labor	$5,000
Etc.	$2,000
Total	$27,000
# Units	10,200
Cost/unit	$2.65

Profit/Loss Statement	
Revenue (P = $2.75)	$28,050
Costs	$27,000
Gross Profit	$1,050
Taxes	$150
Net Profit	$900

Figure 29

The firm has paid $20,000 for the fuel it purchased, and has additional costs for labor and other items as shown. Total costs are $27,000. Since 10,200 units have been sold, the cost of goods sold is $2.65. The fact the firm bought on a net basis and sold on a gross basis is completely irrelevant to the cost of goods sold. The only thing that matters is the number of units sold and whatever expenses were incurred in achieving those sales.

In the profit/loss statement, we show a price per unit of $2.75, (which compares to a cost per unit of $2.65), and results in total revenues of $28,050. The total costs are again $27,000, resulting in a gross profit of $1050. After tax the firm shows a profit of $900.

There are some important lessons in showing this accounting, and it was something missing in the California study and in studies on hot fuel/cold fuel in general. The first is that there is a separation between the inventory control problem and the cost of goods sold, unit pricing, and profit/loss accounting. The hot fuel inventory fraud myth relies on an audience that understands neither inventory control nor basic accounting.

Firms in hot fuel states do not invoice customers in net gallons and do not temperature compensate gallons because it is less profitable to do so, but the inventory fraud myth misleads

us. In terms of inventory control, there is no benefit to invoicing in net gallons in a hot fuel state. Monthly reports are correctly filed with taxing authorities despite fuel being sold at temperatures significantly higher than the 60 F net gallon reference temperature they are invoiced at themselves.

In Alaska, the problem is the reverse, where fuel is colder than the 60 F standard. We can construct examples in the opposite direction that serve the same point. Let us consider a situation in which fuel is purchased at -20 F, but is invoiced to the retailer at the 60 F reference temperature. We are going to leave the fuel at -20 F throughout this discussion to clarify a point obfuscated by changing it. A simplified truck manifest and invoice is shown on Figure 30.

Truck Manifest		
Gross Gallons	Temp	Net Gallons
10,000	- 20 F	10,500

Invoice		
Net Gallons	Unit Price	Total Due
10,500	$2.00	$21,000

Figure 30

Observe again that the retailer knows both the net and gross gallon quantities of the fuel. It can enter into inventory either way. We recognize that there may be time enough for the fuel to have changed temperature between the loading rack at the refinery or tank farm and the time the full load of fuel is received. We will discuss that situation separately in order to clarify the difference between the reference temperature and the temperature of the fuel. If we tried to do inventory reconciliation with buying net and selling gross, then we would have something that looked like Figure 31 it were done incorrectly:

Cold Fuel Inventory - Incorrectly		
Initial Inventory	0	
Receipts	10,500	gallons (net)
Disbursement	10,000	gallons (gross)
Ending Inventory	500	

Figure 31

Of course, the firm cannot end up with 500 gallons of inventory if it has sold all of the fuel that it purchased, and it started with no fuel in the first place. So it has to do its inventory on either a net gallon basis or a gross gallon basis.[55] Moreover, this inventory can proceed on either basis

[55] The comment was made to the draft report that notwithstanding the accounting clarifications here, firms lost money by "buying net and selling gross. At the risk of being repetitive, this position requires nonsensical

without regard to how the firm is making its pricing and profit/loss accounting. That is, assume the firm has an ending inventory of zero in either net or gross gallons for simplicity, but it is selling its fuel on a gross gallon basis. (Because retail gasoline stations in Alaska sell on a gross gallon basis). The inventory statement will look like either of the tables in Figure 32:

Cold Fuel Inventory - Correctly (net)		
Initial Inventory	0	
Receipts	10,500	gallons (net)
Disbursement	10,500	gallons (net)
Ending Inventory	0	

Cold Fuel Inventory - Correctly (gross)		
Initial Inventory	0	
Receipts	10,000	gallons (gross)
Disbursement	10,000	gallons (gross)
Ending Inventory	0	

Figure 32

This is again fuel that was brought into inventory at -20 F. It is important to remember that the 60 F reference is not the temperature of the fuel. Inventory loss from fuel shrinkage has nothing to do with the reference temperature of the fuel. The reference temperature could be a thousand degrees and it is irrelevant to inventory loss. Since the fuel came in at -20 F and left at -20 F there has been no inventory loss.

In the next frames we show the cost of goods sold accounting. The fuel invoice is for $21,000, and is entered along with $5,000 labor and $2,000 in other costs as before. Total cost of goods sold is $28,000, and since 10,000 gross gallons are sold, it results in a unit cost of $2.80. It is irrelevant whether inventory was done on a gross or net basis for this accounting.

In the profit and loss accounting we show a unit price of $2.90, and thus total revenues of $29,000. With costs of $28,000, we have a gross profit of $1,000. Taxes are shown as $100, leaving a net profit of $100. Note that it is irrelevant that every customer at the gasoline station bought on a gross gallon basis, but inventory was done on a net gallon basis (or gross, as the case may be). The retail dispenser is metering in gross gallons and reporting to the cashier or internal accounting system the amount of the sale, and printing a receipt in gross gallons. But

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accounting. If this argument is to be made coherently it has to demonstrate its merit with a month-to-month inventory reconciliation example, as here.

the inventory tracking system is separate from the "point of sale" transaction data. Software can be acquired that can do either or both, but it is important to understand that the consumer invoicing and inventory tracking systems are not the same thing.

Cost of Goods Sold	
Fuel	$21,000
Labor	$5,000
Etc.	$2,000
Total	$28,000
# Units	10,000
cost/unit	$2.80

Profit/Loss Statement	
Revenue (P = $2.90)	$29,000
Costs	$28,000
Gross Profit	$1,000
Taxes	$100
Net Profit	$900

Figure 33

We are about to close in now on what is an advantage to selling net gallons. The advantage is in a market where some firms are selling gross and other firms are selling net – and consumers do not know the difference. So assume now that the price is still $2.90 but the firm is now selling 10,500 net gallons instead of 10,000 gross gallons. The cost of goods sold is the same. The inventory reconciliation is the same. It is irrelevant whether inventory is kept in gross or net gallons. But now revenue is $30,450 instead of $29,000. Profits are $2,350 instead of $900.

Clearly, selling smaller gallons when your competitors are selling larger gallons results in an extra profit margin that has nothing to do with stemming losses from fuel shrinking in the cold. This is not to imply inventory loss doesn't happen. Rather, it is to demonstrate that there is a conflation of two separate advantages to selling net gallons – and the temperature data from Flint Hills makes clear that fuel is loaded at the rack at temperatures far below the reference standard. It is irrelevant that you "bought" the fuel at a reference temperature of 60 F. That does not mean one has purchased warm fuel and sold cold fuel.

Cost of Goods Sold	
Fuel	$21,000
Labor	$5,000
Etc.	$2,000
Total	$28,000
# Units	10,000
cost/unit	$2.80

Profit/Loss Statement	
Revenue (P = $2.90)	$30,450
Costs	$28,000
Gross Profit	$2,450
Taxes	$100
Net Profit	$2,350

Figure 34

Real Inventory Losses from Temperature Changes

We have glossed over in this example what happens when fuel temperatures *change* over the course of purchase and delivery. But it was important to first dispense with any confusion over inventory losses being associated with the reference temperature of 60 F. Inventory "losses" occur in one situation only: when inventory is kept on a gross gallon basis and the fuel has cooled while it is in inventory.

The most radical changes that will occur in temperature for a retailer purchasing wholesale in Alaska are in three different potential situations. One is when fuel is transported over a long distance and conditions change in the interim, such as a barge loading fuel in Washington State and then delivering in Unalaska – or a barge loading at the Nikiski refinery before it has adjusted to ambient completely and delivering to a remote location such as Bethel many days later.

Another is when there is a short lead time between a refinery run and rack loading in the extreme cold of the winter. There can be a seventy degree difference between minimum and maximum loading temperatures in February at the Flint Hills North Pole rack, given the right combination of lead time and ambient temperatures. The last situation is when, regardless of source, fuel in a remote location such as Kotzebue, Bethel, Ft. Yukon, etc. is delivered in the short barge season and stored for the entire winter at a tank farm.

In a study of barge service from Anchorage vs. Washington State, NERA (2006) gave distances, barge speeds, and travel time estimates. The distance between Anchorage and False Pass is 688 nautical miles (NM), while the distance between Seattle and False Pass across the Gulf of Alaska is 1,643 nautical miles. At a barge speed of 8 NM per hour, the minimum conceivable time just for this leg of the journey is either four days or nine days with no additional stops[56]. This is plenty of time for fuel to change temperature in a significant way.

But the fuel can be entered into inventory on either a gross or net basis at the time of offloading or at the time of the next inventory reconciliation. All that is necessary to know is the

[56] One of the notable observations in that report is that barge costs are about the same between a place such as Unalaska and Seattle vs. Unalaska and Cook Inlet, despite the difference in distance and time. The deciding factor is not shipping costs, but rather the price of fuel.

temperature of the fuel placed into inventory. In some states this is actually done as fuel is received. In others it is done at the next regular inventory accounting.

Temperature changes in fuel stored above-ground over the course of the long winter months are potentially very significant as we have seen in our temperature study (Appendix 1). This is the worst case scenario insofar as cooling and inventory losses, so we will construct an extreme example for illustration. Suppose a fuel vendor purchases fuel on a net gallon basis, but from a refinery such as Nikiski at 80 F. The fuel is sent in a company barge to Kotzebue or some distant place where it cools to -40 F in the winter.

In our example to simplify things we will have a 10,000 gallon load that is purchased and none of it is sold the entire time it is in inventory. It is simply stored and an inventory reconciliation is performed. (In reality, the inventory reconciliation would be performed multiple times and the numbers would not be so extreme, but we wish to make a point by having the example be a worst-case scenario.) Regardless of whether we are keeping inventory on a net basis or a gross basis, we need to know the temperature of the fuel or we cannot perform an inventory reconciliation either way. The following information is based on the Coefficient of Expansion 0.00052 for #1 heating oil:

Temperature	Net	Gross
80 F	10,000	10,104
-40 F	10,000	9,450

Figure 35

If the inventory is kept in net gallons, what is the inventory loss? The answer is zero. If the inventory is kept in gross gallons, then what is the inventory loss? The answer is 554 gallons. Both methods of inventory reconciliation are shown below. Exactly the same information is required to do either one of them. A temperature reading and a volume reading on the tank level:

Inventory Reconciliation (net)	
Beginning Inventory	10,000
Receipts	0
Disbursements	0
Inventory Loss	0
Ending Inventory	10,000

Inventory Reconciliation (gross)	
Beginning Inventory	10,104
Receipts	0
Disbursements	0
Inventory Loss	-554
Ending Inventory	9,450

Figure 36

Does it matter what the units of sale are? No. There have been no sales. The inventory loss is strictly due to the manner in which inventory is being kept. That may seem counterintuitive, which is why it is so important to work through these examples. We are on the cusp now of

making a very important observation about the equivalency of either adjusting price or the units of sale to result in exactly the same outcome.

Assume now for simplicity the entire load of fuel is sold to one customer. This is not necessary for any purpose but making the math easier. It could just as easily be ten thousand customers getting a gallon each. Let us also assume that regardless of how we invoice that the fair return on our purchase requires $30,000 in revenue from the customer. It is exactly the same load of fuel, at exactly the same temperature, so either of two manners is exactly equivalent:

	Gallons	Price	Invoice
Net	10,000	$3.00	$30,000
Gross	9,450	$3.17	$30,000

Figure 37

If we are invoicing in gross gallons then the price has to be $3.17. If we are invoicing in net gallons the price is $3.00. It cannot be argued that the firm can sell smaller gallons at a lower price, but it cannot sell larger gallons at a higher price. This is exactly the same load of fuel – the same volume, the same temperature, and the same invoice regardless of which way it is handled. It is the same information required to do either transaction.

Finally, it doesn't matter how inventory is kept. It can be kept in net gallons and the sales transacted in gross. It can be kept in gross gallons and the sale transacted in net. What is important either way is that the firm keep track of both inventory temperature and tank level. Approved Alaska Division of Environmental Conservation (DEC) automatic tank gauging systems can provide daily reports with the necessary information, or for that matter manual tank gauging can as well.

Summary

To summarize, the inventory control and invoicing or financial accounting systems are separate concerns. Inventory must be performed either one way or the other, but the fact inventory is kept one way does not interfere in invoicing and financial accounting in the other. There is a myth or hoax that has been propagated in "hot fuel" states that pretends firms are capable of creating inventory out of accounting trickery and profiting from it.

There is somewhat of a corollary in cold fuel states. It is quite true that fuel is much colder in Alaska than the 60 F benchmark. But this does not mean firms are buying fuel at 60 F and selling at -20 F. Secondly, inventory "loss" only occurs by definition when fuel cools while in inventory, and when inventory is kept in a gross gallon basis.

Firms lose inventory from draining sumps, from vapor loss, spillage, or other reasons. These are costs of doing business in much the same way hiring labor is. Firms do not, however, compensate for these losses by selling smaller gallons. While we do not minimize the problem of fuel loss from cooling while in inventory, selling smaller gallons is not necessary to

compensate for those losses either. We need to point out the equivalency between compensating by selling smaller gallons and raising price.

What advantage is there to doing one vs. the other? The answer is that there is only a potential advantage when some firms are invoicing net and some are invoicing gross – and consumers are ignorant about the difference. Clearly, a fully aware consumer can see the equivalency between the two. It is $30,000 for the same load of fuel at the same temperature and therefore they are equivalent.

When consumers do not know the difference between net and gross gallons, then the advantage goes to the person who is selling smaller gallons. In a cold fuel state that would be net gallons. But it is not because invoicing by net gallons makes up for inventory loss. It is because selling a smaller gallon gives rise to a competitive margin no matter what the temperature of the fuel is. It is for the same reason a gross gallon is preferable to the retailer in a warm fuel state. It is the smaller gallon.

Tax Implications of Gross vs. Net Gallons

Taxes on fuels in Alaska are levied on "gallons" without regard to gross vs. net definitions. Chapter 43.40 (Motor Fuel Tax) of the Alaska Statutes sets forth taxes by type of fuel. If we change the method of sale from one to the other, then the number of total gallons sold changes. Metering by net gallon results in a larger number of gallons when the average temperature is less than 60F. So the amount of tax revenues for the State of Alaska increases when gallons are metered on a net basis.

The amount of the differential depends on season, but we will work with averages just to have a rough idea of the magnitudes involved. Figure 38 reproduces data from the 2008 Annual Report, Division of Tax.[57] The table begins with the relevant tax rate, and the number of gallons subject to each tax. Temperature differentials were calculated relative to the 60F benchmark. Fuels sold from underground tanks are on average warmer, and for highway fuels the data from the NIST survey was used. For the remainder, Anchorage and Fairbanks rack temperatures were averaged from the Flint Hills data base.

[57] Pg 47 and pg 49. Note that the amount of taxes collected are in reality slightly different from the number of gallons times the tax rates. This is because refunds from a previous period are being received as taxes are remitted for a current period.

Tax Differentials: Gross vs Net Gallons

	Tax Rate	Gallons	Avg Temp Differential	Avg Volume Differential	Revenue Differential
Highway	$0.08	369,568,110	13	0.00775	$229,132
Marine	$0.05	115,536,050	22	0.013933333	$80,490
Aviation Gas	$0.05	14,822,878	22	0.013933333	$9,707
Jet Fuel	$0.03	142,874,628	21	0.008400	$38,405
				Total	$357,734

Figure 38

Volume differences were then calculated using specific gravity of 0.893 for fuel oil/jet fuel, and 0.739 for gasoline. In the case of highway fuels these were averaged. Revenue differentials are then calculated based on multiplying three things: tax rate, gallons, and volume differential coefficient. The resulting revenue differentials are found in the last column.

The differentials are not that significant, totaling $357,734. Highway fuels comprise the largest component at $229,132. Marine fuels follow at $80,490, then jet fuel at $38,405. Aviation gas is a very small differential at $9,707. Revenue differentials are not a significant factor in the method of sale decision. (At present with the tax holiday on fuels, it is actually irrelevant altogether, but this is a temporary situation.)

Economics of ATC Devices for the Individual Firm

The economics of ATC devices are compelling for the individual firm. It is central to the analysis below that consumers do not know the difference between a gross and a net gallon. A simple question is asked: If an ATC device is installed at $7500 for this illustration, how many gallons must be sold in order for the device to pay for itself. (The break-even quantity.)

The break-even point depends on two factors: the price of fuel and the difference between net and gross gallons. In the illustration below there are two scenarios – one in which the volume difference is 1% and the other at 2%. The prices range from $1.00 to $4.00 per gallon in each scenario.

One can see with $4.00 per gallon fuel and a 2% smaller net gallon, an ATC device pays for itself with only 100,000 gallons. On the other hand, at $1.00 per gallon fuel and a 1% volume difference, an ATC device takes 500,000 gallons to pay for itself.

There are a number of reasons to illustrate this payback. First, the economics are so compelling at high prices of fuel and in temperature extremes like Alaska – firms “cannot afford

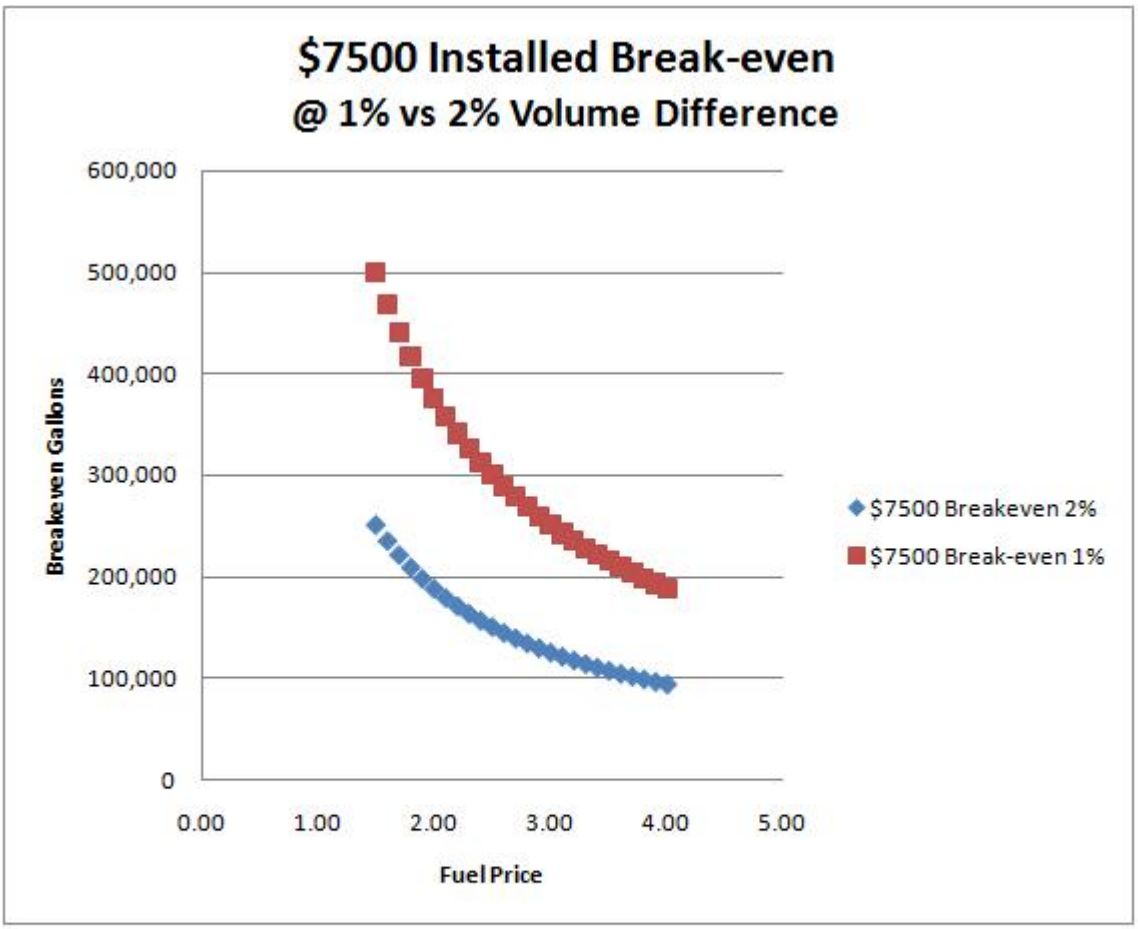
not to do it" as it has been put in comments to this study. We agree. It has never been a question of whether firms that install them can show they pay for themselves. They clearly do.

There are a couple of problems with using this firm perspective to decide on social policy. First, selling a smaller gallon is the same thing as charging a higher price, but the consumer is incapable of recognizing that. Because he doesn't know it is a smaller gallon. It is not considered a "consumer benefit" when he is charged a higher price without realizing it.

But also what is true for one firm acting individually is not necessarily true for all firms acting collectively. Above we are asking what happens if one firm sells a smaller gallon, all else the same. It is better for the firm according to a degree set forth in the diagram. But if all firms simultaneously sell a smaller gallon then whatever individual benefits there might have been are completely eradicated by market price adjusting accordingly.

We are simply asking the reverse situation now as compared with a hot state. If Alaska suppliers all sell a gallon half as large tomorrow, what will the price be? The answer is of course twice as much. But in this case we have a higher cost now added on to the product as well.

The break-even diagram also gives a good indication of whether the three-year phase-out of permissive ATC in Alaska's initial regulation prohibiting ATC was sufficient to allow for cost recovery. It appears to have been so.



At $4.00 a gallon a brand new temperature compensating vehicle tank meter of 1.5 inches, 60 gpm, will pay for itself at 100,000 gallons when the volume difference is 2%. But at $1.50 fuel and 1% volume difference, it would take 500,000 gallons to pay for itself.

Figure 39 – Breakeven for ATC Devices

Price Rigidity in Remote Barge Communities

Comment was made to the draft report that the remote and risky conditions of barge communities in Alaska deserved particular attention as it pertains to ATC. We observe first that in such a community there is a strong expectation that after the last barge of the season, the price will remain the same until the next barge season. (This period is roughly October through May in Western Alaska)

We accept that as a feature of Alaskan communities with one additional observation: We have to allow that fly-in fuel is available year-round. Although it is more expensive than barging in large quantities generally, under the right conditions flown fuel can be competitive. If wholesale prices drop significantly, fuel flown in December can undercut barged fuel that was stored in September.

In addition when a village really does find itself with a fuel shortage, when the barged fuel will be completely exhausted before break-up, more expensive fuel can be flown in. It is not that the village will have no fuel at all – just very expensive fuel compared to what was sold by barge distributors.

Having said that, a fuel retailer is faced with the following planning problem: there are a number of costs that must be covered through the season. This would include expected loss of every type – fuel handling, sumpage, shrinkage or vapor loss, theft, spills, etc.

The argument goes that a conservative position to take if expected shrinkage is being factored in is to assume a somewhat worse than average amount of shrinkage. So if the average shrinkage from the fuel cooling is 2%, then assume somewhat more than 2%. This results in "over-charging" for shrinkage due to uncertainty under gross gallon sales.

First of all with respect to the value of ATC devices in remote barge areas, note that retail fuel in such communities is at the expensive end of the spectrum. Regardless of the amount of shrinkage, an ATC device pays more quickly wherever price is high. On the other hand it is also more expensive to ship, install and maintain an ATC device in remote Alaska communities.

In the months of October through May we have of course the colder months of the year so the difference between the gross and net gallon is widest. We have a recipe for strong ATC economics as shown in figure 39, despite high installation costs, all things considered. (High prices and large difference between gross and net gallons makes up for higher installation costs). It is easy to see where a 20 cent per gallon margin (or more) to net gallons vs. gross gallons is possible. That is quite a lot in an industry relying on small margins.

Industry officials suggesting the argument did not give examples of what kind of price premium they were expecting to obviate with ATC. It certainly cannot be much relative to the main

benefit of selling the smaller gallon. ATC fuel at zero degrees has a 4% size margin advantage over gross gallons. At $7 per gallon the difference is 28 cents per gallon.

We point out that individual retailers do not set the market price. A firm cannot arbitrarily decide to be super-conservative and charge a high price in an environment where other firms are not. If ATC eliminates a risk it has to be something the market is doing as an equilibrium result as opposed to a firm "deciding" what his price will be. Perhaps so. But clearly the main motivation is the profitability of net gallons vis-à-vis gross gallons where consumers are ignorant to the difference.

Bush Alaska is where fuel is the most expensive to transport and where volumes are small. It is where installation of ATC is most costly. We have already observed that ATC devices can be individually profitable (meaning profits of the firm are higher with one than without one) but socially inefficient.

The first conversions to ATC earn a return from a margin gained against its competition not using them. That is true whether it is a Fairbanks heating oil delivery truck one in Unalaska. The last to convert is compelled to because everyone else in the industry is doing it to his disadvantage. Once ATC is universal the playing field is again level and the price is the same with the exception being the cost of the devices where ATC is sold. The consumer will bear that cost.

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Victoria Office of Regulation Reform *Regulatory Impact Statement: Temperature Compensation of Petrol and Diesel Fuel* Victoria 2001.

Appendix 1

Temperature Data Analysis for Refineries, Tank Farms and Underground Tanks PLEASE REFER TO FILE Appendix 1 Alaska Fuel Metering Project

Appendix 2

Benefits Computations for ATC Regulatory Regimes PLEASE REFER TO FILE Appendix 2 Alaska Fuel Metering Project

Appendix 3

Estimated Fuel Use for Heating and Electricity Production PLEASE REFER TO FILE Appendix 3 Alaska Fuel Metering Project

Appendix C
Method of Sale Regulation:
Automatic Temperature Compensation – Letters
(Items 232-1 and 232-2)

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Overview of Alaska's Permissive ATC State

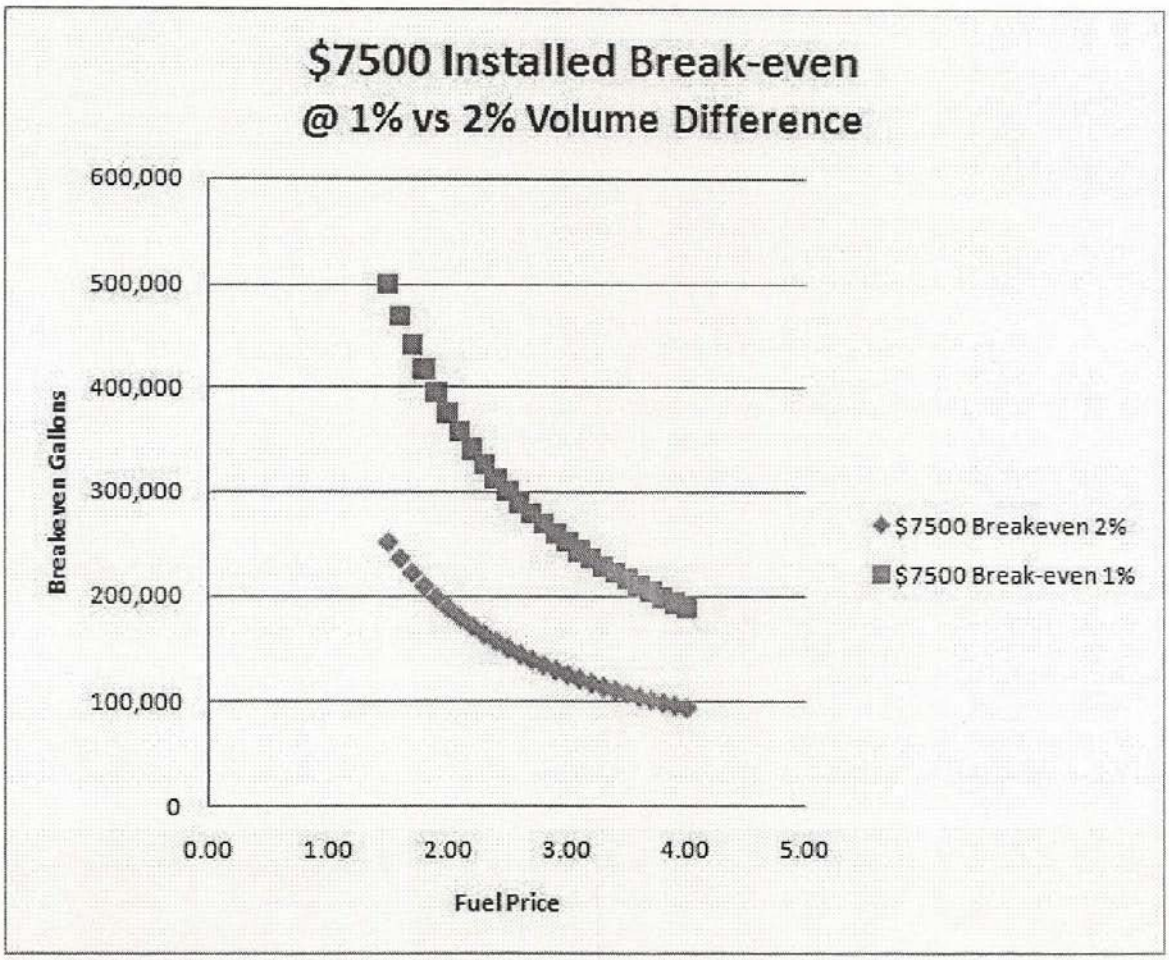
For vehicle tank meters, Automatic Temperature Compensation (ATC) is permissive in Alaska. This is not so for devices dispensing motor fuels, as there remains no national approval. Alaska, like many states, adopts the National Institute of Standards and Technology (NIST) Handbook 44 as law unless contrary regulations are established. There are no contrary regulations in Alaska on ATC so Handbook 44 is state law with respect to ATC. In 2008 regulation that effectively eliminated ATC at retail was proposed and led to this independent study.

The debate over ATC at retail has largely been about which standard should prevail based on equity and transparency. The National Conference on Weights and Measures (NCWM) has not taken a position "pro" or "con" except to say that if ATC is adopted it should be mandatory and with a reasonable transition period. Alaska's concern is that it has, and remains in a continuous state of permissive status in the vehicle tank meter market.

ATC Devices are Economic in Alaska

The economics of ATC devices in Alaska are compelling and are the greatest incentive to use them. Alaska is an extreme cold state. As a practical matter, net gallons are smaller than gross gallons, as will be demonstrated.

In high-volume, high priced markets one "can't afford not to" install ATC technology, as it has been aptly put by industry representatives. In figure 39 of page 92 the report uses an example of a $7500 installation on a fuel truck with retail fuel prices ranging from $1.50 per gallon to $4.00 per gallon. The break-even quantity of fuel (necessary to have the ATC device to pay for itself) is shown for a 1% vs. 2% volume difference net vs. gross.



At $4.00 a gallon a brand new temperature compensating vehicle tank meter of 1.5 inches, 60 gpm, will pay for itself at 100,000 gallons when the volume difference is 2%. But at $1.50 fuel and 1% volume difference, it would take 500,000 gallons to pay for itself.

Figure 39 – Breakeven for ATC Devices

$4.00 fuel and 2% volumetric difference, ATC pays for itself in 100,000 gallons. One
s to pose an extreme situation – such as $1.50 fuel and 1% volumetric difference to
ıke ATC start to look less attractive. If we double installation costs in consideration of
emote application of new equipment then reasonable price and volume scenarios
tainly still justify the expense.

Consumer Ignorance

The study conducted two small surveys that were conclusive in addition to a number of revealing interviews in the course of the study. In one small survey of 20 random home heating oil customers, not one in that twenty was familiar with net gallons. There is no point in a larger survey with a response this overwhelming. Consumers are ignorant and there is no question about that. The survey was conducted after media coverage of the study.

The second survey was earlier, prior to any media coverage. Home heating oil retailers were surveyed in exactly this manner: Firms were called to establish the price per gallon for deliveries on that day. After the price quote was given the respondent was asked which gallon was being delivered – gross vs. net – and none knew the answer save one. In that case the call was to a cell phone operated by the owner/driver dispensing the fuel. The most common response by the position assigned to quote prices was that they had never heard the question before.

In interviews with numerous people who "ought to know" – an owner of a regional airline, the chief of flight operations for another, purchasing agents for school districts, etc. – they had either gone years before discovering the difference despite seeing delivery tickets or invoices - or still did not know the difference.

So there is a lack of transparency in pricing that gives the competitive advantage to the net gallon because it is smaller. It has been suggested that it is inflammatory to use the term "smaller", but that is exactly why the ATC math "works" as illustrated in figure 39.

There are no intentions of suggesting impropriety or nefarious motives on the part of those who have a rightful property interest in the ATC devices purchased. They have also offered other reasons they have an incentive to invest in them: greater accuracy in tracking inventory for example.

But in the long run just as with Canada the advantage to ATC will prevail and the industry will adopt it universally wherever it pays for itself. Product labeling thus far has failed to convey to consumers what net gallons are because the concept itself is far too complex to convey in a label. "Volume corrected to 15^{0}C" appears on Canadian motor fuel dispensers. But explaining what that means requires a baffling discussion of fuel-expansion physics.

Net vs. Gross Volumes in Alaska

In the analysis of temperature data collected by the study it is clear how quickly fuel adjusts to ambient air temperatures. We reproduce figure 10 from page 21 of the temperature study appendix first to show how closely fuel temperatures follow ambient once distant from the refinery. The data is from the Anchorage truck rack for the Flint Hills refinery. The truck rack is located several hundred miles by rail from the North Pole refining facility. All retail fuel in the major population center of Alaska must be transported from refineries distant from Anchorage by barge, railroad, truck, or pipeline.

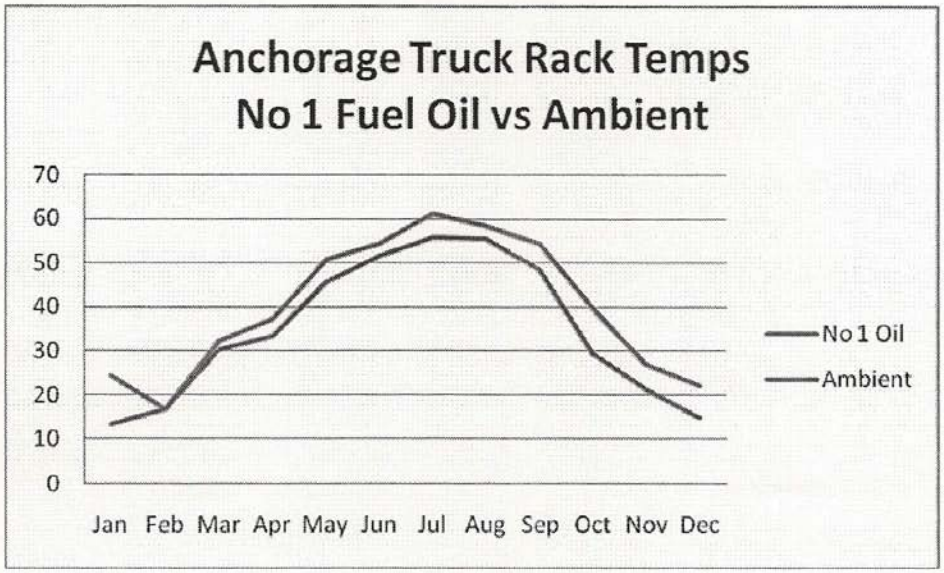


Figure 10: Anchorage Truck Rack Temperatures - No 1 vs. Ambient

It is quite clear from this diagram that in such a circumstance the difference in volumes of delivered fuels for retailers under either a mandatory gross or net standard will be far less than the variation between retailers under a permissive standard with some delivering gross and some delivering net.

Delivering ATC fuel is equivalent to delivering gross gallons at 60 degrees. So if one puts it in these terms it is equivalent to one retailer delivering fuel thirty or forty degrees warmer than another for about half the year at this location.

Stored fuel will not match ambient on a real-time basis. The speed of adjustment depends on a lot of factors. But generally speaking a below-ground tank is following a monthly average cycle and above-ground a weekly average cycle. Below ground tank cycles are more moderated compared with above-ground.

Under a gross gallon standard the largest potential differences between retail suppl distant from refineries in Alaska would depend on the method of storage – above vs below ground. But retailers generally store their fuel in the same way. One can propose a maximum difference between two fuel oil retailers based on one having left overnight in a delivery truck parked outside vs. one parked inside. But the great bulk of deliveries are occurring the same way between retailers similarly situated.

Fuel temperatures at the refinery tell a similar but more complicated story. We reproduce minimum, maximum, and average ambient vs. fuel temperatures below the Flint Hills refinery North Pole truck rack facility.

One can see fuel temperatures at the rack in the -20 F to – 30 F ranges, as with the lowest ambient temperatures. But the maximum truck rack temperatures are much greater than maximum ambient in the deepest winter months. So clearly, recent refinery runs placed into storage are much warmer than ambient in those months.

This is at least one step removed from retail. If you ask what is the maximum potentia difference between one retailer and another on any given day in the vehicle tank meter market, it will be in the coldest months. When one retailer is taking delivery of warm refinery run and another is closer to ambient. But whatever that difference is, much less than the difference between a net gallon and gross gallon retailer can be the same winter day.

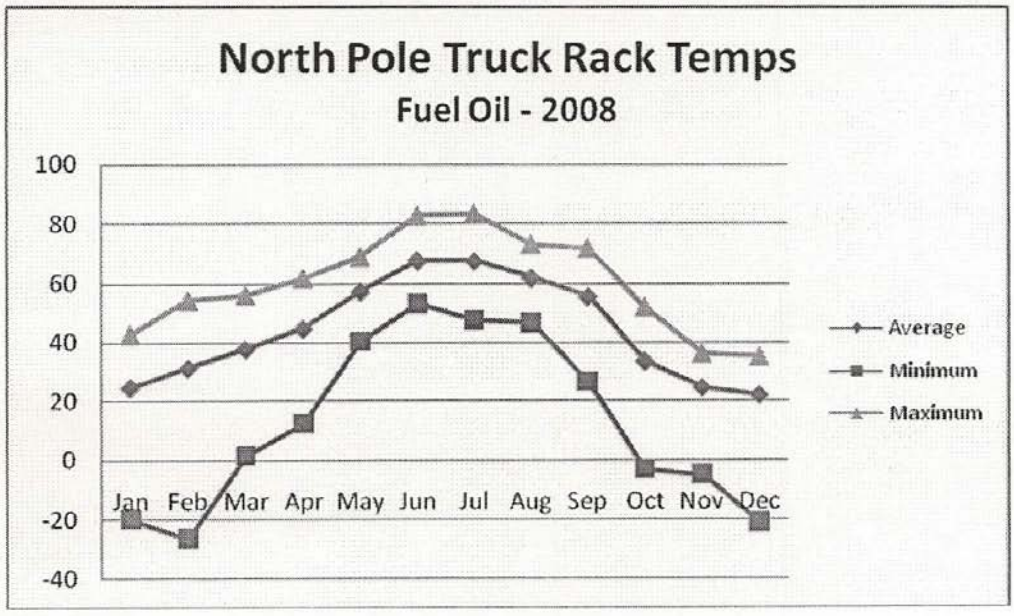


Figure 2: North Pole Truck Rack Temperatures - No. 1 Fuel Oil

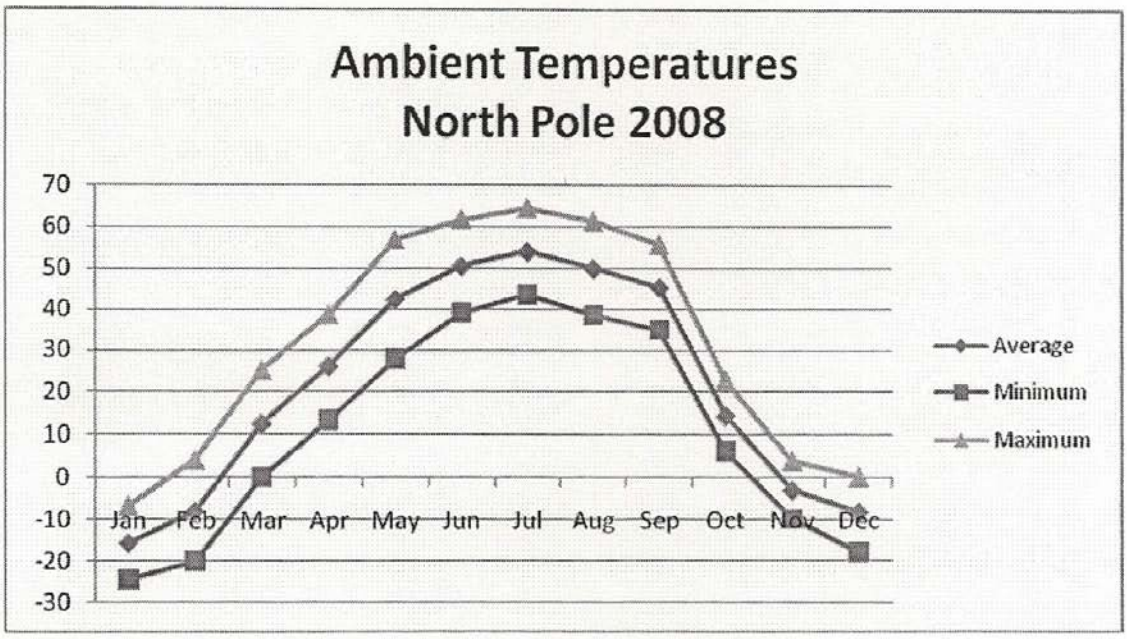


Figure 3: Ambient Air Temperatures: North Pole

temperature extremes in Alaska make for considerable difference between net vs. ss gallon volumes. Figures 24 and 25 from pages 71 and 72 of the report are shown e. Differences of around 5% or 6% are possible for the case of fuel oil vs. gasoline. charts have "price differential" on the vertical axis. That is, two suppliers quoting same "price per gallon" are actually 5%-6% different on an equivalent basis if one is oting net and the other is quoting gross. That is a reasonable worst case scenario

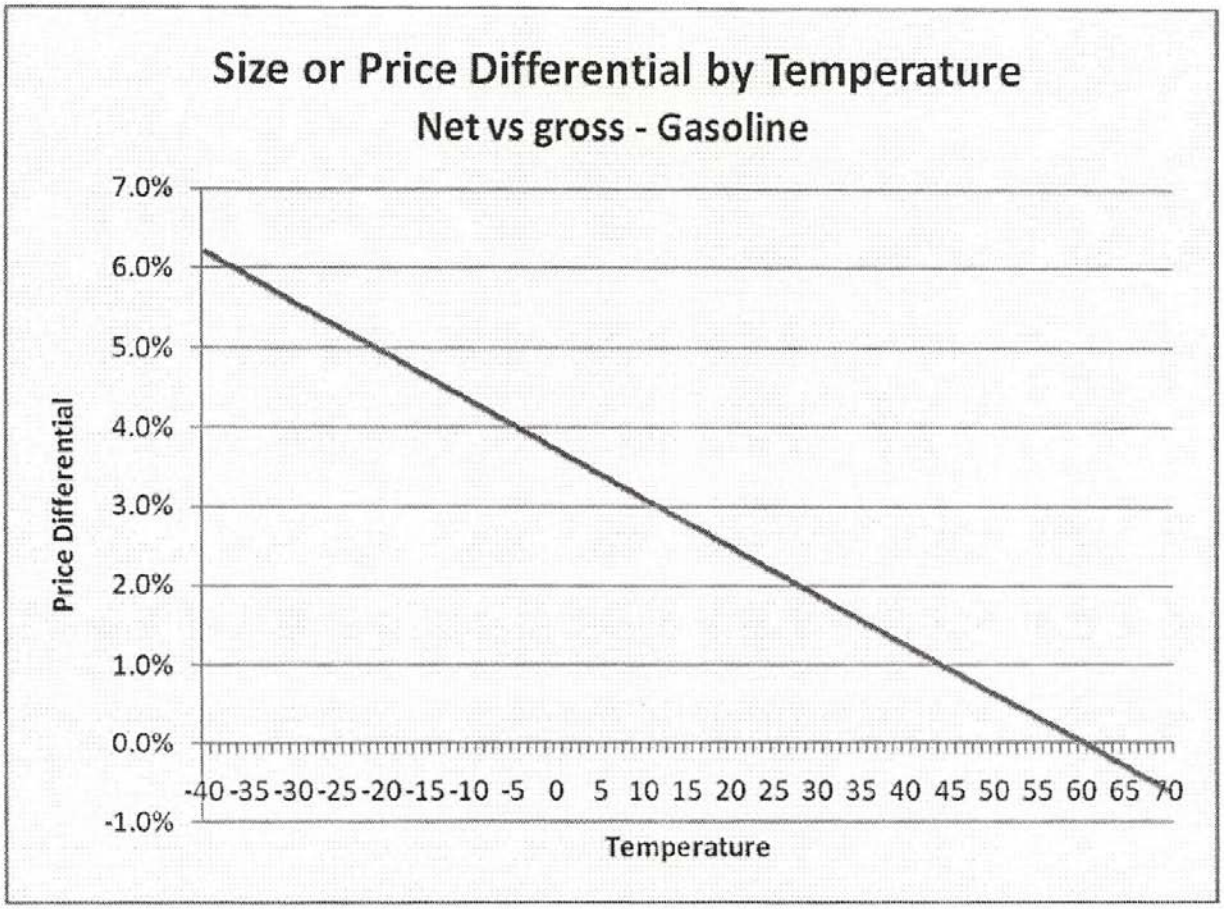

Size or Price Differential by Temperature
Net vs gross - Gasoline
Price Differential
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
-1.0%
-40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70
Temperature

Figure 4

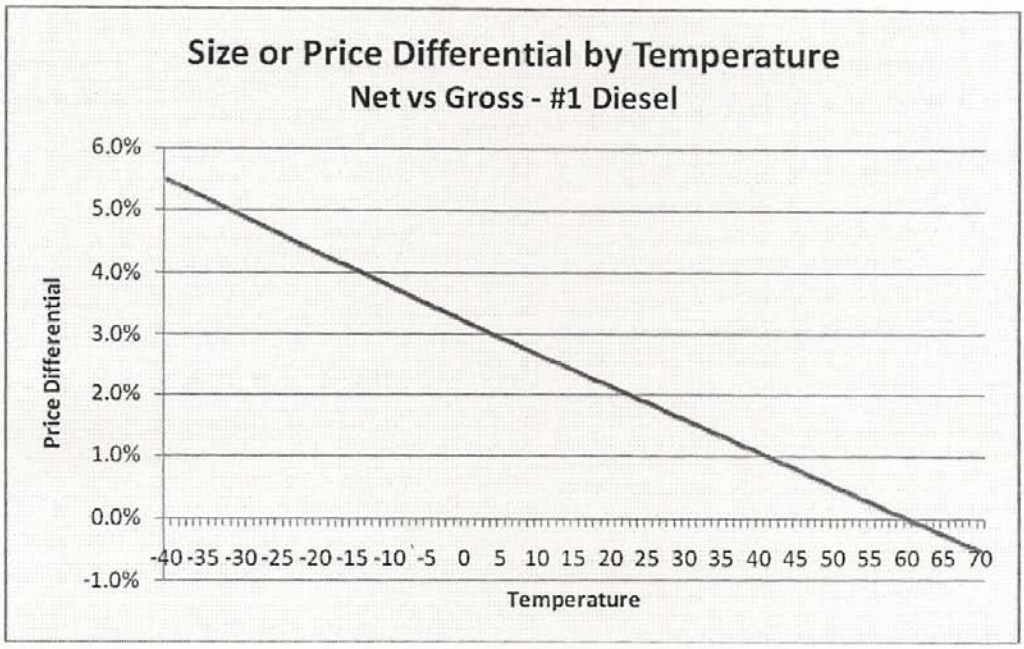


Figure 5

Comparing Net Gallon vs. Gross Gallon Standards

The greatest disparity between retailer volumes occurs under the permissive standard. Eliminating one or the other establishes a more level retail playing field. Deciding between the two requires evaluating the comparative benefits and the costs. In Alaska, converting to mandatory ATC would require conversion costs where ATC is not being practiced.

Benefits of a net gallon standard vs. gross gallon standard were estimated using the method applied in the recent California Report on ATC. Chicago economists Murphy and Topel provided the estimated benefits in that report termed "vanishingly small" in comparison to the costs. It should come as no surprise that the results are similar for Alaska.

These kinds of analytical computations are not perfect, and it is orders of magnitude that matter in this case. For California the costs were on the order of "hundred million" vs. benefits on the order of "hundred thousand". Alaska is a far smaller fuel market but with similar proportion in cost/benefit. Costs of fully converting to ATC are in the millions whereas the benefits are in the thousands.

It was pointed out in testimony during the study that if minimizing consumer cost were the objective, then ATC will lose by construction. (Because it costs more than

dispensing by gross gallons). But the issue is not whether ATC costs more. It is whether those costs produce benefits that exceed them.

ATC's economics in the diagram above are not based on the consumer placing a higher value on net gallons vs. gross gallon. It is based upon an ignorance between the two. Generally when a product has higher value to the consumer, firms market the product based on that higher value. We do not see that in Alaska markets where net gallons are sold.

A Note on Inventory Accounting

Generally the issue of ATC at retail has been brought to any kind of public attention by those alleging a nefarious "hot fuel" inventory accounting switch perpetrated by fuel retailers in warm fuel states. Net gallons have greater volume than gross gallons in warm fuel states. So the allegation is that the retailers are buying larger gallons, and selling smaller gallons thereby profiting from the difference.

This is sort of an "inventory fraud" myth where consumers are "shorted" product relative to what the firm buys. The study is the first time, as far as we know, that inventory and financial accounting has been used to clarify the ATC debate. In this case, it is shown that the allegation is a mythical view of how inventory accounting is actually performed, as well as the financial accounting of profits and losses.

The Hot Fuel Inventory Fraud Myth		
Initial Inventory	0	
Receipts	10,000	gallons (net)
Disbursement	10,200	gallons (gross)
Ending Inventory	-200	

Figure 6

Figure 27 of Page 82 in the report shows that if firms actually did "net in gross out" inventory in warm states then they would be reporting ever larger and absurdly negative inventories to state and federal agencies. If one starts with no inventory and buys 10,000 net gallons, but sells 10,200 gross gallons, then the firm has an ending inventory of -200 gallons.

Alaska is a cold state, setting consumers and retailers in the opposite direction vis-à-vis a warm fuel state. It is tempting to make the argument as a retailer that if fuel is

purchased on a net gallon basis but sold on a gross gallon basis that there is an inventory loss. But it is not true, and for the same reasons.

News from NATSO

FOR IMMEDIATE RELEASE
May 1, 2009
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"Hot Fuel" Settlement Leaves Consumers Out in the Cold, says NATSO

Agreement Likely to Achieve Little More Than Pay Day for Trial Lawyers

ALEXANDRIA, VA. – A proposed settlement agreement with Costco over "hot fuel" is the latest attempt by trial lawyers to mislead the public, according to Lisa Mullings, CEO of NATSO, a national association representing travel plazas and truckstops.

Despite claims that the warehouse club will "fix hot fuel," the only likely results from the 19-page settlement agreement are a payout for plaintiffs' lawyers and an end to the litigation for defendant Costco.

The proposed class action lawsuit claims that when consumers buy gasoline in warm-weather states, they get less than they pay for because warmer fuel expands. According to comments made by trial lawyers and lawyer-funded groups such as Consumer Watchdog, Costco has agreed to "fix hot fuel" in at least 14 states within five years. By that time, they insist, devices installed on Costco fuel pumps will dispense more or less gasoline depending on the temperature.

Mullings says news of the settlement came as a surprise because a California government body, the California Energy Commission, concluded just weeks ago that automatic fuel temperature compensation devices would actually *increase* the retail cost of gas and diesel.

In 2007, California's legislature directed the CEC to study the effects of mandating automatic fuel temperature compensation, or ATC. The report, released in March, concluded that "under all the options examined," ATC presented a "net cost to society."

In fact, transcripts reveal that one commissioner remarked during the release of the study that "hot fuel" was "a lot of hot air and big dollars."

Yet another commissioner remarked, "I say this as a public interest lawyer. [R]econsider what are the most important public interests here. Rome is burning, the Titanic is sinking...this just does not seem like the highest and best use of the state of California…"

Mullings said, "The trial lawyers can continue their charade, but the cat's out of the bag on ATC—it would cost consumers more."

She continued, "Despite all the hype, the mere existence of this agreement does not require Costco to install these devices. We believe this is simply a ploy by trial attorneys to induce other defendants into settling frivolous litigation." She noted:

- Automatic temperature compensation is not permitted by law. The settlement agreement puts the burden of obtaining legal approval for ATC squarely on the plaintiff's lawyers, not on Costco.

- The agreement states that as long as Costco believes that the devices cannot be installed under any state's law, they do not have to install them in that state.

- If the settlement agreement directly or indirectly results in higher fuel costs for Costco in any state ("determined ***solely*** in the good faith ***subjective judgment*** of ***Costco***" in provision 4.8) (emphasis added), Costco is able to unilaterally rescind or cancel the agreement for that state.

- If any other defendant secures "a more favorable settlement," Costco ("in its sole discretion") can modify its agreement to take advantage of the more favorable terms, according to provision 4.7.

"The fact that these trial attorneys are willing to enter into this agreement tells me that they are desperate to secure a financial windfall while they still can. It is unconscionable that they will go this far to score a big settlement award," said Mullings. "Costco will not pay one penny in damages to the proposed class of consumers. On the other hand, the agreement clearly requires Costco to pay the plaintiffs' lawyer fees awarded by the court."

###

NATSO is the trade association of America's travel plaza and truckstop industry. Founded in 1960, NATSO represents the industry on legislative and regulatory matters; serves as the official source of information on the diverse travel plaza and truckstop industry; provides education to its members; conducts an annual convention and trade show; and supports efforts to generally improve the business climate in which its members operate.

APMA Arizona Petroleum Marketers Association

April 29, 2009

Mr. Steve Gill
Chair
Central Weights and Measures Association
24th Annual Conference
RE: Automatic Temperature Correction

Dear Mr. Gill & CWMA Attendees:

On behalf of the Arizona Petroleum Marketers Association, I would like to thank you and your colleagues in the Central Weights and Measures Association (CWMA) for your time and efforts in addressing the issue of automatic temperature correction (ATC) and whether the equipment should be recommended or required for use in the retail marketplace. While it may seem strange to be receiving comments from petroleum marketers in Arizona, the actions and recommendations that CWMA can make prior to the annual NCWM conference in July could significantly impact petroleum marketers in Arizona.

Given the latest development of a large big-box retailer, Costco, agreeing to install ATC equipment where it is not prohibited in southern states as part of a legal settlement, retailers across the country are justly concerned. The potential implementation of ATC devices at retail should not be adopted hastily. It is imperative that all of the potential costs, ultimately borne by consumers, be accounted for and carefully weighed against any perceived social benefit in the accuracy of measurement delivered with ATC devices at retail.

Having attended the NCWM's annual meetings since June 2007, I would like to offer the following observations for your consideration before this again becomes a voting issue at the annual NCWM meeting in 2009.

ATC Benefits

In determining retail consumer benefits from ATC, many have argued using the following formula: (fuel volume) x (retail fuel price) x (volume correction factor). APMA is concerned that basing the formula for consumer benefits using current retail fuel prices ignores the fact that fuel pricing will likely change with ATC installation and that fuel pricing is a fluid process.

Common sense dictates that if retailers selling in warmer climates are required to sell an additional amount of fuel with ATC equipment, that the retailer will adjust fuel pricing to take into consideration that he is now selling "larger" gallons to consumers.

Some proponents of ATC have assumed retail prices will remain the same with ATC versus without ATC. However, by making this assumption, it is easy to end up with an inflated retail consumer benefit number.

The reality is that it is unclear if consumers will perceive ATC to be a benefit if they know that while they may get a larger gallon from an ATC dispenser they are also likely to pay more for that larger gallon.

ATC Costs

The special committee on ATC within NCWM attempted to gather data on the business costs associated with the installation of ATC at retail back in 2007. These would include the costs of equipment, either new dispensers with ATC capability or retrofit kits for existing dispensers, and the cost of labor associated with installation. Additional costs to consider for retailers would be the maintenance and inspection of the ATC dispensers. The installation of ATC in states would also likely lead to new costs for Weights & Measures Departments to acquire the proper testing equipment and train their staff for inspecting ATC in the field. With current state budget deficits in Arizona, this would be particularly problematic.

Much of the estimates for ATC costs to date have come from manufacturers selling the equipment in Canada. On behalf of my membership I have repeatedly attempted to get pricing data from Gilbarco since they have equipment which was type-approved by the California Division of Measurement Standards. However, I am repeatedly told that the equipment is not available for sale in the US and therefore there is no pricing available.

Forced to use the Canadian numbers by default to calculate the estimated cost of the ATC equipment alone without calculating in the installation fees in Arizona, APMA has found the following: with over 2,000 retail outlets in Arizona, APMA estimates the cost just to purchase the ATC equipment to be at least $30 million. These costs do not include the hidden costs of installation/labor, breaking concrete and additional costs related to new federal standards which will only add to the retailer's financial burden to install ATC. With over 40% of Arizona's retail outlets in rural areas, many gasoline retailers will be forced to purchase completely new dispensers at an enormous expense. It is important to note that the majority of motor fuel retail outlets are now independently owned---meaning they are not owned by major oil companies, so the costs associated with installing ATC will not be paid by big oil but rather by small businesses. In Arizona, over 90% of all retail is independently owned—not owned by a major oil refining company. This shift in retail ownership has occurred nationally as well.

Given the federal Energy Act of 2005, when retailers break concrete on the dispenser pad in Arizona, they will also be required to install double-wall piping and double-wall tanks which will add to the overall costs of implementing ATC for some retailers. For rural retailers this burden may not make sense financially for them to remain in business.

Cost Benefit Analysis

When discussing the cost benefit methodology used by the California Energy Commission, APMA is concerned that the comparison of retail station costs to consumer benefits just does not provide the full picture since the formula again assumes the same retail prices in a post-ATC installation scenario as in a pre-ATC marketplace.

It seems much more likely that fuel pricing already does in fact take into consideration temperature. It's also important to note that Arizona ranked last in retail margins in 2007 according to OPIS bringing in a measly 3.8 cents per gallon when compared to the national average of 14.2 cents per gallon. In 2008, while margins improved slightly, Arizona still ranked lower at 10.1 cents per gallon versus 18.1 cents per gallon nationally. With these retail margins being lower than other "cooler" parts of the country, many of the consumer driven arguments for ATC at retail don't seem to hold-up. If the consumer does not benefit from the installation of ATC, then whom does?

Permissive versus Mandatory ATC

NCWM in the past asked industry to weigh in on the various scenarios in which retail ATC would be implemented and whether there should be a permissive phase and/or ultimately a mandatory phase. This is also how the vote at the annual meeting in July is set-up. While it is true that industry would prefer that the status quo remain in place and that retail ATC not be pursued for reasons outlined above, W&M officials need to recognize that a permissive retail ATC scenario will likely create major problems in the petroleum retailing market.

By allowing the installation of ATC to be permissive, NCWM would be essentially allowing large well-financed retailers to use the ATC regulation as a potential way to gain an unfair market advantage over smaller retailers. When coupled with the recent additional tank requirements under the federal Energy Act of 2005, many small retailers may decide that they can't afford to make these costly changes to their operation and close shop. Ultimately, this harms the consumer by decreasing their fueling options.

Permissive ATC also creates major confusion for the consumer because they can no longer compare station's pricing based on the same gallon being sold station to station. While the temperature in Arizona may very well be over the 60 degree standard---the temperature is constant corner to corner—consumers can easily compare price per gallon from the street—even if it is a gallon at 80 degrees. However, under a permissive retail ATC scenario, a consumer will be hard-pressed to compare stations selling ATC fuel v. retail sites selling traditional gallons. If some states decide not to implement retail ATC while other states do implement it---interstate commerce and taxes could be significantly impacted as well.

APMA truly appreciates the opportunity to share our concerns with CWMA officials. We intend to remain active and engaged on the issue of retail ATC and hope that the ultimate decision reached by any state legislature or regulatory agency will be one which balances science and the best interest of the consumer.

Sincerely,

Andrea M.G. Martincic
Executive Director

APMA * P.O. Box 93426* Phoenix AZ 85070* (480) 460-1561 * FAX: (480) 460-9016

American Trucking Associations
950 N. Glebe Road, Suite 200, Arlington, VA 22203

Driving Trucking's Success

Richard Moskowitz
Vice President and Regulatory Affairs Counsel

May 4, 2009

Jack Kane, Chairman
National Conference on Weights and Measures
1135 M Street, Suite 110
Lincoln, NE 68508

Via e-mail: jkane@mt.gov

Re: Automatic Temperature Compensation Devices for Fuel Dispensers

Dear Chairman Kane:

The American Trucking Associations, Inc.[1] (ATA) is writing to provide comments on the issue of automatic temperature compensation (ATC) and its potential impact upon consumers of diesel fuel. As the national representative of the trucking industry, ATA is interested in the matters affecting the purchase and sale of diesel fuel, including the manner in which diesel is dispensed at retail fueling stations. Diesel fuel is the lifeblood of the trucking industry. Last year, the trucking industry consumed 39 billion gallons of diesel. For most carriers, fuel is the second largest expense after labor. As the largest diesel fuel consumer group, ATA members are keenly interested in any initiative that could impact diesel prices.

The trucking industry is the backbone of this nation's economy, accounting for more than 80% of the nation's freight bill and employing nearly 9 million Americans. The trucking industry delivers virtually all of the consumer goods in the United States, and over 80 percent of all communities in the United States receive their freight exclusively from trucks.

ATA has closely followed the debate over ATC and has previously provided comments to the National Conference on Weights and Measures (NCWM), opposing both permissive and mandatory ATC.[2] With the recent findings of the California Energy Commission (CEC) that implementation of ATC will result in additional costs for

[1] ATA is a united federation of motor carriers, state trucking associations, and national trucking conferences created to promote and protect the interests of the trucking industry. Directly and through its affiliated organizations, ATA encompasses over 37,000 companies and every type and class of motor carrier operation.

[2] *See* Letter from Richard Moskowitz, ATA to Judi Cardin, NCWM (January 14, 2008).

retailers and consumers with virtually no quantifiable benefit, we wish to again express our opposition to implementation of ATC at the retail level.

As we expressed to NCWM in our letter of January 14, 2008, ATA opposes a permissive standard for ATC. Permissive temperature compensation leaves the decision regarding whether to install temperature compensation equipment to the fuel retailer's discretion. A permissive temperature compensation regulatory environment could allow retailers to manipulate the system by installing the equipment where the average temperature of the fuel dispensed is below 60 degrees, and refrain from such installation where the average temperature of the fuel dispensed is above 60 degrees.

Permissive temperature compensation also could undermine fair trade and transparency in the retail marketplace. Many trucking companies rely upon daily price surveys to determine where and how much fuel to purchase at given points along a truck route. Other trucking companies rely on advertised prices to determine where to refuel. The use of ATC equipment by an unknown portion of fuel retailers will greatly complicate our members' ability to determine the most economic place to refuel. Retailers, whether located across the street from one another or across a state border, would no longer be selling comparable volumes of fuel, making it exceedingly difficult to make an educated purchasing decision.

ATA recognizes that the retail motor fuels industry is highly competitive with gas stations and truck stops competing fiercely to attract additional business on the basis of a penny per gallon. Fuel retailers price their fuel to cover the cost of the bulk fuel they purchase and include a reasonable return on their investment. In pricing diesel fuel, the retailer also must consider the prices that competing stations are charging, since a difference of as little as one penny per gallon could result in a substantial gain or loss of business. In this highly competitive environment, inventory expansion and shrinkage are accounted for in the retail price of diesel fuel, and any perceived advantage from temperature variation is eliminated through competitive pricing.

ATA does not believe that ATC technology will ensure that every gallon yields the same energy content. There are far more variables affecting the energy content of fuel other than temperature. BTU reductions from various renewable blends (e.g. ethanol and biodiesel) may have a greater impact upon energy content than temperature.

As we have commented previously, we are concerned that the trucking industry will bear the cost of installing ATC devices on fuel dispensers. The CEC's cost benefit analysis confirmed this. Therefore, we stand by our previous statement that the installation of ATC devices is a solution that is more expensive than the problem it is trying to address.

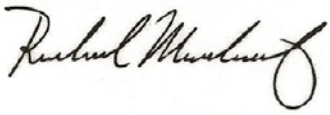
In a single day, a truck driver may travel through several states. We believe it would be detrimental to our industry if various states each adopt their own systems for

measuring motor fuel. Therefore, we again recommend that the NCWM consider new language that prohibits states from adopting ATC at the retail level.

* * * * *

If you have any questions concerning the issues raised in this letter, please contac the undersigned at (703) 838-1910.

Respectfully submitted,



Richard Moskowitz
Vice President & Regulatory Affairs Counsel

cc: States Weights and Measures Officials

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June 14, 2009

ATC as a Better, More Comprehensive Form of Measurement
By Henry Oppermann
Weights and Measures Consulting, LLC

I. Overview

Over the past 5 years, much valuable information has been collected and diverse views presented as the issue of temperature compensation has been addressed by the NCWM. Several reports and the temperature data collected by state weights and measures programs are referenced in this document. They are:

1. Fuel Delivery Temperature Study, California Energy Commission, Transportation Committee, January 2009, Report No. CEC-600-2009-002-CTF
2. An Economic Analysis of the California Energy Commission Staff's Fuel Delivery Temperature Study and the "Hot Fuel" Allegations, by Michael A. Flynn, distributed at the NCWM Interim Meeting, January 2009. Several claims in Mr. Flynn's report are challenged in this paper.
3. Temperature Compensation of Liquid Fuels, A Study for National Weights and Measures Laboratory, Stanton Avenue, Teddington, Middlesex, Project No: NWM006, Report No: 184/99, Date: 21 July 1999
4. Temperature data collected by weights and measures programs.

The report by the staff of the California Energy Commission provides the best economic analysis that has been done on the subject. However, the economic analysis is not the only issue that should be considered. One issue has not yet been adequately addressed, namely, **does the benefit of more comprehensive measurement that results from temperature compensation justify the cost?** The answer to this question does not come from an economic analysis of these issues, but is a judgment of the value of better measurement. Weights and measures officials will have to make this judgment when they vote on the temperature compensation issue again. The benefit referenced should be considered in terms of:

- Equity in individual transactions;
- Transparency for consumers and in competition among companies in that unit prices are based on the same temperature;
- Better service station management of fuel inventories; and
- More accurate field tests performed by service companies and weights and measures officials.

To highlight these aspects of the debate, this paper looks at several issues that are relevant to making a decision on the value of automatic temperature compensation for retail motor fuel dispensers.

1. Are weights and measures officials interested in accurate measurement only on the basis of an annual average or are they interested in the accuracy of individual transactions? Product temperature data collected by weights and measures programs are presented to illustrate the significance of this issue. (See sections III and IV, in particular.)

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2. Several claims and conclusions contained in the report by Mr. Michael A. Flynn are challenged to address issues that are incorrect or not adequately substantiated.
3. Does selling gasoline on the basis of average temperatures and not addressing product temperature in individual transactions a good business practice or good for consumers?
4. Will service station owners achieve better inventory control by using temperature compensated dispensers? Most people recognize that inventory control will be improved by the use of temperature compensation.

II. Oil Industry Justification for ATC at Wholesale

The oil industry has justified the use and need for ATC at wholesale, because the shipment and delivery of fuel products occur at different times and locations in the country. In his testimony before the Subcommittee On Domestic Policy Of The Committee On Oversight And Government Reform Of The United States House Of Representatives on July 25, 2007, Mr. Hugh Cooley, Vice President and General Manager, National Wholesale and Joint Ventures, *Shell Oil Company,* stated the following.

> "Furthermore, the reasons that temperature adjustment makes sense for intercompany exchange transactions do not apply to retail sales: distance, time, quantity, and temperature. Gasoline marketers like Shell exchange large volumes of gasoline between terminals that are very far apart, often in markedly different climates, and at varying times of the year, all of which requires accounting for the impact of temperature variations. For example, Shell might deliver a specific number of gallons of gasoline to another company in Texas (where we have a refinery) in exchange for that company's near simultaneous delivery of gasoline in northern Minnesota (where we do not have a refinery). Similarly, in some instances a company may receive product in one season and repay the gallons at a later date when the weather is cooler or warmer. In contrast, retail gasoline sales occur at far smaller quantities under highly competitive conditions in a specific place, at a specific time, under specific conditions, which include the ambient temperature and large signs visible from the street posting prices. Unlike the exchange context, consumers do not buy and sell gasoline over a huge geographic distance and climate difference - in fact, they cannot do so. Likewise, consumers do not receive product in one season and repay it in another — nor is that possible."

In reality, the only justification for the use of temperature compensation at wholesale is to address temperature changes in the product. The locations and times of delivery are not important, except for the fact that the temperature of the product is different based upon location or the time of the transaction. The oil industry makes temperature corrections to the volumes, because the temperature of the petroleum products usually varies from the source to the destination of delivery. Temperature differences are large for consumers as well, so the same considerations apply at retail as they do at wholesale. Why is temperature compensation justified because millions of gallons of fuel are bought and sold between two

large companies, but temperature compensation is not justified for millions of gallons of fuel sold to consumers?

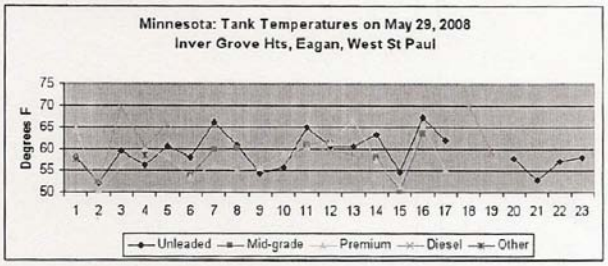
The fact is that the temperatures of retail gasoline and diesel fuel vary from station to station, from dispenser to dispenser within the same station, and may vary from transaction to transaction for the same dispenser. If the rationale of the oil industry to justify ATC at the wholesale level is essentially due to the fact that the product temperature changes, then the rationale and justification for the use of A TC applies equally well to retail deliveries of gasoline and diesel fuel at service stations.

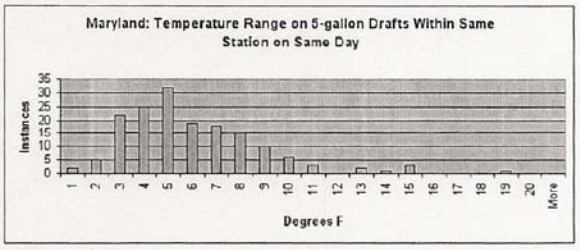
III. Variations in Product Temperature at Retail

Product temperatures can vary greatly at retail. Consequently, temperature differences are significant at retail. Data presented to the NCWM for product temperatures in Topeka, KS, (below left) and for underground tank temperatures in Minnesota (below right) show that the temperatures of gasoline and diesel fuel vary from station to station.

Topeka Product Temp: 12/4-8/07



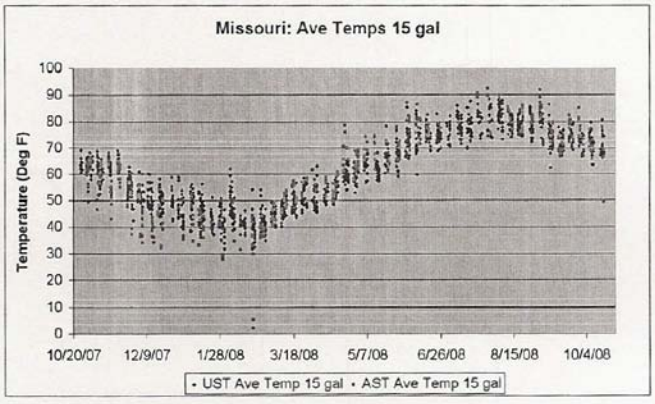




Temperature data collected by Maryland demonstrate the extent to which product temperatures can vary on the same day within the same station.

Temperature data collected by Missouri show how product temperatures can vary across the state throughout the year. The temperatures are the average temperatures of three consecutive 5-gallon test drafts, which is equivalent to 15-gallon deliveries.

Since temperature has such a large effect on the volume of gasoline, why shouldn't the effect of temperature be

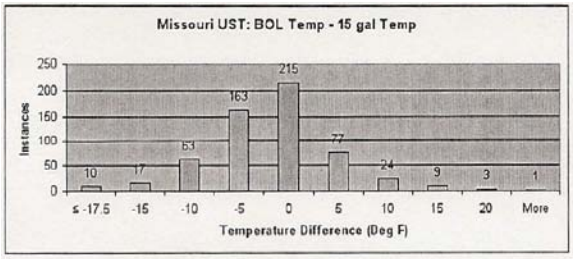


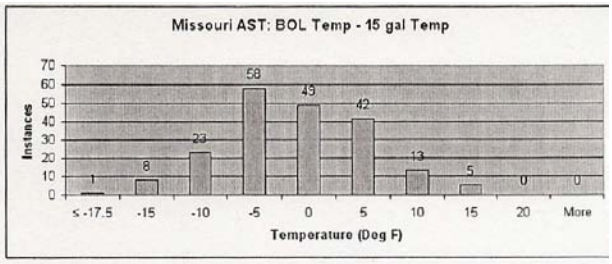
corrected at retail? The technology exists and is in widespread use in Canada. The California study showed that the cost of ATC equipment per gallon of fuel dispensed is relatively small. There is no technical obstacle to performing temperature compensation at retail.

IV. Accuracy on the Average or Accuracy on Each Transaction

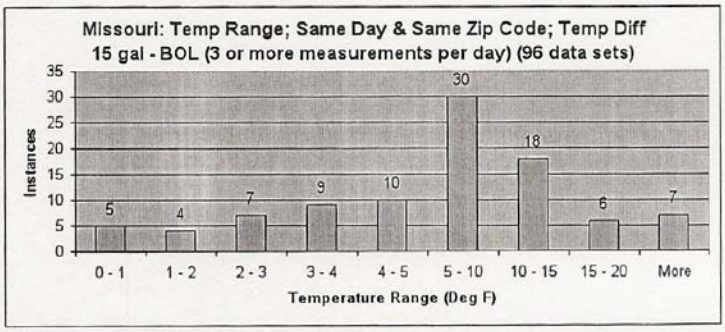
Mr. Michael Flynn explained in his report how service station owners establish the unit price for gasoline and diesel fuel based upon the number of gross gallons received at the temperature of the product as stated on the bill of lading. It is important to assess whether or not the stations actually sell the products at the temperatures for which the station owners compute the unit prices. Should product temperature variations be addressed in individual transactions or is the average of product temperatures over a year sufficient?

Several weights and measures programs collected significant amounts of temperature data that allow the comparison of the temperature on the bill of lading (BOL) for deliveries to the temperatures of the products actually delivered from the retail fuel dispensers. If one looks only at the average difference between the BOL temperatures and the temperatures of the product delivered over a period of a year, the average differences are relatively small, often less than 1.5 F. However, the temperature differences for individual transactions can cover the range from zero to over 20 °F. Below are histograms for the State of Missouri that show the variations in the product temperatures from the BOL for 15-gallon deliveries. The graph at the left is for deliveries from underground storage tanks and the graph to the right is from above ground storage tanks. Each value on the horizontal axis represents temperature differences that are ±2.5 °F from the value on each axis (e.g., the column marked "5" is for temperatures from 2.5 to 7.5 °F.





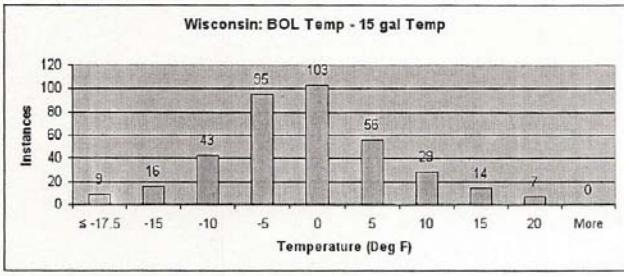
The Missouri data were evaluated to see how much the delivery temperature varied from the temperature reported on the most recent BOL for the stations. The range of the temperature deviations of the delivery temperatures on each day was calculated when three or more "deliveries" (three consecutive 5-gallon test drafts) were run by Missouri inspectors. The distribution of the deviations is shown on the graph to the right. Sixty-one out of 96 tests (63.5%) had temperature deviations of 5 °F or more, which represents a

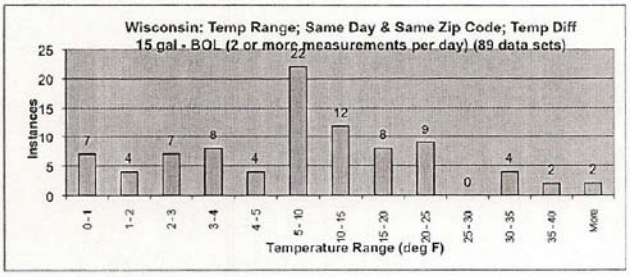


change in volume of gasoline of about 0.33%.

The "peak" of the distribution (30 instances or 31 %) is centered at 5 to 10°F, which includes all values from 7.5 OF ± 2.5 °F and represents a temperature effect of 0.5% on the volume of gasoline. Approximately, 14% (13 of 96) had a temperature effect greater than 15 °F, which is more than 1% of the volume of gasoline.

Based on the information Mr. Flynn provided on how gas stations set the unit prices based on the gross gallons delivered to the station, that means the temperature effect on the unit price for gasoline causes the unit price to be in "error" by at least 0.5% from the target price in 63.5% of the transactions. Therefore, at a unit price of $2.00 per gallon, this means that the variation in product temperature within the same zip code area amounts to at least 15 to over 30 cents on a 15-gallon delivery of $30. Thirteen of those 96 "deliveries" (13.5%) have temperature deviations of 15 or more degrees, which represents a temperature effect of 1 % of the volume (and the unit price) of 30 cents or more on a 15-gallon or $30 delivery. At $4 per gallon, the money values in all of the examples double.





To show that the product temperature variations in Missouri are not unusual, to the right is a histogram of temperature variations for a 15-gallon "delivery" from data collected by the State of Wisconsin for three consecutive 5-gallon test drafts. The temperature range on the same day for the same zip code is even greater in Wisconsin than in Missouri. The maximum temperature range in Missouri was about 26 °F, but for Wisconsin, the maximum range was almost 46°F. For Wisconsin, 66% of the tests had temperature deviations of greater than 5 °F; 28% had temperature deviations greater than 15 °F (or 1% of volume); and 9% had temperature deviations greater than 30 °F (or 2% of volume). Based on how Mr. Flynn reported that service stations take temperature into consideration when setting unit prices, these deviations represent over 1% and 2% "errors" in the unit prices.

ATC would virtually eliminate the varying effect of temperature on individual deliveries. Why shouldn't the effect of temperature be addressed?

The net weight criteria in Handbook 133 for the accuracy of the net contents of prepackaged goods requires that packaged products comply with two requirements, namely, (1) the average net weight for the inspection lot and (2) the maximum allowable variation limit for individual packages. The temperature effect on the volume of gasoline combined with the temperature variations from station to station and transaction to transaction are analogous to the variations in

the net contents of packages. Again, why shouldn't the effect of temperature on the delivery of gasoline and fuel oil be addressed through ATC?

V. The Average Approach to Temperature Variations

Mr. Michael Flynn explained that the average of random purchases of gasoline and diesel fuel made throughout the year at different service stations (which also applies to random purchases throughout the year at the same service station) will result in the average temperature of purchases to be very close to the average temperatures for the stations. Is this good enough? Does this reflect good business practices?

To illustrate this point, we can apply the random sampling concept to the purchase of hamburger from different supermarkets using an extreme example. Suppose that there are five supermarkets in an area and a consumer, using a random sampling plan, is going to pay for 1 lb of hamburger during each visit to these five supermarkets throughout the year. Suppose at Supermarket #1, the consumer pays for a package labeled as I lb of hamburger, but the consumer actually receives 2 lb of hamburger. Suppose that at Supermarket #2, the consumer pays for l lb of hamburger, but receives 1.5 lb of hamburger. Continuing this example, at Supermarket #3, the consumer pays for l lb of hamburger and receives l lb of hamburger. At Supermarket #4, the consumer pays for 1 lb of hamburger, but receives 0.5 lb of hamburger. At Supermarket #5, the consumer pays for l lb of hamburger, but receives an empty package (0 lb) of hamburger. If the consumer makes 10,000 purchases of hamburger (and all of the packages are labeled with l Ib) at these supermarkets during the year using a random sampling plan, then the average net weight of the consumer's annual purchases will be l Ib. Are all of these transactions equitable? Are all five supermarkets following good business practices? The net content of packaged goods is based on both the average requirement and accuracy limits (maximum allowable variations) on individual packages.

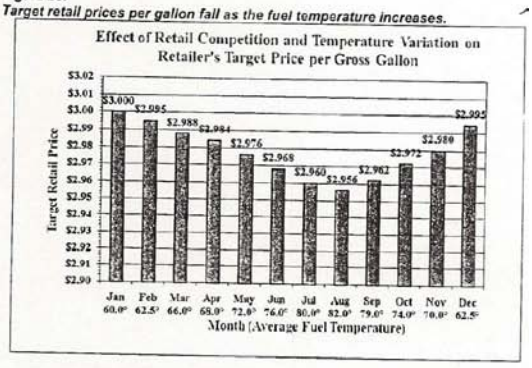
The temperature of the gasoline and diesel fuel at the gas pump cannot be controlled, but the effect of temperature on the volume of gasoline is often greater than the tolerance applied to retail fuel dispensers. Does the consumer deserve more comprehensive (temperature corrected) measurement in individual purchases of gasoline? This brings us back to the question, “Should the product temperature be addressed for purchases of gasoline and diesel fuel for individual transactions or only to the annual average?”

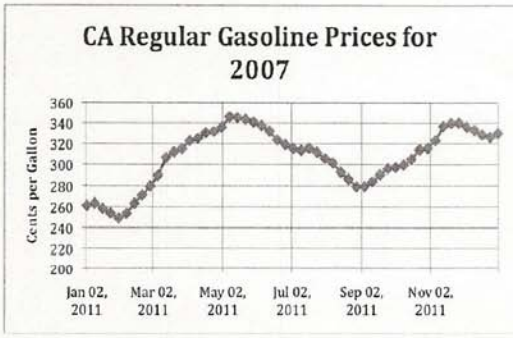
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VI. Does Competition Automatically Correct for Product Temperature?

Mr. Flynn states, "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."[1] Mr. Flynn explains in great detail how service station dealers can use the monthly product temperature to set the target price of the retail product. However, on page 50 of his report, Mr. Flynn states that "…dealers themselves do not consciously and explicitly change their pump prices to achieve this result…" and "…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." Furthermore, the method to calculate the target price of service stations carefully explained in his report and illustrated in the graph at the right (taken from page 57 of his report) are not reflected in the actual retail prices for California. Consequently, Mr. Flynn cannot substantiate his claim with the actual gasoline prices in California (graph at the right) over the time period covered by his report[2]. Mr. Flynn admits in his statement during the December 9, 2008, meeting of the California Energy Commission, "Now, this is not to suggest that these are what wind up as the street prices, because there's lots of other factors that go into the determination of the competitive retail price."[3] Mr. Flynn is correct on this point, because the actual retail prices in California do not follow the target retail prices that he has computed. One can reasonably question if the temperature of the product has any effect on how the prices of gasoline at service stations are established.

Target retail prices per gallon fall as the fuel temperature increases.





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[1] An Economic Analysis of the California Energy Commission Staff's Fuel Delivery Temperature Study and the "Hot Fuel" Allegations, by Michael A. Flynn, page 4.

[2] Department of Energy, Energy Information Administration web site, http://www.eia.doe.gov/oil_gas/petroleum/data_publications/wrgp/mogas_history.html

[3] Transcript of the December 9, 2008, , Committee Workshop Before The California Energy Resources Conservation And Development Commission, page 155, web sites http://www.energy.ca.gov/transportation/fuel_delivery_temperature_study/documents/2008-12-09_workshop/2008-12-09_TRANSCRIPT.PDF and http://www.energy.ca.gov/transportation/fuel_delivery_temperature_study/documents/index.html.

In short, Mr. Flynn says that market competition automatically corrects for all factors that affect the price of gasoline and diesel fuel. Therefore, Mr. Flynn claims that whatever factors affect the fuel products that service stations sell, even the effect of temperature, have already been factored into the unit prices that stations have set in the past by virtue of the fact that the unit price is based upon the gross volume of fuel delivered to the station. However, the temperatures of the majority of fuel sold through the fuel dispensers are different from the temperature on which the station owner has set the price for selling the fuel. Some could argue that the multitude of pricing errors that occur, average out over the course of a year, so the cost of using ATC equipment is not justified. However, selling gasoline on a temperature compensated basis would provide a uniform and definite basis for service stations on which to set the unit price of gasoline and allow consumers to make better price comparisons, since temperature is no longer an unknown variable in the transaction.

Regarding Mr. Flynn's approach that competition addresses all market factors that affect the price of gasoline at retail, another analogy can be provided from the net weight of packaged goods. If competition is the "cure all," then when the concept of competition is applied to the net weight of packaged commodities, then packagers could be allowed to sell packaged goods on the basis of gross weight, because competition would drive the unit prices down to the level where the tare weight is automatically considered in the (gross) weight and item price. Is this what weights and measures officials are willing to accept?

VII. Inventory Control

The variation in product inventory for service stations is affected to a significant extent by temperature changes in the gasoline and diesel fuel sold. The shrink of gasoline inventory is a problem that is pervasive in the industry. The study done for the for National Weights and Measures Laboratory (NWML) in the United Kingdom documented the extent of shrink and gain in inventory at service stations in their country. The amount of shrink varied depending upon the source of supply of the product. The report (which should not be interpreted as the position of the NWML) recommended that ATC at retail be allowed to improve inventory control.

VIII. Net Versus Gross Volume Delivery Systems

Mr. Flynn illustrates four relationships for how the price of fuel is expressed at retail and how the quantity of fuel is measured at retail (pages 9-14 of his report). Mr. Flynn states that Scenarios II and III are problematic, because the systems for pricing and measurement are different. Mr. Flynn states, “In particular, the total dollar cost to a motorist for a given quantum of fuel would be identical under either *Scenario lor Scenario IV.”*[4] Scenarios I and IV have the pricing and measurement methods based on gross-to-gross gallons and net-to-net gallons, respectively. Mr. Flynn continues, “It is the core assumption of this paper that no dispute or problem arises as long

[4] An Economic Analysis of the California Energy Commission Staff's Fuel Delivery Temperature Study and the "Hot Fuel" Allegations, by Michael A. Flynn, page 10.

as retail fuel sales are conducted according to *either Scenario I or Scenario IV."*[5] However, Scenario I is valid only if the service stations are selling the products at the same temperatures at which they price the product. We know from the data collected by weights and measures programs that this is not the case, so the legitimacy of Scenario I is lost. Consequently, the only remaining and reliable approach to pricing and selling fuel at retail is Scenario IV, which is pricing and measuring retail fuel on the basis of net (temperature compensated) gallons.

IX. More Accurate Field Tests of Dispensers

When testing retail fuel dispensers without temperature compensation capability (gross volume), weights and measures officials and service company representatives do not correct for (1) the change in volume of the fuel due to any change in temperature of the product from the meter to the prover or (2) the capacity of the volume standard for the difference of the temperature of the standard at the time of test from its 60 OF reference temperature. It isn't possible to correct for a change in temperature from the meter to the standard when testing a temperature uncompensated dispenser, because there isn't a thermometer well adjacent to the meter to get the temperature of the product at the meter. The change in capacity of the volume standard is very much smaller than the temperature effect on the gasoline or diesel fuel during a test.

If the proposed changes to Handbook 44 for temperature compensated fuel dispensers are adopted, then temperature compensated dispensers would indicate the temperature of the product passing through the meter during the tests of the meters, there would be a thermometer well at the meter and temperature corrections could be made to any temperature change from the meter to the standard and to the capacity of the standard. If these corrections would be made during a field test, then the accuracy of the field test would be increased.

X. Conclusions

Automatic temperature compensation provides a more comprehensive measurement at retail and therefore a more accurate and equitable measurement. Changes in the temperature of gasoline and diesel fuel have a greater impact on the volume of the fuel than does the Handbook 44 tolerance allowed for retail fuel dispensers. Automatic temperature compensation would provide greater equity in retail fuel measurement. Hence, automatic temperature compensation should be used at the service station level for the retail sales of gasoline and diesel fuel.

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[5] An Economic Analysis of the California Energy Commission Staffs Fuel Delivery Temperature Study and the "Hot Fuel" Allegations, by Michael A. Flynn, page 10.

California Independent Oil Marketers Association
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July 1, 2009

National Conference of Weights & Measures
Laws & Regulations Committee
1135 M Street, Suite 110
Lincoln, NE 68508

Subject: California Independent Oil Marketers Comments: Automatic Fuel Temperature Compensation Items Under Consideration; Recommendation to Prohibit

NCWM Laws & Regulation Committee Members:

The California Independent Oil Marketers Association (CIOMA) wishes to provide the following comments on the items to be considered regarding development of requirements for the use or mandate of automatic temperature compensation (ATC) technology at retail fuel outlets. ***We recommend that automatic fuel temperature compensation at retail outlets be prohibited.***

CIOMA sponsored the California legislation (AB 868 [Davis, 2007]) which required the California Energy Commission to prepare the first comprehensive cost-benefit analysis ever performed on retail ATC deployment in the United States. We sponsored this legislation as we were continually fighting exaggerated and unfounded claims on how ATC might affect the consuming public. We now have a completed study that provides an independent review and analysis of issues, costs and benefits surrounding deployment of ATC-equipped (or adjusted) fuel pumps. The conclusions of the report provide a solid and irrefutable basis for the prohibition of ATC at retail. It is important to note that the report conclusions were derived in a "warm" state where the average fuel temperature is over 70 degrees (F) – 10+ degrees warmer than the standard 60 degrees (F) reference measuring point.

Our initial assumptions regarding ATC have been ratified by the independent conclusions in the report:

- ATC is expensive to install and maintain;
- consumers will see no benefit and only costs from its installation; and,
- consumers will merely wind up paying *more* for the same units of purchase.

Some of the important conclusions made in the report include:

Cost to Society

- "…it is unlikely that there are any plausible circumstances whereby some consumers could realize a small net benefit of ATC at retail in California."[1]
- "Net costs to society amount to approximately $245 million…"[2]

[1] CEC Final Fuel Delivery Temperature Study, pg. 107, Findings section
[2] CEC Final Fuel Delivery Temperature Study, pg. 73 ATC Retail Cost-Benefit Analysis section

Retrofit Costs

- "Statewide costs for ATC retrofit kits are estimated by staff to amount to approximately $85 million or $8,763 per retail station."[3]
- "Energy Commission staff estimated that the time required to inspect and certify retail fuel dispensers will increase between 10 and 20 percent if ATC is mandated for use at retail stations in California."[4]
- Total statewide costs for the new equipment (specialized thermometers) they will need to verify the accuracy of ATC dispensers is estimated to range between $77,000 and $140,000.[5]

Adjusting fuel price to meet new distribution requirement

- "The conclusion, therefore, is that retail station owners will in fact raise their fuel prices to compensate for selling fewer units, all other things being equal."[6]
- "...the retail station owners are expected to adjust the price of the new units to a slightly higher level to try and maintain similar levels of profitability in a post ATC scenario."[7]

Statewide/regional reference temperature change

- "Based on the report analysis, the Committee concludes that establishing a new statewide reference temperature, or different regional reference temperatures for the state, would not successfully address temperature compensation at the retail level and therefore does not recommend this approach."[8]

Small services stations and fuel supply

- "If ATC was to be mandated at retail stations in California, it is possible that the expense to comply with the regulation could be onerous for some station owners. Some of these station owners may be unable to obtain adequate financing and could possibly close their business."[9]
- "The closure of a retail station that was either the sole or one of only two sources of retail fuel for a community could create a local fuel supply availability problem.[10]

In a nutshell, here is why we believe ATC at retail is inappropriate:

- ATC will cost consumers. The report concludes costs are greater than benefits. The report states that retailers will merely adjust their sales price to compensate for changes made to dispensed volume – there will be no "free fuel" dispensed. The report states that the costs of installing and maintaining the equipment will be passed on to consumers. *"It is unlikely that there any plausible circumstances..."* where consumers will benefit from ATC.
- ATC changes the method of dispensing along the distribution chain. It is important to understand that there is consistency in fuel distribution from the rack to the customer at the current time. Gross gallons are distributed at the rack, gross gallons are distributed though the wholesale chain, and gross gallons are distributed at retail. What is changed (only at the rack) is the *price*. Deployment of ATC at retail will change dispensing from

[3] CEC Final Fuel Delivery Temperature Study, pg. 104, Findings section
[4] Ibid
[5] CEC Final Fuel Delivery Temperature Study, pg. 104, Findings section
[6] CEC Final Fuel Delivery Temperature Study, pg. 70, Quantification of Potential Consumer Benefits section
[7] CEC Final Fuel Delivery Temperature Study, pg. 71, Quantification of Potential Consumer Benefits section
[8] CEC Final Fuel Delivery Temperature Study, pg. 3, Executive Summary section
[9] CEC Final Fuel Delivery Temperature Study, pg. 105, Findings section
[10] Ibid

gross gallons to net physical gallons at the pump. This brings *inconsistency* into the distribution chain, *not* greater consistency.

- ATC creates greater consumer mystery - At the time the customer receives their final receipt they have no idea how much more, or less, fuel they have received. They merely get a receipt stamped with "Temperature Corrected Gallon". We believe that if Canadian customers truly understood they were receiving less than a full gallon on a consistent basis, the issue of temperature compensation would become more hotly argued in that nation.
- No free fuel – There has been an underlying, incorrect assumption that the fuel customer will receive, in warm states, more cubic inches of fuel for the same price as they are currently paying. The CEC report concludes that retail prices will be adjusted to compensate for changes in dispensed volume created by the ATC equipment. The analogy is like switching from gallons to liters. The same type of adjustment will be used to adjust price for ATC-dispensed fuel. Since fuel is purchased in gross gallons (regardless of how it is priced), the retailer must sale-price product in gross gallons to achieve a like-quantified return on investment. Retailers are *not* going to give away fuel.
- ATC does not give customers an accurate energy-density-adjusted gallon. ATC only corrects for one variable in the energy density of fuel at the retail nozzle – temperature. The CEC report notes that other factors such as refinery fuel composition, regulatory seasonal fuel blend adjustments, and inclusion of biofuels can have much more dramatic impact on fuel energy density than temperature. ATC falsely leads customers to believe they are getting an energy-adjusted gallon. They are not.

For all of these reasons we believe the argument and controversy over automatic fuel temperature compensation needs to be put to bed. ATC needs to be prohibited and the Conference needs to take an affirmative stand that it is not an appropriate sales technology at the retail level. ***We ask you to take this action.***

CIOMA represents independent marketers who purchase gasoline and other petroleum products from refiners and sell the products to independent gasoline retailers, businesses, and government agencies, as well as representing branded "jobbers" who supply branded retail outlets, especially in rural areas. Our members are primarily small, family owned businesses who encounter unique difficulties in meeting California's complex and increasingly expensive environmental requirements. We represent approximately 400 members, about half of whom are actively engaged in the marketing and distribution of petroleum products and fuels.

If you need additional information or insight into our conclusions please do not hesitate to contact me at your earliest convenience.

CIOMA Letter to NCWM: Prohibit ATC
July 1, 1009

Sincerely,



Jay McKeeman, Vice President, Government Relations & Communications

cc: PUMP Coalition members
CIOMA Board of Directors

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AFFAIRS AND BUSINESS REGULATION

CHARLES H. CARROLL
DEPUTY DIRECTOR

July 6, 2009

Joe Gomez, Chairman
NCWM Laws and Regulation Committee
New Mexico Department of Agriculture
MSC 3170, P. O. Box 30005
Las Cruces, NM 88003-8005

Dear Chairman Gomez:

The ATC issue is not a new issue to NCWM it has been around a long time. When last visited by the conference it was rejected as there was no compelling argument or consensus to adopt ATC as a required method of sale at the retail level at that time.

The current discussions and multiple hearings held on the issue raised more questions than answers. In addition, those most affected by the proposal if adopted are opposed to it and consumer groups are also against it by more than a two to one margin.

The statement in the L & R Committee report that the NCWM was now in a position to make an informed decision on this issue couldn't be more further from the facts. The facts are two regional associations representing half the country are opposed to adopting ATC as a method of sale. This fact does not spell out consensus it spells out dissention. Before we move this issue forward we must have a very definitive consensus to adopt. In reality the arguments presented thus far have not convinced me that the current method of sale is inequitable to either the buyer or seller.

In any geographic locale the temperature variations are very small from one retail location to another within that location. Competition for market shares is based on pricing rather than a large or small gallon. Consumers purchase motor fuel in most cases based on price. The competition for these consumers is fierce and pricing is the major tool used to attract customers. If retailers all sell the same gallon then we have a level playing field which is the bottom line in enforcing weights and measures laws. ATC if mandated will do nothing but increase costs for businesses and consumers. NEWMA has discussed this issue in depth and we took a stand not to support adoption of this requirement. Remember, retail motor fuel individual sale volumes are small thus any variation due to temperature is also small.

We in the Northeast feel that the current system of measurement is accurate and equitable and urge your committee to withdraw the two proposals currently in your committee.

Respectfully,

Charles H. Carroll
Deputy Director, Commonwealth of MA

APMA Arizona Petroleum Marketers Association

July 6, 2009

Mr. Joe Gomez
Chairman
Laws & Regulation Committee
NCWM 2009 Annual Meeting
RE: Automatic Temperature Correction Voting Items

Dear Mr. Gomez and L&R Attendees:

On behalf of the Arizona Petroleum Marketers Association, I would like to thank you and your colleagues for your time and efforts in addressing the issue of automatic temperature correction (ATC) and whether the equipment should be permitted or mandated for use in the retail marketplace.

Given the current economic climate, retailers across the country are justly concerned. The potential implementation of ATC devices at retail should not be adopted hastily. To date, it has not been clear at NCWM meetings or at regional W&M meetings how the petroleum marketing landscape will be improved for consumers with the adoption of ATC, nor has it been vetted out among NCWM officials exactly how an ATC marketplace would provide consumers with greater clarity regarding the energy content of their fuel purchase. Various gasoline formulas have varying BTU's and ATC devices do not balance out the BTU difference for consumers.

Having attended the NCWM's annual meetings since June 2007, APMA urges NCWM officials to vote NO on L&R voting items 232-1 or 232-2 for the following reasons:

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

This first voting item on ATC is a multi-prong proposal which would permit ATC for both wholesale and retail devices as of January 1, 2010 and then mandate ATC for both wholesale and retail devices as of January 1, 2020. The permissive and mandatory provisions have a caveat so that they are not effective where they conflict with other statutes or regulations.

NCWM in the past asked industry to weigh in on the various scenarios in which retail ATC would be implemented and whether there should be a permissive phase and/or ultimately a mandatory phase. NCWM officials need to recognize that a permissive retail ATC scenario will create an unlevel playing field in the petroleum marketplace. In fact the ATC Special Committee actually recommended that any permissive stage be as short as possible.

By allowing the installation of ATC to be permissive, NCWM is essentially allowing large well-financed retailers to use the ATC regulation as a potential way to gain an unfair market advantage over smaller retailers. When coupled with the recent additional tank requirements under the federal Energy Act of 2005, many small retailers may decide that they can't afford to make these costly changes to their operation and close shop. Ultimately, this harms the consumer by decreasing competition in the

Permissive ATC also creates major confusion for the consumer because they can no longer compare station's pricing based on the same gallon being sold station to station. While the temperature in Arizona may very well be over the 60 degree standard---the temperature is constant corner to corner—consumers can easily compare price per gallon from the street—even if it is a gallon at 80 degrees. However, under a permissive retail ATC scenario, a consumer will be hard-pressed to compare stations selling ATC fuel versus retail sites selling traditional gallons.

Additionally, if some states decide not to implement retail ATC while other states do implement it---interstate commerce and taxes could be significantly impacted as well.

Overall, voting item 232-1 would not result in a better petroleum marketplace for consumers but instead will result in almost ten years of uncertainty and confusion for consumers regarding the legal method of sale for petroleum products.

Another concern with voting item 232-1 is section 2.32.2.2 (c) 3, which states that "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." Because NCWM changed its definitions for wholesale and retail devices in 2004, many transactions which industry would consider wholesale are considered transactions with retail devices and would now fall under this provision.

So, it is possible for a petroleum jobber who delivers to agricultural customers and/or business fleets to be in a situation where one customer may request their deliveries to be ATC and another customer does not want ATC. This jobber would no longer be able to deliver fuel to both customers under the proposed provision because the tanker to deliver that fuel would have to have a vehicle tank meter with ATC and be dedicated to delivering ATC gallons only for twelve months to accommodate the customer requesting ATC, thereby no longer able to deliver non-ATC fuel to his other customer.

Voting item 232-1 does not contain any flexibility in it to address the hardship or difficulty in implementing the new method of sale for specific customers. While APMA recognizes that the purpose of section 2.32.2.2 (c) 3 is to prevent a "traditional" retailer from selling through the compensated or uncompensated dispenser only when it benefits the seller, the language in the proposal snags what would be considered wholesale transactions by industry due to the definition of retail devices.

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

The second ATC voting item in L&R allows for the use of ATC where it is not in conflict with other statutes or regulations. It essentially codifies permissive ATC for states wanting to implement ATC and for those 18 states which automatically adopt the regulation by reference or citation.

Voting item 232-2 also contains section 2.32.4.2 under Other Provisions which states "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…"
APMA would urge voting members of the NCWM to reject voting item 232-2 for the same reasons that 232-1 should equally be rejected.

Creating the infrastructure to allow for two legal methods of sale for petroleum products sanctions a confusing and chaotic marketplace for consumers where they can no longer compare prices between competing stations at an intersection. NCWM would essentially be injecting inconsistency into the market.

Voting item 232-2 will also inadvertently harm those engaged in the wholesale jobber business and force them to make a decision to serve only customers wanting ATC or those not wanting ATC products. This voting provision essentially requires them to have all of their vehicle tank meters to dispense ATC if they choose to serve a customer who wants product delivered ATC.

POTENTIAL FUTURE SOLUTIONS

In the interest of cooperation and better understanding on ATC issues at retail; APMA would like to see NCWM prohibit the use of ATC for retail devices. There still does not appear to be consensus that ATC benefits consumers or creates a better marketplace for consumers. If NCWM is not of a consensus to mandate a new legal method of sale for petroleum products it does not seem just that NCWM would allow for multiple methods of sale to exist for a product. Prohibiting ATC at retail, even if it is for a finite time, would allow for a much more meaningful and merit driven debate on whether ATC should become the new legal method of sale for petroleum products.

At the same time, it would be beneficial to have L&R take a closer look at the definitions of retail and wholesale devices and also consider whether it might make sense to develop definitions for actual transactions—wholesale versus retail to account for various end user tanks. It also seems appropriate for L&R and/or the regional W&M associations to consider language which would provide jobbers with some flexibility recognizing the diversity of customers served.

APMA truly appreciates the opportunity to share our concerns with NCWM officials. We intend to remain active and engaged on the issue of ATC for retail devices and hope that the ultimate decision reached by any state legislature or regulatory agency will be one which balances science and the best interest of the consumer.

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July 6, 2009

Joe Gomez, Chairman
NCWM Laws and Regulations Committee
New Mexico Department of Agriculture
MSC 3170, PO Box 30005
Las Cruces NM 88003-8005

Dear Chairman Gomez,

I have been a student of the ATC issue for many years. My connection to the issue began with my first trip to an NCWM meeting in Portland, Oregon in 1979. The ATC issue was already an old issue at that time. I have also conducted my own research and reviewed multiple papers on the subject, both pro and con. I served on the NCWM ATC Steering Committee and I was contributor to the California Energy Commission study. Based on long and careful study of the issue, I must urge you to withdraw your proposals that either permit or mandate the use of ATC at retail. In addition I urge you to consider offering instead a proposal that recognizes the current method of sale on the gross basis but puts it formally in regulation with a ban on artificial heating.

I am also submitting a paper that exposes the weaknesses in the arguments for increased fairness with ATC. For many years we have heard claims of great economic losses and of unfair competition. I believe my presentation and written materials combined with works of many other more worthy experts has dispelled every one of those claims. The paper attached tries to show that the fairness claims are presently unfounded since even the supporters of the argument must admit that there is no empirical data to show that variations between stations are significant. In addition, there is no cost based analysis of any kind that shows ATC pays. Thus your two proposals are promoting a solution where there is no problem to solve.

Weights and Measures professionals have always recognized that allowing reasonable variation is necessary to keep costs of measurement low. In my paper I reference both Handbook 44 and 133 and show that they both limit variation to prevent serious harm to either buyer or seller. We have no evidence to support any claim that the variations in the present system are unreasonable or cause any serious harm. The recent draft report from the Alaska Fuel Metering Project calls this a lottery that participants (both buyers and sellers) have a 50% chance of winning with jackpots measured in pennies. Thus I have always been confused by the eagerness of this Committee to move ATC forward without valid supporting facts.

Two years ago at the Annual Meeting in Park City New York abstained from voting on the ATC proposal. I told the Committee in open hearings that we did not have sufficient information to make a valid decision on public policy at that time. I urged the Committee to craft its report in the form of a Regulatory Impact Statement (RIS) exactly to show that we did not have that information. Now we are again faced with voting items that the Committee hasn't justified.

The CEC report left us with a powerful visual image for California of an equal arm scale loaded on the cost side with $210 to $410 million and loaded on the benefits side with a meager $3.8 million. What were the critical issues and indicators that convinced the Committee that fairness issues would trip that balance to the other side? They are not in your report. Instead we are directed to view the reports of past years and they too lack any conclusive justification for either of the proposals now up for vote. If you had the justification, I would have expected to see at least a comprehensive summary of what tripped the scales for you in the text of this year's report. Those needed to be very powerful arguments because of the overwhelming imbalance. I and about 30 other state directors need that summary to help us craft the RIS text for our states.

I am very concerned about the lack of consensus and what appears to be a lack of interest in consensus by the Committee. I quote from page L&R -5 of your report:

> *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 was 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 consensus building process that is the hallmark of the NCWM is not visible in this paragraph. Instead I see a straw poll decision making process. Let's float a few ideas and see if anyone takes a fancy to one of them? Perhaps that meaning is not what you intended to say, but it most definitely leaps off the page when you read it. We should not be voting to see if we have a consensus, we should vote only when we are confident we have actually reached that consensus!

Does this Committee somehow claim to have a consensus when the four regional associations are split two for and two against ATC, the regulated industry is 100% opposed to ATC, and even consumer interest groups are running 70/30 against ATC? By the basic rules of engagement, the supporters of ATC have to make a case that change is cost beneficial. I submit they have failed to make that case and this has been exposed by the works of the economics experts. The arguments for fairness are equally as hollow as the hot fuel rip-off arguments and as I have shown they only make sense when you constrain retailers to make business decisions that don't make sense.

If you are using straw polls to create NCWM standards, why only offer us net gallon options? I am confused as to why a gross gallon proposal that adopts the status quo with a ban on artificial heating has never appeared in your previous reports. The ban on artificial heating could eliminate the only real problem ever identified in our discussions, namely a few above ground storage tanks that were painted black. Why is it that we could not even discuss a gross gallon proposal? Why is the method of sale we are using today, and have used for 80 years, not worth codifying in regulation to eliminate confusion?

I have served on the L&R Committee and I know that the issues are not easy to resolve. Gaining consensus on controversial issues takes hard work on everyone's part. I urge the Committee not to make rash decisions without a consensus and continue to work toward that consensus. Please do not force a vote on the two proposals in your report. Unlike two years ago, today we have the information necessary to vote intelligently against any proposal that either permits or mandates ATC at retail. I would much rather vote for something that really represents a consensus.

Respectfully submitted,

Ross Andersen, Director, New York State
Michael Sikula, Assistant Director

Is the ATC "Fairness" argument just as hollow as the hot fuel allegations?
Ross Andersen, New York State
July 6, 2009

There are numerous claims that temperature compensated measurements are more comprehensive and thus more fair than the present gross gallon measurements for fuel transactions. These claims are not new and can be traced to debates at the NCWM from the early 1970's. Henry Oppermann's latest paper on the subject [1] is essentially a restatement of those assertions with the addition of some new analysis of temperature data gathered over the last few years. He strains to force the data to fit his arguments by pushing the wrong point of view, i.e. a focus on individual transactions rather than on reasonable averaging. In the process he attempts to invalidate long standing principles in Weights and Measures that have always permitted reasonable variation within a framework of tolerance.

Mr. Oppermann is correct to use NIST Handbook 133 [2] as a good focal point. That standard recognizes that variations within reasonable limits are acceptable and it further recognizes that averaging is an acceptable business practice for the packer to make business decisions. Mr. Oppermann is essentially arguing that the Handbook 133 approach is wrong, i.e. that the retailer should be using technology to ensure each package contains the exact net weight regardless of cost, and that averaging variations is not a solid business practice for either the buyer or seller.

In Section III of his paper Mr. Oppermann states, "Product temperatures can vary greatly at retail. Consequently, temperature differences are significant at retail." We are expected to take that statement at face value and without question. Taking the view of an impartial arbitrator in this case, I am required to question it and I believe the burden of proof lies with those who would seek change. We have heard the claim that temperatures vary greatly many times over the year, but never have we heard what objective standard is being used to judge whether that assessment is correct. Is the variation excessive or is it actually within reasonable limits, i.e. within tolerance? Nor have we seen any explanation of how the significance of the impact of the variation on retail trade practices was assessed.

I will try to show that those advocating for ATC have essentially failed to see the forest for the trees. They zoom in, but you can't assess the viability of the forest from that point of view. This is critical since ATC advocates have never made a positive connection between fuel temperature variation and profit or loss for either buyer or seller. While many have made claims of that connection, I do not believe that anyone has yet convincingly made arguments to support it. Specifically, they cannot project that any change at the individual transaction level with ATC will impact the pricing practices of the seller or the purchasing practices of the buyer. If this connection cannot be made convincingly, then any cost to upgrade will accrue to the buyer but not result in delivery of any additional fuel or increase in value to the transaction.

To continue the HB133 analogy, compare transactions involving other commodities. A one pound package of hot dogs or chicken can vary in value (net weight) up to 6.25%. For other non-meat products the permitted variation is 4.4%. Energy content of conventional gasoline without ethanol can easily vary 5% due to fuel composition. With added ethanol the variation is even larger. In the case of a retail fuel sale the variation due to temperature is about 1%. On what basis do you say this is too large?

To look at it in another way, let's consider the gas station that buys 100 loads of fuel of 10,000 gallons each and averages the price over each tanker. Is this not equivalent to a packer putting

up 100 production lots of 10,000 packages each? The packer is permitted to average over the production lot just as the retailer averages over the sale of each tanker load. Provided no one is seriously harmed by the individual transaction variations and the average is very close to the true quantity, I suggest you cannot find that anything is out-of-tolerance. I further submit that nothing I've seen in the fairness arguments have supported that conclusion that anything is out-of-tolerance.

Do the transactions average close to zero? Yes, even Mr. Oppermann admits this in Section IV where he states, "If one looks only at the average difference between the BOL temperatures and the temperatures of the product delivered over a period of a year, the average differences are relatively small, often less than 1.5 °F." In the marketplace we find the averaging comes very close to zero, even over much shorter averaging periods, as retailers must be able to justify any significant inventory gains or losses to tax, environmental and fuel quality auditors. Most people in the retail fuel business will acknowledge that fuel sale temperatures are varying slightly, but claim that intense competition forces them to make correction for the macro impact of those variations in their everyday business decisions.

Mr. Oppermann also fails to mention that in aggregate the gains and losses in inventory at retail have traditionally been in favor of the buyer, as retailers typically sell less gross gallons than they buy. I provided a specific example for a local retailer that showed the gains and losses do average close to zero even on a weekly or monthly bases and the aggregate is close in agreement to the 1.5 F mentioned by Mr. Oppermann. I also was provided data from the Pilot Truckstops in California that confirmed similar findings. For over 120 million gallons of diesel fuel sold in 2008, the 10 Pilot truck stop locations lost a total of 114,000 gallons of inventory and I was told this is consistent year to year. This is close to 0.1% loss resulting from selling fuel about 2 F colder than they purchased it.

The weights and measures community adopts NIST Handbook 44 [3] as the regulation for assessing compliance of commercial weighing and measuring equipment. The philosophy used to set device tolerances is given in Fundamental Considerations section 2.2. Theory of Tolerances. This philosophy is entirely consistent with Handbook 133 as it is also based on keeping the average close to zero error (also see section 2.3. Theory of Adjustments). That standard declares the intent to set tolerances so as to prevent "serious harm" to either buyer or seller, yet keep the cost of the measuring equipment low. Commercial equipment needs to be practical, i.e. "good enough" to meet commercial needs. Yet ATC advocates seem to disagree with this principle as with the Handbook 133 averaging concept. They believe that variation is unacceptable and advocate using the best equipment available regardless of any cost benefit relationship. Would it not seem appropriate for them to show some serious harm in the present system? Otherwise, would it not be appropriate to show some cost benefit relationship for the improvement? I submit they have completely failed in either regard.

The California Energy Commission's Report [4] suggested a method to evaluate "fairness" through experiments to assess the significance of between station temperature variations and consumer willingness to pay the ATC costs. While we acknowledge variation exists due to temperature, no one has yet split out the within station and between station variations that comprise the total variation. The temperature data collected thus far only provides total variation. Simply stated, we do not know if the between station variations are significant! The CEC with assistance from Murphy & Topel [5] used a 10 F range to reach their conclusions that ATC did not pay economically. Yet the ATC supporters would have us commit to spend these enormous sums to implement ATC without valid facts.

We already have some consumer perspective and they are polling at least 70-30 against ATC. The consumer groups that support ATC made their pitch primarily on the basis of the hot fuel allegations with fairness being the icing on the cake. Now they are left with only the fairness to carry the entire battle. The ATA makes very powerful arguments that they do not see any benefit for them in ATC. This consumer group appears to dwarf the others in the membership they represent and in their fuel purchasing power.

In addition, the CEC plan seems to have left out the retailer. Can we conclude that the uncertainty due to between station variance is of no concern to retailers? What about competitive fairness? The retailer does not know any more or less than the retail customer how his fuel temperature compares to any of his competitors. Shouldn't we also include the retailer's interest in ATC as a factor as well? Perhaps the Commission left them out since retailers had already testified to the NCWM on the issue. That testimony indicated they strongly believed the fairness benefit they would accrue with ATC was clearly not worth the cost.

There are several other arguments made by supporters of ATC that strain to have merit. I'd like to identify several of them as they appear in Mr. Oppermann's paper and have been argued in the NCWM proceedings. The section references in () refer to Mr. Oppermann's 6/14/09 paper.

- Wholesale and Retail trade are equivalent since what is good for wholesale is good for retail (section II). I find this argument totally untenable. For one thing I estimate there are about 50 retail devices for every wholesale device. Thus the cost of ATC will have to be about 50 times greater per gallon at retail to compensate the same volume of fuel. I submit that you can't assume they have the same expectations nor would they make the same business decisions.
- Variations in temperature result in errors in unit prices that reach in excess of 1% (section IV). This of course demands that costs and margin are always passed through to the buyer at 1 for 1, and there is no feedback on incorrect business assumptions. Since the retailer makes price changes on a daily basis or perhaps even more often, the ATC advocates have not provided room for any possible minor adjustments within the system. I see the opposite in the works of Flynn [6] and Murphy & Topel, and the Alaska Fuel Project [7]. They understand that retail pricing is a dynamic process that is always working to find equilibrium. I hold that inventory gains and losses do factor into price setting and do correct for minor offsets. If retailers see inventory gains their target prices adjust down and if they see losses their target prices adjust up. Due to market factors the retailer may be forced to accept less than the target in some cases and may be able to get more than the target in others. The fairness arguments fail to allow for this flexibility and we see this same type of constraint on the market in the hot fuel allegations.
- Showing dollar figure losses are supposed to indicate significance (Section IV). Mr. Oppermann provides estimates of $0.30 cent losses at $2.00 per gallon on a 15 gallon purchase as proof of harm. But isn't harm relative? Against what standard shall we assess the relevance of these individual transaction variations? The ATC supporters have not even suggested a standard nor have they provided justification for their assessments. Instead we are asked to accept their opinion on significance without question. The authors of the Alaska Fuel Project describe this as a lottery in each purchase that both buyer and seller have a 50% chance of winning but the winnings add up to pennies.
- Gross gallon sales are like the sale of hamburger where the variation reaches 100% (Section V). We have heard this argument many times but note that it is really

meaningless as the variation we are discussing is really around 1%. Can the ATC supporters make the same claims when the delivered value varies only by 1%? The retailers consider the temperature variation to be reasonable or "in tolerance." ATC supporters have never made a case that the variation is excessive.

- Mr. Flynn's projection of gross price changes are not reflected in actual retail prices (Section VI). Here Mr. Oppermann compares two graphics and the reader is expected to see that the two graphs do not match in the pattern of change. However, it is important to note the differences in Y scale. Mr. Flynn's graphic has a 12 cent Y scale and the retail price graphic has a 160 cent Y scale. Had Mr. Oppermann redrawn Mr. Flynn's graphic in equal scale, the price changes would have almost been a straight line. It would not have had any visual impact since the variation due to temperature is totally dwarfed by the market fluctuations due to non-temperature related factors. It is unreasonable to suggest that you could conclude anything from those two graphics. Indeed, to suggest from that comparison alone that Mr. Flynn's projections are unsupported is preposterous. He was trying to show that the hot fuel profits cannot be seen in other independent studies of station profitability. He suggests that if the price changes he projects were not made, then stations in California would be almost $60,000 more profitable each year than their Minnesota peers.
- Mr. Flynn's Scenario # 1 of equal fairness when buying and selling in gross units is invalid since it contains variation (Section VIII). Why is reasonable averaging not permitted? Variation is part of every measurement system. Clearly the inventory gains and losses are small over any small period of time and this indicates that the small losses and gains in individual sales do average out very near zero error. I believe that retailers assume they are all competing at the same local average temperature and in aggregate, the system is in tolerance. There is also going to be some variation in net gallon purchases and sales. Does that mean we can also invalidate scenario 4, buying in net and selling in net, as well? I do not see how Mr. Oppermann summarily dismissed the argument without some justification that the system under scenario 1 was in fact out-of-tolerance.

'o see the crux of the argument, look near the bottom of page 1 of his paper [1] where Mr.)ppermann asks, "Are weights and measures officials interested in accurate measurement only n the basis of an annual average or are they interested in the accuracy of individual ansactions?" Clearly my answer is, neither of those is the right choice. To the extent ATC upporters make this argument, they are trying to restrict the reality to make a case. They are ssentially tossing basic W&M philosophies and premises out the window. I suggest that we ıust find the point of view where we can examine the retailer's price changes and see what npact fuel temperature and temperature variations have on those changes. The averaging one by the retailer is going to be over a rather short period, maybe less than one day to erhaps two or three days. Either way, it is much shorter than the annual average that ATC upporters try to impose as a limitation.

Aore important, can temperature variability at the individual transaction level really drive the ıarket? I conclude that is also preposterous. The retailer can't be expected to think and act in ıicro terms. It is totally unreasonable for the retailer to check the inventory and the money alance in the till after every single transaction with intent to adjust the advertised prices.

t the other extreme, the retailer can't set a price on May 15th with no further check on rofitability until COB the following May 14th. Clearly the retailer has to operate on a macro level nd the critical time frame lies somewhere in between the individual transaction and the annual verage. I suggest that the market forces the retailer to find the correct time frame in order to

stay in business. It's also critical to keep in mind that the appropriate time frame to assess temperature variations may be different than for variations in other market factors. Thus I would ask Mr. Oppermann's question in a slightly different way. Instead of asking from the W&M official's perspective, how about asking from the perspective of a buyer or seller. What real improvement will be made with ATC, if the averaging of the temperature correction with gross sales is made at the daily or tanker load level with minor corrections made for the small inventory gains and losses? Clearly the answer for both parties is little or none. This is in concert with the findings of Flynn, Murphy & Topel, and the Alaska Fuel Project who conclude the consumer cost for the same quantum of fuel will not change with ATC.

Thus I conclude that the supporters of ATC have grossly failed to make the case for ATC. I submit the system is operating within tolerance. In particular, there is no objective standard to suggest that the minor daily temperature variations in the fuel are in any way excessive. There is also no clear connection between these temperature variations and any profit or loss to either buyer or seller. Finally, critical facts regarding an analysis of between station temperature variations are missing. We are left with the cost side of the balance loaded with $210 to $410 million in costs projected by the CEC over the first 20 years in California alone. The benefit side contains only a meager $3.8 million in potential economic benefits for California and the vague promise of some increased fairness. The consumers I speak for want to know that ATC will either get them more fuel for their dollar or get them better fuel that carries their vehicle farther. Where is the evidence to suggest either will happen if we implement ATC? Frankly it does not exist!

References:

1. ATC as a Better, More Comprehensive Form of Measurement, Henry Oppermann, Weights and Measures Consulting, LLC, testimony submitted to NCWM L&R Committee, June 14, 2009.

2. Checking the Net Contents of Packaged Goods, NIST Handbook 133 (Fourth Edition), January 2005, refer to section 1.2 on pages 2-3.

3. Specifications, Tolerances and Other Technical Requirements for Weighing and Measuring Devices, NIST Handbook 44 (2009 Edition), January 2009, refer to Appendix A. Fundamental Considerations sections 2.2. and 2.3.

4. Fuel Delivery Temperature Study, California Energy Commission, Transportation Committee, January 2009, Report No. CEC-600-2009-002-CTF.

5. Comments on the California Energy Commission's Fuel Delivery Temperature Study, Kevin M. Murphy & Robert H. Topel, University of Chicago, January 12, 2009.

6. An Economic Analysis of the California Energy Commission Staff's Fuel Delivery Temperature Study and the "Hot Fuel" Allegations, Michael A. Flynn, LECG, testimony submitted to the Commission and also distributed at the NCWM Interim Meeting, January 2009.

7. Alaska Fuel Metering Project (Draft May 18, 2009), Northern Economic Research Associates, www.alaskafuelproject.com

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National Conference on Weights and Measures
Joe Gomez, Laws and Regulations Committee Chairman
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July 8, 2009

Dear Chairman Gomez:

On behalf of the Petroleum Marketers Association of America (PMAA), I would like to express my concerns regarding the upcoming voting items on automatic temperature compensation (ATC) at retail. PMAA believes national uniformity in retail motor fuels measurements benefits consumers and must be preserved. We strongly recommend that both the permissive and mandatory ATC at retail gas stations and truckstops be prohibited.

The retail petroleum business is one of the most competitive industries in the United States. Few industries advertise their prices on big signs that are visible to consumers from the highway. Because of competition, consumers are currently getting the best possible retail price everyday and fuel temperature is not a factor in retail pricing decisions. Proposals to mandate costly automated temperature compensation (ATC) equipped dispensers at retail outlets will only add most costs to consumers.

For over three years, PMAA has been actively engaged in the discussion of proposals to mandate or permit gasoline station owners to install ATC devices to compensate for temperature on a gallon of gasoline. PMAA supported the California Energy Commission's (CEC) thorough analysis which provides an independent review on the costs and benefits of ATC refueling pumps. It is our belief that NCWM officials might rely on the CEC's independent analysis in determining their decision to either vote for or against the two upcoming voting items on ATC.

PMAA applauds CEC's thorough report, which included these findings on ATC:

- The costs of ATC far outweigh the benefits, even when using the low-cost estimates. *"The cost-benefit analysis concludes that the results are negative or a net cost to society under all the options examined."* (pg. 1) *"Net costs to society amount to approximately $245 million . . . over a 20 year period."* (pgs. 76-77)

- Consumers will not receive larger gallons with no corresponding increase in retail price. *"But the perception by various stakeholders that the price of the retail fuel would not be raised to compensate for the selling of slightly larger-sized 'gallons is unrealistic'..."* (pgs 111-112)

- There will be no economic benefit to consumers. *"...it is unlikely that there are any plausible circumstances whereby some consumers could realize a small net benefit of ATC at retail in California."* (pg. 113)

- Retrofit costs would be expensive and small retailers might have to close up shop. *"If ATC was to be mandated at retail stations in California, it is possible that the expense to comply with the regulation could be onerous for some station owners. Some of these station owners may be unable to obtain adequate financing and could possibly close their business;"* (pg. 111) *"The closure of a retail station that was either the sole or one of only two sources of retail fuel for a community could create a local fuel supply availability problem."* (pg. 111)

- The NCWM should promote unity in the market-place, but under the two voting proposals, they are not supporting consistency. It is important to understand that there is consistency in fuel distribution from the rack to the customer right now. Gross gallons are distributed at the rack, gross gallons are distributed through the wholesale chain, and gross gallons are distributed at retail. What is changed (only at the rack) is the price. ATC implementation at retail will change dispensing from gross gallons to net physical gallons at the pump. This brings inconsistency into the distribution chain not greater consistency.

Permissive ATC Concerns

While states can currently mandate or permit retail ATC if they choose, it is more difficult to implement without references and guidelines from NCWM. We believe NCWM should not make it easier for states to adopt ATC because it will seriously disrupt national uniformity. Currently, mainland U.S. consumers benefit from exact measurements of the gallon. If states began mandating or permitting ATC, consumers could not compare prices and get the best price especially in state border markets. Both permissive and mandatory ATC will harm consumers rather than help them.

Mandatory ATC Concerns

Mandatory ATC will disadvantage the consumer as the costs associated with installing and maintaining ATC equipment must be passed on to the consumer with no net gain in energy. It is also important to note that one of the country's largest fuel consumer groups is on record opposing both mandatory and permissive ATC. In a letter to the NCWM dated January 14, 2008, the American Trucking Associations expressed its opposition to both ATC proposals citing that it would result in higher consumer costs.

Uncertainty regarding the first ATC Voting Proposal (232 – 1)

There is also uncertainty in the marketer community regarding the first ATC voting proposal (232 -1) – specifically, wholesale fuel transactions (Sec. 2.32.2.1). I understand that the provision would make ATC wholesale transactions permissive for ten years and then would require mandated ATC use at wholesale by January 1, 2020.

Several questions are raised by this confusion:

- What constitutes a wholesale transaction? Is that from the rack to the distributor or from the distributor to the final customer or both?
- Does this provision mean that ATC would be mandated on transports (bob trucks or tank wagons) when they deliver fuel to the customer's delivery point?
- If so, would the metering equipment for the wholesale transaction adjust the customer's price or the volume?
- Has any cost information been gathered regarding installation of temperature compensating equipment on fuel transport vehicles?

This information is needed so that I can respond accurately to the proposals being considered before the Committee.

PMAA represents over 8,000 independent petroleum marketing companies who are not "big oil." Of the 160,000 U.S. retail gasoline locations, over 97 percent are owned by independent businessmen and women. Because of the reasons stated above, I ask that you oppose both the permissive and mandatory use of ATC at retail.

PMAA would like to thank the Committee's work to date. If you have any questions or concerns regarding the comments given above, please do not hesitate to contact me.

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Motor Fuel Temperature Adjustment Fact Sheet

By law, since the early 1900's, retail sales of motor fuel in the US have been made based on a single-size volumetric gallon – defined as 231 cubic inches without reference to temperature. These standard size gallons are defined by law, reflected in dictionaries, and have long been used in the retail trade. Some parties have suggested that retail sales of gasoline and diesel be based on temperature-adjusted "gallons." Temperature adjusted gallons change in size, becoming larger or smaller as the temperature of the fuel sold rises or falls. The adjustment in the size of the gallon sold would be accomplished using an automatic temperature compensation (ATC) device installed at the retail motor-fuel dispenser.

Some propose that the NCWM mandate that every retailer install ATC equipment to adjust the measurement of all fuel dispensed. Others are against ATC and oppose any change to the current practice of retail sales of gasoline and diesel based on the standard volumetric gallon.

According to the Energy Information Administration in 2008, approximately 137 billion gallons of gasoline and 40 billion gallons of diesel (60B gallons of distillate) was consumed in the United States.[1] API believes that any analysis of temperature compensation by the NCWM should thoroughly address all aspects of ATC implementation, including economics, market issues, and potential consumer impact before any decisions are made.

The American Petroleum Institute members own about 5% of the 162,000 retail stations and operate less than half of the retail stations that they do own. When a station bears a particular API member's brand, it does not mean that the API member owns or operates the station. The vast majority of branded stations are owned and operated by independent retailers licensed to represent that brand. According to the National Association of Convenience Stores (NACS), more than half of the 162,000 retail stations in the US are owned by an individual or family. Through various branding agreements, approximately 40% of the retail stations in the US sell fuel under API members' brands.

Recently two states have released final reports on the issue of fuel delivery and metering: California and Alaska.

California

In March 2009 the **California Energy Commission** delivered a report, "Fuel Delivery Temperature Study," in response to California law AB 868. The CEC report has several important conclusions:

[1] www.eia.gov

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1. "If the ***only criterion*** for assessing the merit of mandatory ATC installations for use at California retail stations is a net benefit to consumers, the Transportation Committee (Committee) of the California Energy Commission concludes that ATCs should not be required since the results of the cost-benefit analysis show a net cost for consumers."[2]
2. "...[T]he perception by various stakeholders that the price of the retail fuel would not be raised to compensate for the selling of slightly larger-sized "gallons" is unrealistic if retail station owners are expected to maintain a similar level of profitability before and after a conversion to mandated ATC. Staff assumes that since the industry of retail station owners and operators will continue to grow and remain profitable. The conclusion is that retail station owners will in fact raise their fuel prices to compensate for selling fewer units, all other things being equal."[3]
3. "If the Legislature chooses not to mandate the use of ATC at retail stations, they should clarify if the current intent of the existing statutes is to permit or prohibit voluntary ATC at retail outlets for gasoline and diesel fuel."[4]
4. "The [CEC] recommends that the Legislature also consider whether the possible value of increased fairness, accuracy, and consistency of fuel measurement, in addition to the benefits quantified in the cost-benefit analysis, justify mandating ATC at California retail stations."[5]

CEC report conclusions regarding costs:

1. "If ATC devices are mandated, California businesses would incur a total first cost between $103.8 million and $127.4 million, or between $10,704 and $13,136 per retail outlet. Recurring costs for more expensive ATC-ready dispensers, maintenance, and higher inspection fees would total between $7.4 million and $20.6 million per year."[6]

CEC study conclusions regarding benefits to the consumer:

1. "California consumers could expect a slight financial benefit of approximately $258,000 per year due to this increased price transparency."[7] According to the website, EconomyWatch.com, the California gross state product is $1.543 trillion. Thus the benefit is essentially zero.

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alifornia Energy Commission, Fuel Delivery Temperature Study, CEC-600-2009-02-CMF, March 2009,
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CEC study conclusions regarding how fuel is purchased at wholesale and retail:

1. "According to a recent California Energy Commission (Energy Commission) survey of the distribution terminals serving California, transactions at the terminal are measured in gross gallons and then a software calculation is done using the API gravity and temperature of the dispensed fuel is used to calculate the quantity of net gallons. The net gallons are then multiplied by the posted net gallon price to calculate the total cost for that load of gross gallons of fuel."[8]
2. Thus, retailers purchasing product at the terminal receive a gross gallon that was paid for using a net calculation.
3. If ATC is implemented at the retail level, the consumer will purchase a differently sized gallon that is based on temperature.

Alaska

In July 2009 the Alaska state government released its final report, **"Alaska Fuel Metering Project"** that reviews the issue of ATC. The report has several important conclusions:

1. "The purpose of this report was to determine what definition of 'gallon' should prevail in Alaska petroleum retail markets. The conclusion of the report is that given present technology, there should be one retail petroleum gallon in Alaska – and it should be the standard 'gross' gallon already familiar to consumers. A requirement to sell 'net' gallons would force the statewide adoption of more expensive dispensing equipment, and the costs would outweigh the benefits.

   "Comment on the draft report suggested that the study may have pursued the objective of choosing the retail gallon that was the least expensive for the consumer. But that was not the objective of the study. It is tantamount to saying benefits were not considered. They were. But benefits did not justify the costs vis-à-vis a gross gallon standard."[9]
2. "It is more expensive to meter net gallons because it requires taking the temperature of the fuel and adjusting the size of the gallon, depending on that temperature. Ultimately, the cost of doing so will be borne by the consumer."[10]
3. "The gross gallon standard is not a perfect way of metering fuel, but it is the most economical. In all of the studies that were reviewed where gross gallon vs. net gallon standards were studied from a cost/benefit standard, the gross gallon

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orthern Economic Research Associates, "Alaska Fuel Metering Project, Final Report," State of Alaska partment of Transportation and Public Facilities, Measurement Standards and Commercial Vehicle forcement, July 5, 2009, p. 5
d, p. 7

proved to be superior. So it should not come as a surprise to find the same thing in Alaska."[11]

4. We are not concerned whether delivered fuel temperatures vary from 60F. We are concerned with how much temperatures variation there can be between retailers essentially across the street from one another and competing for the same customers. It makes no difference to temperature compensate fuels when temperature fluctuations are minimal between suppliers. It does not make sense to bear the cost of adjusting for something that as a practical matter makes no difference."[12]
5. "[The California Fuel Delivery Temperature Study] has now been completed and the upshot is that temperature compensation costs are not worth the limited and unclear benefits."[13]

Some have alleged that consumers are losing billions of dollars because there is no automatic temperature adjustment of retail gasoline sales. This allegation is incorrect. Consumers purchase motor fuel dispensed in a uniform measurement that is developed and approved by the NCWM, adopted by state laws and regulations, and sold in a competitive marketplace, in which prices reflect a range of factors, such as supply, demand, distribution logistics, temperature, etc. Consumers are able to compare advertising and signage at retail stations and decide which product they will purchase. By definition, consumers aren't "losing" money because they are receiving a gallon of motor fuel for every gallon of motor fuel they purchase--the very unit posted at the pump, and the very unit retailers are legally required to provide throughout the United States.

A common misconception is that temperature compensation would guarantee a uniform energy content for every gallon of gasoline. This misconception ignores many factors other than temperature that affect the energy content of gasoline.

In general, denser fuel contains more energy. Density is affected by the type of crude oil and the refining process used. The density of the gasoline also changes with the seasons where some areas use various winter-boutique fuel formulations designed in part to promote cold starts and better car performance by making the fuel more volatile, resulting in less energy per gallon. Conversely, some states mandate various summer-boutique formulations that are designed to lessen evaporation, making the fuel denser and helping to reduce ozone pollution. Further, fuels that contain ethanol contain less energy than gasoline without ethanol because ethanol contains about two-thirds of the energy of gasoline.

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[11] Id, p. 7
[12] Id, p. 12
[13] Id, p. 20

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For these reasons, among others, uniform energy content for gasoline is virtually impossible to achieve. Gasoline from different service stations will likely have different energy content per gallon even if the law was changed to mandate or permit ATC at the retail level.

Some have asked why temperature adjustment is used for wholesale gasoline transactions (supplier sales to retailers and exchanges between suppliers) but not for retail sales. Temperature compensation is **not** used in all supplier sales to retailers. By law, some states require temperature adjustment in wholesale transactions, some states allow it but do not require it, some states prohibit it altogether, and some states give the wholesale buyer the right to choose whether sales will or will not be adjusted for temperature. Thus, not all wholesale transactions are adjusted for temperature.

Certain gasoline suppliers and resellers buy and sell very large volumes of gasoline at different locations that may be hundreds or thousands of miles apart, often in markedly different climates, and at varying times of the year, all of which warrant accounting for the impact of temperature variations. In contrast, retail gasoline sales occur at far smaller quantities, in a local competitive market, at a specific time, and under specific conditions, including the specific fuel temperature.

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July 10, 2009

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COMMENTS ON L&R NCWM MEETING AGENDA ITEM

Reference L&R 2.32.1.1. Quantity, Wholesale Transactions.

"Method" of Temperature Compensation is being specified as "Density". The Coefficient of Thermal Expansion Method also needs to be included.

The "method" of Temperature Compensation is being specified in paragraph 2.32.2.1 as "Density". The widely used and accepted electronic register method for Automatic Temperature Compensation is the Coefficient of Thermal Expansion Method. The Coefficient Method needs to also be included, and the coefficients of thermal expansion for the products defined along with the densities in table 2.32.1. The coefficient for Gasoline that is normally used is .00070 for degrees F and for Diesel 0.00045.

Note that the Coefficient Method is accepted per the S&T information U.R. 3.6.1

Extracted and noted:
L&R
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)

1

Correction shall be made automatically for the fuel temperature either based on the fuel standard dens
coefficient of thermal expansion) **and reference tables specified in Table 2.32.1. or based on the act**
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 shall make those records available for inspection by a weights and measures official on request during 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 wit unit of measure and the terms "Volume corrected to 15 °C" (60 °F)or"Volume corrected to 15.56 °C."

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)
Gasoline, gasoline-oxygenate blends (3.7 mass percent oxygen, maximum), gasoline ethanol blends (10 volume percent maximum)	API Table 6b	62 API (730 kg/m3)
Diesel Fuel (grade 2-D), biodiesel blends (20 volume percent biodiesel, maximum)	API Table 6b	37 API (840 kg/m3)
Other fuels TBD	–	–

Coefficient Here
0.0007 /Degree F

Coefficient Here
0.00045 /Degree F.

Note in S&T the coefficient method is allowed per UR.3.6.1

Refer to paragraph b-1 below.
Extracted:
UR.3.6.1.23. Recorded Representations (Invoices, Receipts, and Bills of Lading).
(a) A**n 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.

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Appendix D

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

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An Economic Analysis of the CEC Staff's *Fuel Delivery Temperature Study* and the "Hot Fuel" Allegations[1]

Michael A. Flynn[2]

> 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 temperature on the volume of fuel sold to consumers. Retail competition and repeat

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[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.

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:

- The claim that – at least in the short- and medium term – California consumers would enjoy "more fuel" worth $438 million annually following the proposed

[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 ºF), rather than standard U.S. gallons measuring 231.0 cubic inches. See *CEC Staff Report* at Chapter 5, pp. 86-88.

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 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

[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.

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).

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	***Imperial Gallon***	***277.40***	***6,661.8***		***$3.603***	***$300.00***
Change		***20.09%***			***20.09%***	***0.00%***

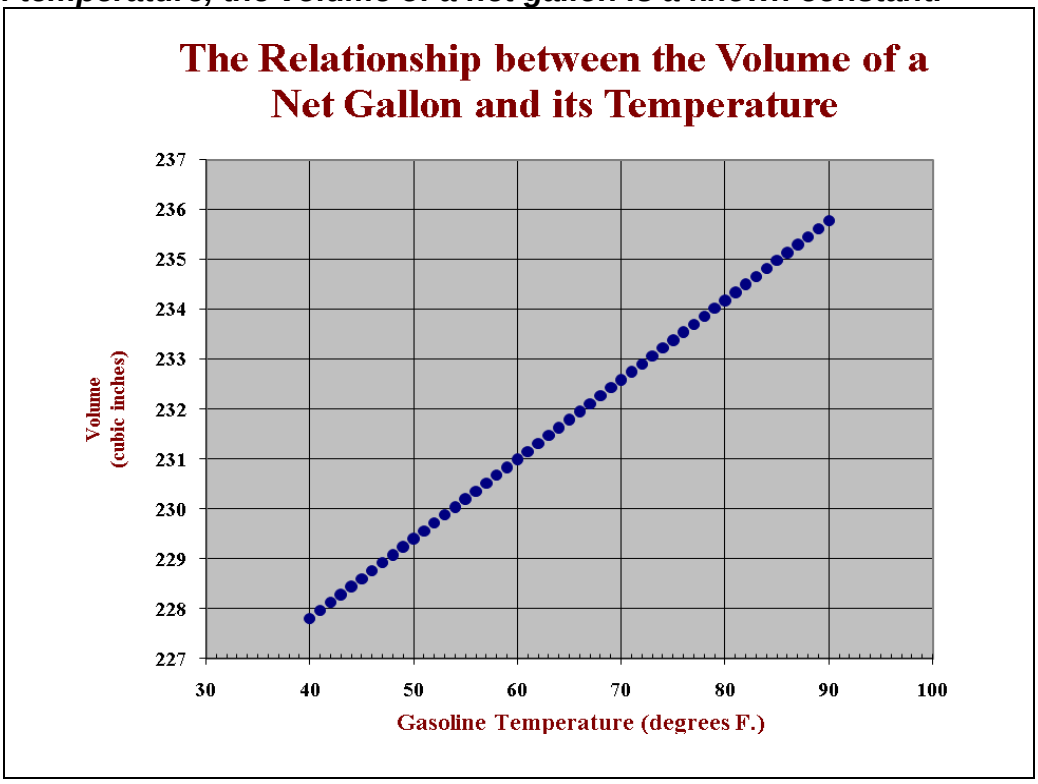
[8] However, this seems to be the "logic" implicit in the *CEC Staff Report*.

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.

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)**
Before	**U.S. Gallon**	**231.00**	**8,000.0**	**$24,000**	**$3.000**	**$300.00**
After	***75° Gallon***	***233.39***	***7,918.0***		***$3.031***	***$300.00***
Change		***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

[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.

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:

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

		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

[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.

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.

[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.

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.

[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.

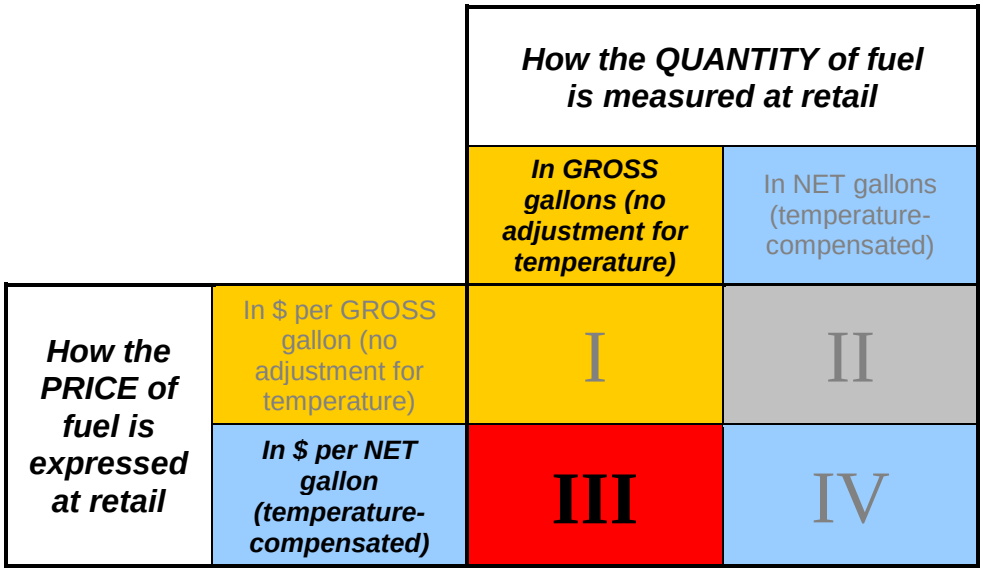
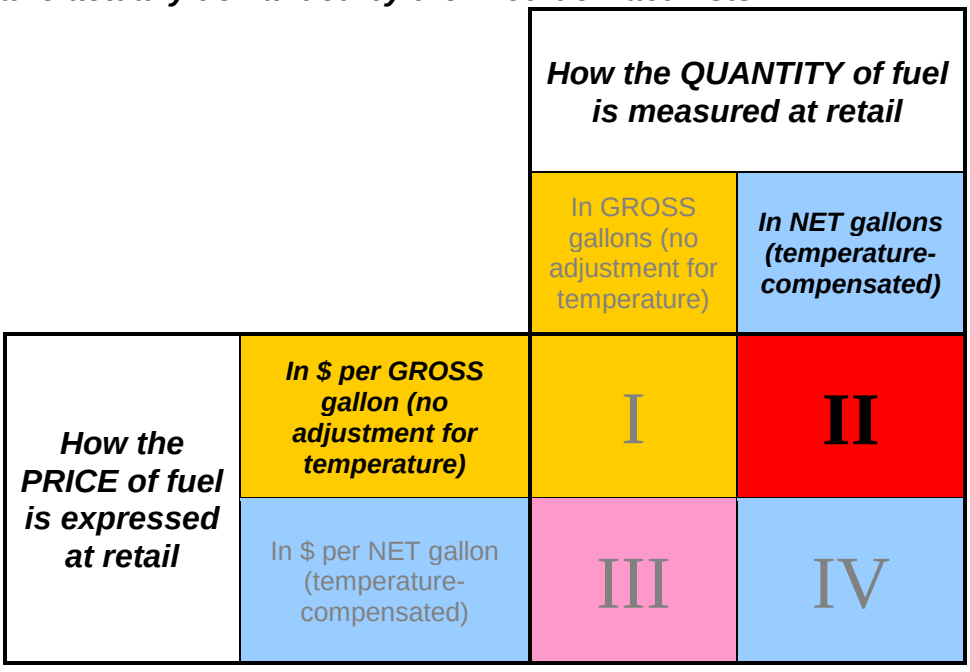


Figure 7.
The scenario actually demanded by the "hot fuel" activists.



Net vs. gross systems in the <u>CEC Staff Report</u>

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

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***.

[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.

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

[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.

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.

In "Cold" Climate (gasoline at 45° F.)					
	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*
In "Hot" Climate (gasoline at 75° F.)					
	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 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.

In "Cold" Climate (gasoline at 45° F.)					
	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*
In "Hot" Climate (gasoline at 75° F.)					
	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
What the CEC Staff Report advocates…	*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" basis[16] 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]

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.

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[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 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.")

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]

The charges in the *Kansas City Star* series were taken up, repeated and amplified by a number of advocates[21] and journalists at other newspapers.[22] In 2007, the "hot fuel" allegations

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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, 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*.

resulted in congressional hearings[23] 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 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.

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[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.

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 hearings[26] 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.

The CEC Staff Report and the "hot fuel" allegations

Pursuant to AB 868[28] 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

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[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)."

[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

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 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]

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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.

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

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:

> 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

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

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.

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.

As already shown in ***Figure 4***, the adoption of any particular "reference temperature" – such at 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

[37] *CEC Staff Report* at p. 76.

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.

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]

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[38] *CEC Staff Report* at p. 83.

[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

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 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.

"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.

[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.")

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 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]

[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.

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 "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

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[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.").

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 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 $\boldsymbol{P_{none}}$ (the price per unit paid by consumers in the absence of ATC) is greater than $\boldsymbol{P_{full}}$ (the price per unit that would prevail under ATC) *and at the same time* $\boldsymbol{Q_{none}}$ (the quantity of fuel purchased by consumers in the absence of ATC) exceeds $\boldsymbol{Q_{full}}$ (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 $\boldsymbol{Q_{none} > Q_{full}}$ 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 $\boldsymbol{P_{none} > P_{full}}$ 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.

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[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, $\boldsymbol{P_{none} > P_{full}}$ *and* $\boldsymbol{Q_{none} > Q_{full}}$ only because *CEC Staff Report* assumes an *inward* shift (i.e., toward origin) in the demand curve from $\boldsymbol{D_{no\ info}}$ to $\boldsymbol{D_{full\ info}}$, 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 fuel quantities similar to the "Hawaii gallon" adopted by the State of Hawaii at the urging of

[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.

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***.

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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.

Change from U.S. Gallons to "50° 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)**
Before	**U.S. Gallon**	**231.00**	**8,000.0**	**$24,000**	**$3.000**	**$300.00**
After	***50° Gallon***	***229.41***	***8,055.6***		***$2.979***	***$300.00***
Change		***-0.69%***			***-0.69%***	***0.00%***

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.

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)**
Before	**U.S. Gallon**	**231.00**	**8,000.0**	**$24,000**	**$3.000**	**$300.00**
After	***90° Gallon***	***235.78***	***7,837.8***		***$3.062***	***$300.00***
Change		***2.07%***			***2.07%***	***0.00%***

[52] By design, this is more than 20 cooler than California's actual average fuel temperature.

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)**
Before	**U.S. Gallon**	**231.00**	**8,000.0**	**$24,000**	**$3.000**	**$300.00**
After	***71.1° Gallon***	***232.77***	***7,939.2***		***$3.023***	***$300.00***
Change		***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.

Change today 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)**
Before	**U.S. Gallon**	**231.00**	**8,000.0**	**$24,000**	**$3.000**	**$300.00**
After	***80° Gallon***	***234.19***	***7,891.1***		***$3.041***	***$300.00***
Change		***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 2006[53] and

[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

taken up subsequently by other "hot fuel" activists.[54, 55] The *CEC Staff Report* cites the State of 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:

> 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."

[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.

> 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]

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 Mattimoe[63] 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

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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.

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.

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]

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)**
Before	**U.S. Gallon**	**231.00**	**8,000.0**	**$3,500**	***$0.438***	**$43.75**
After	***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

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").

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 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.

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[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.

[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.

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.

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.

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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.

73 *CEC Staff Report* at p. 14.

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

Fuel temperature at 45° F.	"First Mover" (Installs ATC equipment)				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								
Option 1 (pump price "same" as Local Rival)	***228.61***	***8,083.7***	***$3.000***	***$24,251***				
or								
Option 2 (pump price "below" Local Rival)	***228.61***	***8,083.7***	***$2.969***	***$24,000***				

That Canadian manufacturer of ATC equipment – Kraus Technology[74] – 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 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]

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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 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

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]

> 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 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."

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.

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

---

"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 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."

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.

Fuel temperature at 75° F.	***"First Mover"*** *(Installs ATC equipment)*				**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								
Option 1 (pump price "same" as Local Rival)	***233.39***	***7,918.0***	***$3.000***	***$23,754***				
or								
Option 2 (pump price "above" Local Rival)	***233.39***	***7,918.0***	***$3.031***	***???***				

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 staff[79] – 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,

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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.

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.

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

[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.

prices will do so in vain. This is because the mechanism at work is a practical illustration of Adam Smith's "invisible hand".[81]

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 market[82] with knowledge of how much sales revenue he needs to generate and how many (gross) gallons he has available to sell[83] 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.

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[81] Adam Smith, *The Wealth of Nations*, Volume IV Chapter II, Modern Library edition, pp. 484-485 (emphases added):

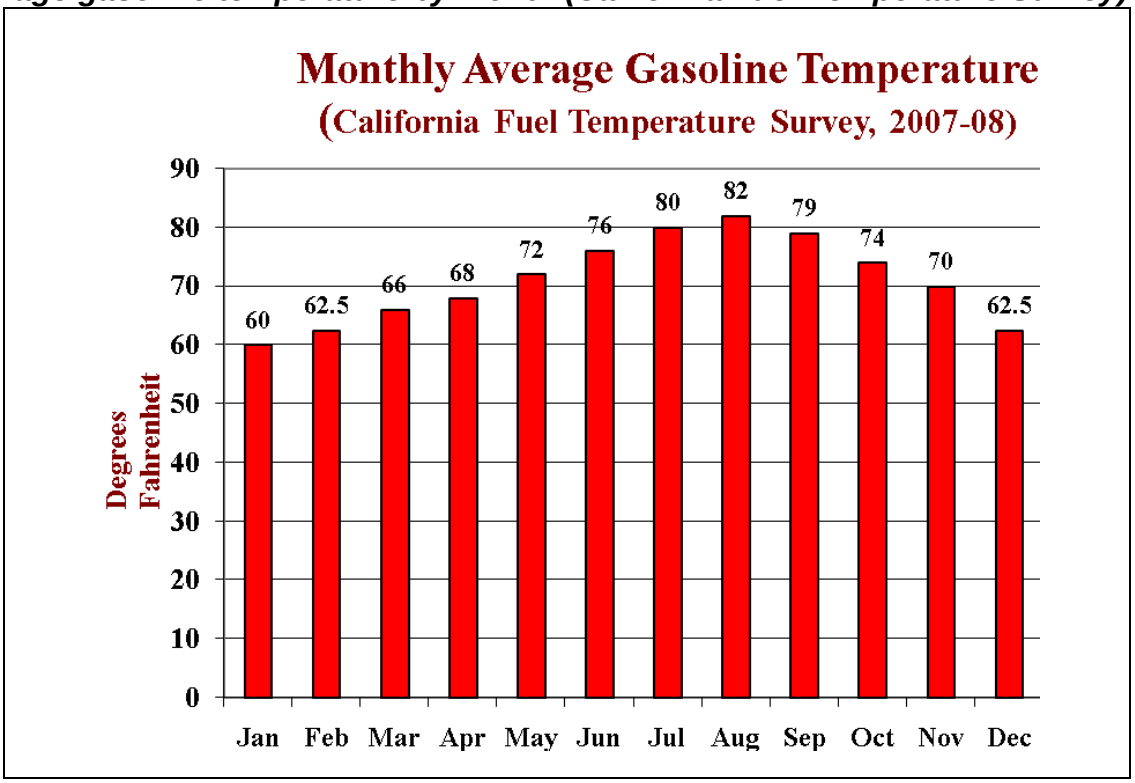
> As every individual…endeavors as much he can both to employ his capital in the support of domestic industry, and so to direct that industry that its produce may be of greatest value; every individual necessarily labors to render the annual revenue of the society as great as he can. He generally…neither 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 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.

Figure 23.
Average gasoline temperature by month (California Fuel Temperature Survey).



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]

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***.

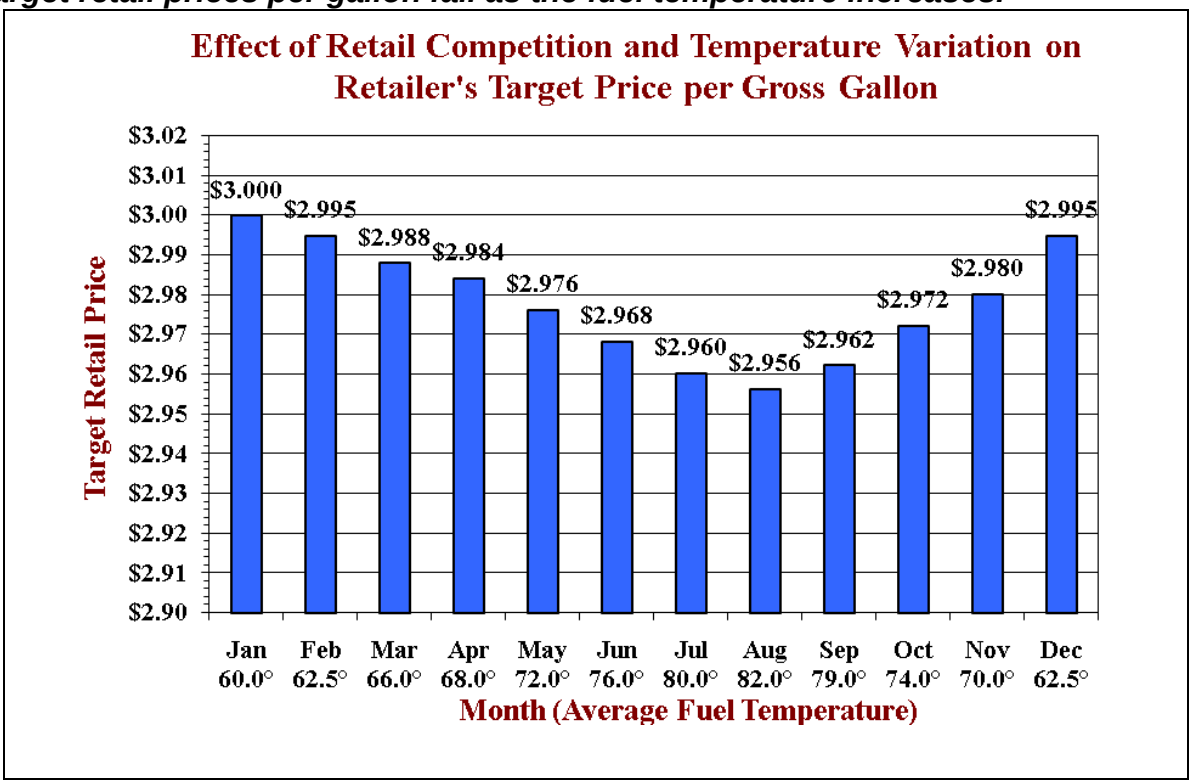
[85] As a net gallon has expanded by 0.41 percent since January, the dealer's target street price per *gross* gallon has fallen by 0.41 percent. However, his target retail price per *net* gallon remains constant at $3.000.

Figure 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 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.

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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

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 gallon[87] 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]

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.

[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.")

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]

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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.)		
Obs no	*Temp*	***Devn***	*Obs no*	*Temp*	***Devn***	*Obs no*	*Temp*	*Dev*	*Obs no*	*Temp*	***Devn***
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 same ambient air temperature, and deliver this product into storage tanks surrounded by ground of the same ambient ground temperature.").

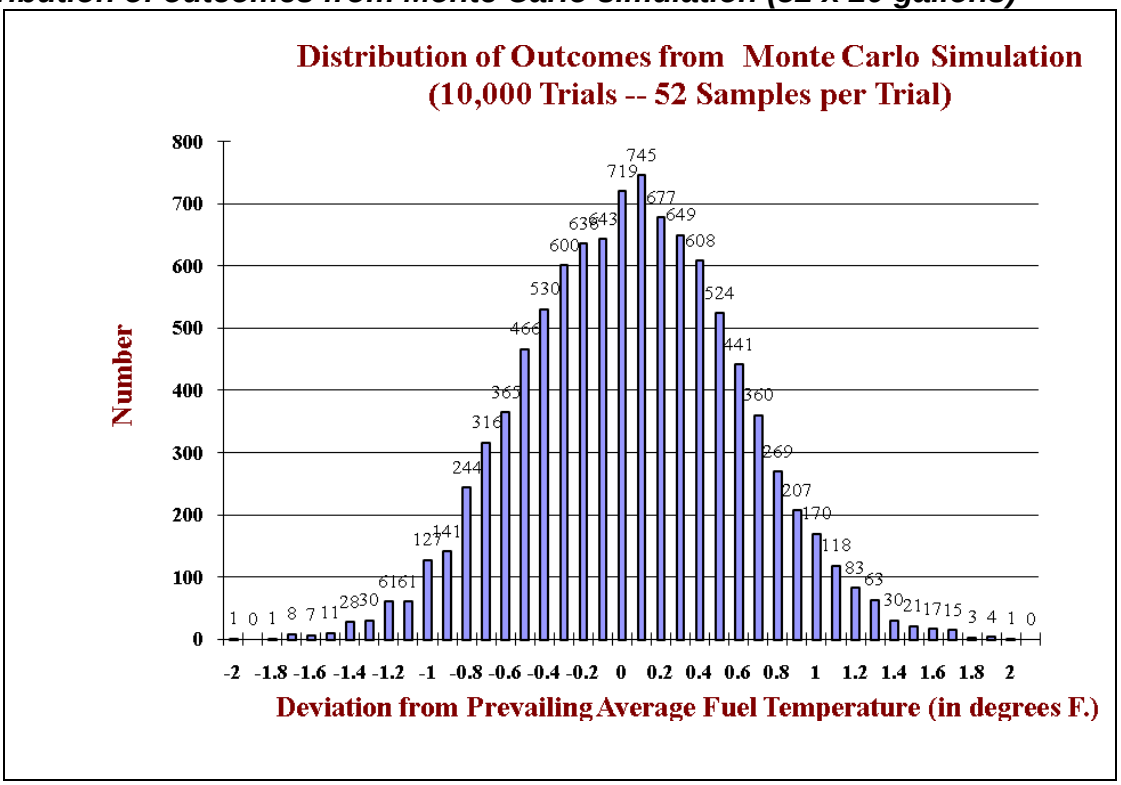
The question of interest is this: What is the probability that a consumer – who either randomly chooses among all of the available dealers in the local area or chooses to purchase from a specific retailer at random times since its most recent delivery – might as a matter of chance (or bad luck) end up 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.

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 expensive[96] 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 "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.

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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>

- *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.

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?

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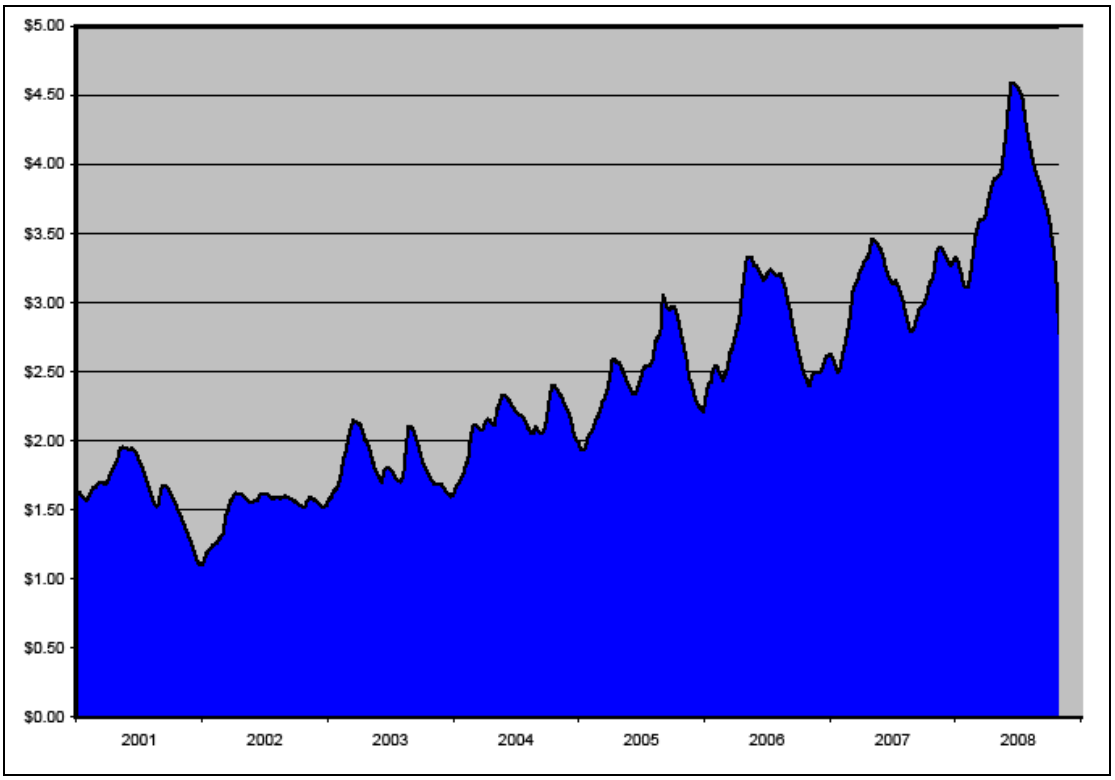
[100] Steve Everly, "There's little gain in selling gas", *Kansas City Star*, December 26, 2008: Gas retailing has long filled an awkward niche in the oil business. Federal lawyers compiling an antitrust case against Big Oil in the 1970s – a case that was eventually dropped by President Ronald Reagan – 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>

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***.

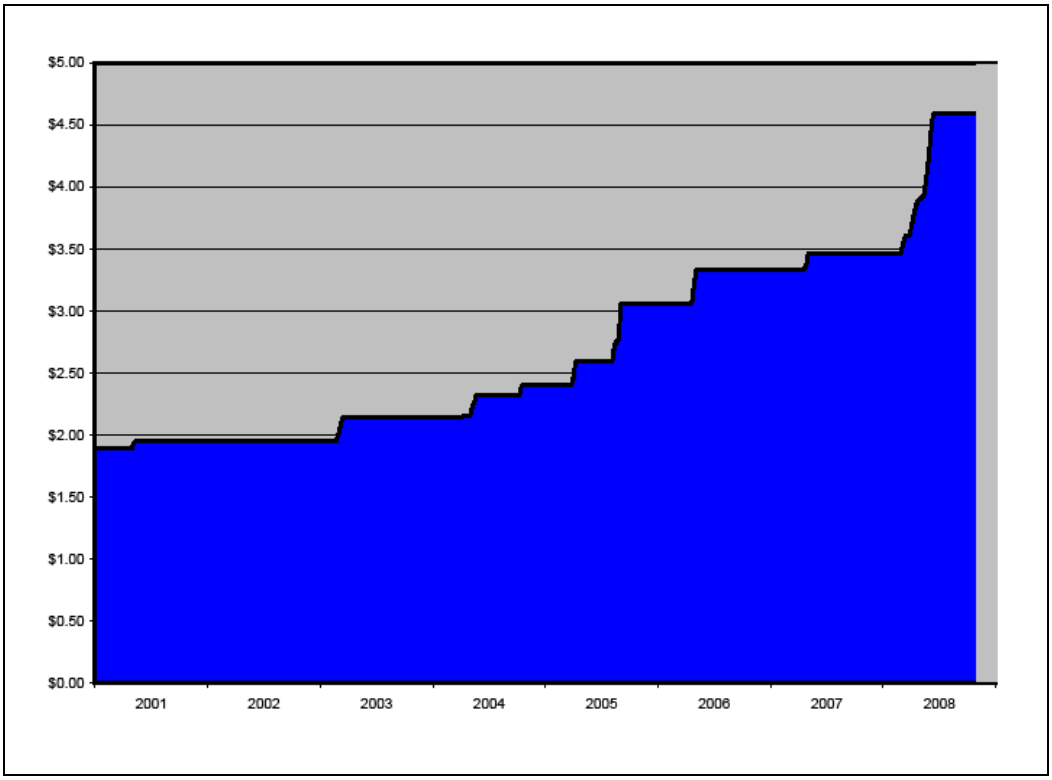
Figure 38.

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.



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]

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[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?

"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 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

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
California	75	158	-$509
Texas	78	143	-$416
Florida	82	122	-$367
Georgia	72	41	-$123
Arizona	82	39	-$115
Louisiana	77	28	-$81
North Carolina	69	25	-$74
Alabama	72	22	-$63
South Carolina	73	22	-$61
Tennessee	70	21	-$60
Virginia	66	16	-$46
Mississippi	74	16	-$46
Arkansas	71	11	-$32
Nevada	75	10	-$31
Oklahoma	69	11	-$31
New Jersey	63	8	-$22
Maryland	64	7	-$22
New Mexico	69	6	-$17
Missouri	62	5	-$15
Kentucky	63	5	-$14
Kansas	65	4	-$12
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
Rhode Island	59.8	-0.1	$0.1
West Virginia	59.6	-0.2	$0.6
Indiana	59.9	-0.3	$0.9
Wyoming	55	-1.0	$3
Washington	59.5	-1.0	$3
Montana	57	-0.9	$3
New Hampshire	58	-1.0	$4
Vermont	54	-1.4	$4
South Dakota	*54*	*-1.2*	*$4*
North Dakota	*53*	*-1.9*	*$6*
Alaska	47	-2.0	$7
Massachusetts	59	-2.0	$7
Maine	55	-2.5	$7
Connecticut	59	-3.0	$8
Nebraska	54	-3.0	$10
Iowa	57	-4.0	$11
Ohio	59	-4.0	$12
Illinois	57	-9.0	$29
Wisconsin	55	-9.3	$29
Michigan	57	-10.0	$29
Minnesota	53	-13.0	$37

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 Dakota[105] 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 $12,000[108] 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 hard to imagine how this could go unnoticed by industry analysts and especially by tax authorities.

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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.

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"

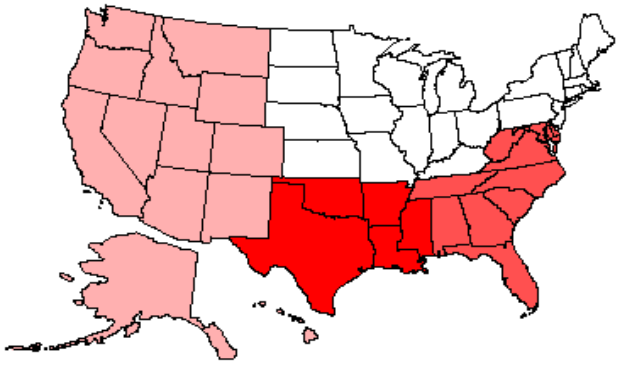
profits.[110] These figures either significantly exceed – or are at least equivalent to – the average *total pre-tax profits* per convenience store noted in the *CEC Staff Report*. It strains credulity to think that no one – not the U.S. Commerce Department, the Internal Revenue Service or the retailers 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.



Since independent data on the profitability of retail gasoline stores are available for the

RMA Region	Avg Temp	States Included
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*

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 $17,000[111] to $28,000[112] 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.

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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" (*Kansas City Star)*	1998-2007 PROFIT BEFORE TAXES AS PERCENT OF SALES (*RMA)*	1998-2007 MEDIAN PROFIT BEFORE TAXES AS PERCENT OF ASSETS *(RMA)*
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*.

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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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RFA
Renewable Fuels Association

Downstream Alternatives Inc.

July 9, 2009

Mr. Joe Gomez
State of New Mexico
Chair, Laws & Regulation Committee
National Conference on Weights and Measures
Via email: jgomez@nmda.nmsu.edu

RE: Section 2. Standard Fuel Specification Amendments to the Uniform Fuels and Automotive Lubricants Regulations

Dear Mr. Gomez,

The Renewable Fuels Association (RFA) and Downstream Alternatives Inc. appreciate the opportunity to provide supportive comments on the proposed fuel regulation modifications for NIST Handbook 130, agenda item (key reference number) 237 from the Law & Regulations Committee agenda for the July 2009 meeting. We believe the proposed modifications will help to achieve the goals outlined in the Energy Independence and Security Act of 2007. Today, the US fuel market is expanding to combine energy and environmental goals culminating in a very complex and changing profile. We expect this trend to continue with the introduction of additional alternative fuel production and use. From an ethanol perspective, 2009 proves to be the largest ethanol production year ever as nearly all of gasoline today is blended with 10% ethanol: we expect 10% ethanol blends may soon be the "standard" fuel available in the United States. This will be of tremendous benefit to consumers by providing a domestic, renewable, low carbon, clean burning fuel that will lower gasoline prices and make real strides toward energy and environmental security.

The proposed modification to the 2010 edition of the NIST Handbook 130 regulations recognizes the growth in ethanol blended fuels and thus seeks to clarify fuel quality expectations.

The modifications recognize the impact that ethanol has on base fuel volatility. Bottom line is that today's automobile fleet will not experience *any* adverse driveability or performance effects from the proposed fuel volatility specification being consider for ethanol blends. In short, we believe the amendments for the gasoline/ oxygenate fuel blends section of the NIST Handbook 130's Uniform Fuels and Automotive Lubricants Regulation – Section 2. Standard Fuel Specifications provide the needed guidance for fuel quality while recognizing the changing landscape of the fuel industry.

Alongside our support for the proposed amendment, we would offer this notice to a limitation included in the wording that may need revisited in the very near future. The proposed modification in 2.1.2 Gasoline and Gasoline Oxygenates Blends of Section 2.1 Uniform Engine Fuels, Petroleum Products and Automotive Lubricants reads as follows:

> 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.

This language is true in that there is recognition for fuels approved by EPA through either the substantially similar or fuel waiver process. However, on March 6, 2009, a petition was made to the U.S. Environmental Protection Agency to permit the use of up to 15% volume ethanol content in gasoline. There have been many research projects focused on proving the suitable use of 15% ethanol blends for "gasoline only" engines and many research projects continue. We feel the data available today shows very positive evidence on the acceptable materials compatibility and fuel use of higher ethanol content blends. When EPA permits the increased ethanol content in gasoline, we believe it prudent of the National Conference on Weights and Measures to act swiftly to eliminate any barriers that may be in place restricting ethanol's use such as the above referenced section.

The National Conference of Weights and Measure Fuel and Lubricants Subcommittee, of which we are both a member, met several times and spent many hours developing the proposed amendments. While recognizing there may still be concerns on the part of some stakeholders, we believe the wording is a balanced compromise. Finally, we would like to express our appreciation to all the petroleum subcommittee members for the time they devoted to this effort. In particular, we applaud Ron Hayes and Randy Jennings for their leadership in guiding the diverse group of stakeholders through the consensus building process.

We believe the proposed modification represents a good compromise for all parties and primarily for consumers. Thank you again for the opportunity to provide comment.

Respectfully,

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Appendix F

Handbook 133, *Checking the Net Contents of Packaged Goods,* Fourth Edition Proposed Amendments and Editorial Changes

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Handbook 133, Fourth Edition
Proposed Amendments and Editorial Changes

The following table lists the amendments and editorial changes that are under consideration by the membership of the NCWM. As appropriate, the text on the cited pages indicates the changes to the section or paragraph as indicated in bold **~~strikeout~~** for deletions and bold **underscore** for insertions.

Line item #	Section & Page Number	Title	Action	Comments
CHAPTER 1				
General Information				
1	1.1. G9	Scope	Replaced **~~standards~~** with **laws and regulations**"	
2	1.1.a. G9	When and where to use checking procedures?	a. When and where to use package checking procedures?	
Package Requirements				
3	1.2.(1) G10	Inspection Lot	Replaced **~~this collection~~** with **the lot** for clarification.	
4	1.2.(3) G11	Individual Package Requirement	Change the end of the last sentence. This handbook does not specify limits of overfilling **(with the exception of textiles)**, which is usually controlled by the packer **for economic, compliance and other reasons.**	This is 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.
5	1.2.(4) G11	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 **minus error**.	Change sentence to improve clarity and to clarify that a package error that exceeds the Maximum Allowable Variation is an "unreasonable error."
6	1.2.(5)a. G11	Deviations Caused by Moisture Loss or Gain - Why do we allow for moisture loss or gain?	a. Why **and when** do we allow for moisture loss or gain?	
7	1.2.(5)a. G11	Deviations Caused by Moisture Loss or Gain - Why do we allow for moisture loss or gain?	Revise the first paragraph, second sentence. The amount of **~~lost~~** moisture **loss** depends upon the nature of the product, the packaging	

Line item #	Section & Page Number	Title	Action	Comments
			material, the length of time it is in distribution, environmental conditions, and other factors. Revised the first paragraph, last sentence. For loss or gain of moisture**,** ~~**apply**~~ the moisture allowances **may be applied before or after the package errors are determined**.	
8	1.2.(5)a. G112	Deviations Caused by Moisture Loss or Gain - Why do we allow for moisture loss or gain?	For loss or gain of moisture**, apply** the moisture allowances **after the package errors are determined.** ~~**may be applied before or after the package errors are determined**~~.	Recommendation from the WWMA
9	1.2.(5)a. G12	Deviations Caused by Moisture Loss or Gain - 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. **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 to adjust the average error** ~~**so the adjusted average error**~~ **and individual package errors.** ~~**provide for loss of moisture**~~	

Line item #	Section & Page Number	Title	Action	Comments
			~~**from the sample packages.**~~	
10	1.2.(5)a. G12	Deviations Caused by Moisture Loss or Gain - Why do we allow for moisture loss or gain?	To apply ~~**an**~~ **a moisture allowance** before determining package errors, adjust the Nominal Gross Weight (see Section 2.3. "Basic Test Procedure")	Recommendation by CWMA
11	1.2.(5)a. G12	Deviations Caused by Moisture Loss or Gain - Why do we allow for moisture loss or gain?	***We suggest removing the first paragraph (To apply an allowance...) and rewording the second paragraph (It is also permissible to apply...) and replace with the following wording:*** Apply the moisture allowance after individual package and average errors are determined. For example, a sample of a product subject to moisture loss might fail because the errors in several of the sample packages are determined to be unreasonable (i.e., the package error is greater than the Maximum Allowable Variation permitted for the package's labeled quantity) or the average error is minus and outside the Sample Error Limit. Adjust the MAV after the individual package errors are determined and adjust the SEL after aver age error is determined. Compare individual package errors to the adjusted MLA and the average error to the adjusted SEL.	Recommendation from WWMA **Note:** California officials question the need for accommodating both methods (before or after). This only presents opportunities for confusion. Recorded package errors should be ACTUAL values. Adjusted package errors on an inspection report cause concern for prosecutors when presenting the report in evidence. The MLA should be applied to the MAV and the SEL only after determining package and average errors.
Chapter 2				
Basic Inspection Procedure and Recordkeeping				
12	2.3.3.d. G24	How many MAVs are permitted in a sample?	d. How many ~~***MAVs***~~ **unreasonable minus errors (UME's)** are permitted in a sample?	
13	2.3.3.d. G24	How many MAVs are permitted in a sample?	To find out how many minus package errors are permitted to exceed the MAV, **(errors known as unreasonable minus errors or UME's)** ~~(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." **(refer to Appendix A)** Record this number in Box 8.	

Line item #	Section & Page Number	Title	Action	Comments
Tare Procedures				
14	2.3.5.a.(1) G24	What types of tare may be used to determine the net weight of packaged goods? - Used Dry Tare	WWMA recommends changing the note. 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**, except in instances in which glazed or frozen foods are tested according to Section 2.6. Drained Weight for Glazed or Frozen Foods.**	Note: from WWMA There seems to be a conflict between this note and Section 2.6. Drained Weight for Glazed and frozen Food. If 2.6. applies to frozen food, when would there be an instance to use used dry tare? Please see our comment on Section 2.6.
15	2.3.5.(3) G25	What types of tare may be used to determine the net weight of packaged goods? - Wet Tare	**Wet tare procedures must not be used to verify the labeled net weight of packages of meat and poultry packed at an official United States Department of Agriculture and bearing a USDA seal of inspection. 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]).**	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.
16	2.3.5(3) G25	What types of tare may be used to determine the net weight of packaged goods? - Wet Tare	Paragraph 2, sentence 2 change the following: 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.	
17	2.3.5.(3) c & d G26	How is Tare weight determined?	Does the inspection of aerosol containers require special procedures? How is the tare of vacuum packed coffee determined?	WWMA recommends that the following two questions and answers appear out of place. We suggest moving them behind the next two questions (see line item 19)

Line item #	Section & Page Number	Title	Action	Comments
18	2.3.5.(3)f. G27	How are the tare sample and the tare weight of the packaging material determined?	Step 2: For sample sizes of 12 or more, subtract the individual tare weights from the **respective package** gross weights (Block a, minus Block b, on the report form) to obtain the net weight for each package and record ~~these~~ each value~~s~~ in Block c, "Net Wt.," on the report form.	
19	2.3.5.(3)f. G27	How are the tare sample and the tare weight of the packaging material determined?	Place information from line item 17 in this section after Step 6.	Recommendation from WWMA
Determine Nominal Gross Weight and Package Errors for Tare Sample				
20	2.3.6.a. G28	What is a nominal gross weight?	a. ~~***What is***~~***How do I compute*** *a nominal gross weight?*	
21	2.3.6.a. G28	What is nominal gross weight?	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 a package's gross weight from the nominal gross weight.~~	
22	2.3.6.b. G28	What is nominal gross weight?	Add the following: **How do I compute the package error?** **To obtain the package error, subtract the nominal gross weight from each package's gross weight. The package error is represented by the formula:** **Package error = gross weight − nominal gross weight**	
23	2.3.6.d G29	How is the total package error computed?	Be sure to subtract the minus package errors from the plus package errors and to record the total net error in Box 15**, indicating the positive or negative value of the error**	
Moisture Allowances				
24	2.3.8.b. G31	What are the moisture allowances for flour, and dry pet food?	*What are the moisture allowances for flour,* ~~***and***~~ *dry pet food* ***and other products?*** *(See Table 2-3. "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.
25	2.3.8.b. G31 – G32	What are the moisture allowances for flour, and dry pet food?	Have the Table title read as: Table 2-3. Moisture Allowances **for Product in Distribution**	Recommendation from WWMA

Line item #	Section & Page Number	Title	Action	Comments

Table 2-3. Moisture Allowances		
If you are verifying the labeled net weight of packages of:	**The Moisture Allowance is:**	**Notes**
Flour	**3 %**	
Dry pet food	**3 %**	**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.**
Borax	**See Section 2.4.**	
Wet Tare Only		
If you are using Wet Tare in verifying the net weight of packages of one of the products listed below:	**The Moisture Allowance is:**	**Notice: Wet Tare must not be used in testing packages of meat and poultry subject to USDA regulations.**
Fresh poultry	**3 %**	**Fresh poultry is defined as poultry at a temperature of 3 °C (26 °F) that yields or gives when pushed with the thumb.**
Franks or hot dogs	**2.5 %**	
Bacon, fresh sausage, and luncheon meats	**0 %**	**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 Used Dried Tare are equivalent.**

Line item #	Section & Page Number	Title	Action	Comments
26	2.3.8.b. G32	What are the moisture allowances for flour, and dry pet food?	Delete: ~~**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.**~~	
27	2.3.8.d. G33	What moisture allowance is used with wet tare when testing packages bearing a USDA seal of inspection?	d. What moisture allowance is used with wet tare**?** ~~***when testing packages bearing a USDA seal of inspection?***~~ **Wet tare procedures must not be used to verify the labeled net weight of packages of meat and poultry packed at an official United States Department of Agriculture and bearing a USDA seal of inspection. 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]).**	Comment from CWMA: Two questions remain. 1. What guidance can be provided for manufacturers with products other than those listed for moisture loss? 2. What methodology is necessary for manufacturers to demonstrate the data needed for moisture allowance? (see follow- up on line item 30)

Line item #	Section & Page Number	Title	Action	Comments
28	2.3.8.d. G33	What moisture allowance is used with wet tare when testing packages bearing a USDA seal of inspection?	**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 ºC (26 ºF). 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.**~~	
29	2.3.8.d G33	What moisture allowance is used with wet tare when testing packages bearing a USDA seal of inspection?	When there is free-flowing liquid **and liquid** ~~**or absorbent**~~**absorbed by** packaging materials in contact with the product, all free liquid is part of the wet tare.	
30	2.3.8.e G33	How is moisture loss handled for products not listed in NIST Handbook 133?	**How is moisture loss handled for products not listed in NIST Handbook 133?** **Officials can test products for which no**	

Line item #	Section & Page Number	Title	Action	Comments
			moisture loss guidance has been provided. If studies are a necessity they should be a collaborative effort between officials and industry. Because of the potential impact on interstate commerce studies should be completed on a nationwide basis and not by individual jurisdictions unless circumstances justify only local consideration. **The amount of moisture loss from a package is a function of many factors not the least of which is the product itself (e.g., moisture content, texture and density), packaging, storage conditions (e.g., temperature, humidity, and air flow), time, handling and others. If a packaged product is subject to moisture loss officials must allow for "reasonable" variations caused by moisture either evaporating or draining from the product. Officials cannot set arbitrary moisture allowances based solely on their experience or intuition. Moisture allowances must be based on scientific data and must be "reasonable." Reasonable does not mean that all of the weight loss caused by moisture evaporation or draining from the product must be allowed. As a result of product and moisture variability the approach used by an official must be developed on a case-by-case basis depending on many factors to include, but not be limited to, the manufacturing process, packaging materials, distribution, environmental influence and the anticipated shelf life of the product.** **NIST Handbook 130 provides a starting point for developing a workable procedure in the Interpretation and Guideline Section 2.5.6. regarding "Resolution for Requests for Recognition of Moisture Loss in Other Packaged Products." Most studies involving nationally distributed products will require that products be tested during different seasons of the year and in different geographic locations to develop a nationally recognized moisture allowance. Some studies may require the development of laboratory tests used for inter-laboratory comparisons to establish**	

Line item #	Section & Page Number	Title	Action	Comments
			moisture content in products at time of pack or at the time-of-inspection. **Moisture loss or gain is a critical consideration for any net content enforcement effort and one that, in most cases, cannot be addressed solely by a field official. If moisture loss issues are to be deliberated, it is the regulatory official's responsibility to resolve the packers concern utilizing available resources and due process procedures. To fulfill this obligation the official may be required to utilize specialized test equipment and specific laboratory procedures. Additionally, the collection of adequate test data may require product examination over a broad geographical area and consideration of a wide range of environmental factors. If a national effort is required, a coordinated effort involving industry, trade associations, weights and measures officials, and federal agencies may be required. NIST will provide technical support upon request. If studies are a necessity they should be a collaborative effort between officials and industry and can be very time consuming depending on the product. Because of the potential impact on interstate commerce, studies must be completed on a nationwide basis and not by individual jurisdictions unless circumstances justify only local consideration.**	
31	2.3.8.e G33		e. **Moisture loss must be considered even when no formal allowance for the specific product is found in HB 133.**	Recommend change from Paul Hoffman, Kraft
Calculations				
32	2.3.9.a G34	How is moisture allowance computed and applied to the average error?	a. How is moisture allowance computed and applied to the ~~average error~~?	
33	2.3.9.b G35	**How is a Moisture Allowance made prior to determining package errors?**	**b. 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**	Comment from WWMA: Based on previous comments we suggest entirely removing the question – 2.3.9.b ***How is a Moisture Allowance made***

Line item #	Section & Page Number	Title	Action	Comments
			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.** **c. 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.**	***prior to determining the package errors?***

Line item #	Section & Page Number	Title	Action	Comments
			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 Minus Errors (UMEs) only step 2 is used. **Step:** **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.** **HOWEVER,** • **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**	

Line item #	Section & Page Number	Title	Action	Comments
			error to the AMAV. Mark package errors that exceed the AMAV and record the number of UME'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**~~	

Line item #	Section & Page Number	Title	Action	Comments
			~~**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.**~~	
34	2.3.9.**d.** G37	What should you do when a sample is in the moisture allowance (gray) area?	Add the following title ***d. What should you do when a sample is in the moisture allowance (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: Change the note to read : **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.	

Line item #	Section & Page Number	Title	Action	Comments
35	2.3.9. G37	What should you do when a sample is in the moisture allowance (gray) area?	**Reasonable** 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.	
Borax				
36	2.4.b. Step 3 G39	How is the volume determined?	Step 3. Compare the net volume of the commodity in the package with the volume declared on the package. The volume declaration **must not ~~is not 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.~~**	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.
The Determination of Drained Weight				
37	2.5. G39	Equipment	➢ For canned tomatoes a U.S. Standard Test Sieve with 11.2 mm ($^{7}/_{16}$ in) openings must be used	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 HB 133 so that the requirement matches the sieve size for canned tomatoes in AOAC 968.30 "Canned Vegetables Drained Weight Procedure."
Drained Weight for Glazed or Frozen Foods				
38	2.6. G41	Drained Weight for Glazed or Frozen Foods	2.6. **Determining the net weight of ice-encased frozen foods and ice glazed products**. **~~Drained Weight for Glazed or Frozen Foods~~**	Comment from WWMA: *We believe this procedure is truly intended for all frozen foods as indicated by the existing title. We have made extensive amendments to include additional foods and freezing methods and believe it more closely reflects the intent of the section and the current marketplace*
39	2.6. G41	Drained Weight for Glazed or Frozen Foods		Comment from NEWMA: Section 2.6. specifically references the use of glaze with frozen seafood. Glazed chicken wings are being seen in the marketplace. It was suggested that wording be added to include other glazed products such as frozen (glazed?) chicken.
40	2.6.a G41	How is the drained weight of frozen shrimp and crabmeat determined?	a. How is the drained weight of frozen shrimp ***(e.g., 2.27 kg (5 lb) frozen block of shrimp)*** and crabmeat determined?	

Line item #	Section & Page Number	Title	Action	Comments
41	2.6.a. G41	How is the drained weight of frozen shrimp and crabmeat determined?	a. How ~~is~~**should** the ~~**drained**~~**net** weight of frozen shrimp ~~**(e.g., 2.27 kg (5 lb) block of shrimp), and**~~ crabmeat, **meat or poultry, and similar products encased in ice and frozen into blocks or solid masses (i.e., not individually glazed) be** determined**?**	Comment from WWMA**:** Is this procedure truly intended for all frozen foods as indicated by the title or only SEAFOOD, as indicated by the example? We believe this section needs clarification.
42	2.6.a G41	How is the drained weight of frozen shrimp and crabmeat determined?	First paragraph, second sentence: 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).	
43	2.6.a G41	How is the drained weight of frozen shrimp and crabmeat determined?	When determining the net weight of frozen shrimp**, crabmeat, meat or poultry products, or similar products that are encased in ice and frozen into blocks or solid masses**, use the test equipment and procedure provided below.	Recommendation from WWMA
44	2.6.a G42	How is the drained weight of frozen shrimp and crabmeat determined? - Equipment	• Water source and hose with a**n 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)	
45	2.6.a G42	How is the drained weight of frozen shrimp and crabmeat determined? - Equipment	• A wire mesh basket **(used for testing large frozen blocks of shrimp or other products)** 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)	Recommendation from WWMA

Line item #	Section & Page Number	Title	Action	Comments
46	2.6.a G42	How is the drained weight of frozen shrimp and crabmeat determined? - Test Procedure	Step 1: Place the unwrapped frozen shrimp, ~~**or**~~ crabmeat**, or meat, poultry, or seafood product** 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)	Recommendation from WWMA
47	2.6.b. G43	How is the net weight of glazed raw seafood and fish determined?	b. How is the net weight of **frozen,** glazed ~~**raw**~~seafood**,** ~~**and**~~fish**, poultry, meat, or similar products** determined?	
48	2.6.b. G43	How is the net weight of glazed raw seafood and fish determined?		Comment from NEWMA: Section 2.6. specifically references the use of glaze with frozen seafood. Glazed chicken wings are being seen in the marketplace. It was suggested that wording be added to include other glazed products such as frozen (glazed?) chicken.
49	2.6.b. G43	How is the net weight of glazed raw seafood and fish determined?	For **frozen,** glazed seafood**,** ~~**and**~~ fish, **poultry, or meat products, or similar products**, determine the net weight after removing the glaze using the following procedure.	Recommendation from WWMA
50	2.6.b. G43	How is the net weight of glazed raw seafood and fish determined? - Equipment	Use the equipment listed in Section 2.6. "***Determining the net weight of frozen, ice-glazed products*** ~~***Drained Weight for Glazed or Frozen Foods"***~~	Recommendation from WWMA Title change if agreed upon in Section 2.6.
51	2.6.b G43	How is the net weight of glazed raw seafood and fish determined? - Test procedures	Step 2: Weigh ~~**sieve and**~~ receiving pan. Record this weight on a worksheet as "~~**sieve**~~**pan** weight."	
52	2.6.b. G44	How is the net weight of glazed raw seafood and fish determined? - Test procedures	Step 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 spray**ing 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**~~ **partial thawing of** the product. Nonetheless, remove **all** ~~**the**~~ ice glaze, because it **may be** ~~**is**~~ a substantial part of the package weight.	

Line item #	Section & Page Number	Title	Action	Comments
53	2.6.b. G44	How is the net weight of glazed raw seafood and fish determined? - Test procedures	Step 4: ~~**Transfer the product to the weighed sieve.**~~	
54	2.6.b. G44	How is the net weight of glazed raw seafood and fish determined? - Test procedures	Step 5: **At the end of the drain time immediately transfer the entire product to the tared pan for weighing to determine the net weight.** Place the product and ~~**sieve**~~**pan** on ~~**receiving pan**~~**the scale** and weigh. Record this weight on a worksheet as the "~~**sieve**~~**pan** + product weight."	
55	2.6.b. G44	How is the net weight of glazed raw seafood and fish determined? - Test procedures	Step 6: The net weight of the product is equal to the weight of the pan~~**plus the sieve**~~ plus the product (record in step 5) minus the "~~**sieve**~~ **pan** weight" (recorded in step 2).	
56	2.6.b. G44	How is the net weight of glazed raw seafood and fish determined? - Test procedures	Step 7: Repeat steps 3 through 6 for each package in the sample, cleaning ~~**and drying**~~the sieve and **cleaning and drying** the receiving pan between package measurements.	
Chapter 3				
Gravimetric Test Procedure for Liquids				
57	3.2. G48	Test Procedure	Step 4: Tilt the flask gradually so the flask walls are splashed as little as possible **as the flask** is emptied.	
Other Volumetric Test Procedures				
58	3.4.a. G51	What other methods can be used to determine the net contents of packages labeled by volume? - Test Equipment	Plastic disks… change the second to last sentence and add the last sentence. • Each disk must have a 20 mm (¾ in) diameter hole through its center and a series of 1.5 mm ($^{1}/_{16}$ in) diameter holes 25 mm (1 in) **apart around the periphery of the disk and 3 mm ($^{1}/_{8}$ in)** from the outer edge. **All edges must be smooth**.	
59	3.4.b G51	How is the volume of oils, syrups, and other viscous liquids that have smooth surfaces determined?	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.**	

Line item #	Section & Page Number	Title	Action	Comments
Mayonnaise and Salad Dressing				
60	3.5 G52	New	**3.5 How is the volume of** mayonnaise, salad dressing**, and other water immiscible products that do not have smooth and level surfaces determined?**	
Peat Moss				
61	3.10.(a) G64	How are packages of peat and peat moss labeled by compressed volume testing?	T**ake three measurements (both ends and middle) of each dimension and calculation their average. Multiply the averages to obtain the compressed cubic volume.**	
Ice Cream Novelties				
62	3.12 G68		**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.**	
63	3.12. G68		**Exception – Pelletized ice cream are beads of ice cream which are quick frozen with liquid nitrogen. The beads are relatively small, but can vary in shape and size. On April 17, 2009, the FDA issued a letter stating that this product is considered semisolid food, in accordance with 21 CFR 101.105(a). The FDA also addresses that the appropriate net quantity of content declaration for pelletized ice cream products be in terms of net weight.**	Recommendation from WWMA
Fresh Oysters Labeled by Volume				
64	3.13.a G73	Equipment	Area: 1935 cm^2 (300 in^2) or more for each 3.78 L (1 gal) of oysters (**Note: Strainers of smaller area dimensions are permitted to facilitate testing smaller containers.)**	

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The following items are editorial errors made by NIST during editorial review of current published HB 133				
Good Measurement Practices				
1a	1.7.(2) G15	Certification Requirements for Standards and Test Equipment	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).	Amended this section to refer users to NIST's Calibration Procedures website which 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 this as a primary source for calibration information.
Measurement Standards and Test Equipment				
2a	2.2.f.(3) G19	Which performance tests should be conducted to ensure the accuracy of a scale? – Shift Test	**Bench Scales or Balance** 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 use a test load equal to one-half capacity centered successively at four points positioned equidistance between the center and the front, left, back, and right edges of each pan as shown.** 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~~**.	Amended this section to reflect the changes made in 2007 to the shift test procedures in NIST HB 44, Section 2.20. Scales under N.1.3.7. All Other Scales…. The change in HB 44 reduced the test-load to $^1/_3$ 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.

The following items are editorial errors made by NIST during editorial review of current published HB 133

Diagram 1. Bench Scales or Balance

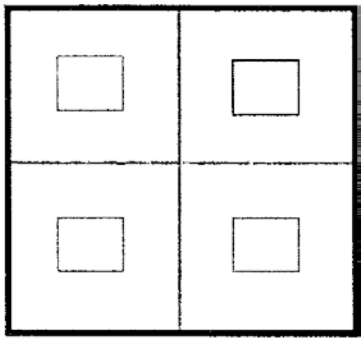
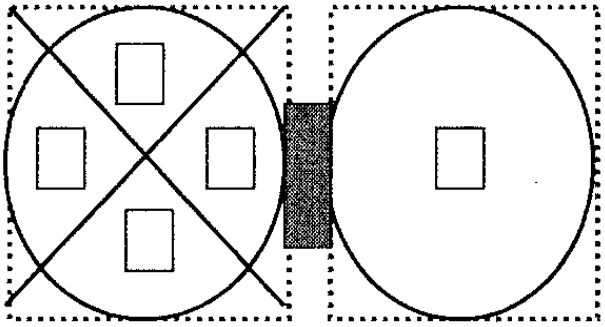


Diagram 2. Equal-Arm Balance



Measurement Standards and Test Equipment				
3a	2.2.(3)g G20	Which Standards Apply to Other test Equipment.	add the URL: These publications may be obtained from the ~~**Office of**~~ Weights and Measures **Division (http://www.nist.gov/owm)** or the U.S. Government Printing Office.	
Basic Inspection Procedure and Recordkeeping				
4a	2.3.3.d. G24	Where are Maximum Allowable Variations found?	Added a missing ● and reference to "Table 2-9." ● packages bearing a USDA seal of inspection – Meat and Poultry "See Table 2-9."	NIST in error missed this during editorial review of published HB 133
Tare Procedures				
5a	2.3.5.a(1) G25	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.	Within HB 133 3rd Edition, Section 3.12. Frozen Food and Other Frozen Products the following note was omitted from the 4th Edition print.
Moisture Allowances				
6a	2.3.8.b. G31	Table 2-3 Moisture Allowances	Corrected a misprint in the moisture allowance for packages of fresh poultry to read 3 %.	NIST in error missed this during editorial review of current published HB 133
Other Volumetric Test Procedures				
7a	3.4. G51	What other methods can be used to determine the net contents of packages labeled by volume?	Updated standards ➢ 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"	

The following items are editorial errors made by NIST during editorial review of current published HB 133

Test Viscous Materials				
8a	3.9 G63	Such as Caulking Compounds and Pastes	Update Standard: Calibrate the density cup gravimetrically with respect to the contained volume using the procedure in ASTM E**5**42 ~~94~~**01(2007)**, "Standard Practice for Calibration of Laboratory Volumetric Apparatus."	Update standard
Peat Moss				
9a	3.10.b. G64	How are packages of pet and pet moss labeled by compressed volume tested?	Update the standard in the second question. The procedure is based on ASTM D2978-~~90~~**03**, "Standard Method of Test for Volume of Processed Peat Materials."	Update ASTM standard
Mulch and Soils Labeled by Volume				
10a	3.11.(b) G66 – G67	Mulch and Soils Labeled by Volume	Modify table – The tables format was simplified and the SI units were changed to millimeters	

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)	**12.7 mm (½ in)**	524.3 mL (32 in^3)
28.3 L (1 ft^3)	**304.8 mm (12 in)**				1 179.8 mL (72 in^3)
56.6 L (2 ft^3)	**406.4 mm (16 in)**	**228.6 mm (9 in)**	**1219.2 mm (48 in)**		
84.9 L (3 ft^3)					
Measures are typically constructed of **12.7 mm**~~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.					

11a	3.11.d. G68	Mulch and Soils Labeled by Volume – "How are package errors determined?"	Package Error = Package Net Volume − Labeled volume	NIST in error left out the "-" during the editorial review of the current published HB 133

The following items are editorial errors made by NIST during editorial review of current published HB 133				
Test Procedure for Cylinders Labeled by Volume				
12a	3.14.2.a. G78	How is it determined if the containers meet the package requirements using the volumetric test procedure?	Change #5 to read as follows: Using NIST Technical Note 1079 "Tables of Industrial Gas Container Contents and Density for Oxygen, Argon, Nitrogen, Helium, and Hydrogen" **(available on-line at (http://www.nist.gov/owm)** determine the value (SCF/CF) from the content tables at the temperature and pressure of the cylinder under test	Added website information
13a	3.15. G79	Firewood	Editorial: Make 3.15 Main Title, subtitle firewood categories	
Chapter 4				
Packages Labeled by Count of More than 50 Items				
14a	4.4 G86	Packages Labeled by Count of More than 50 Items; Audit Procedure	Item 9: Added a minus symbol to the equation between Actual Package Gross Weight and Nominal Gross Weight.	NIST in error left out the "-" during the editorial review of the current published HB 133
Special Test Requirements for Packages Labeled by Linear or Square Measure (Area)				
15a	4.6 G90	Are there special measurement requirements for packages labeled by dimensions?	Updated Standard: 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.	Updated ASTM Standard
Polyethylene Sheeting				
16a	4.7 G92	Which procedures are used to verify the declarations on polyethylene sheeting and bags? Test Procedure	Updated the year (98) of approval referenced in ASTM Standard D 1505 ~~98~~-**03**, "Standard Method of Test for Density of Plastics by the Density Gradient Technique."	Updated ASTM Standard
Packages Labeled by Linear or Square (Area) Measure				
17a	4.8 G97	Packages Labeled by Linear or Square (Area) Measure. – Test Procedure	Item 11: Added a minus symbol to the equation between Package Gross Weight and Nominal Gross Weight.	NIST in error left out the "-" during the editorial review of the current published HB 133
Baler Twine - Test Procedure for Length				
18a	4.9 G99	Equipment	Item 5: Added a minus symbol to the equation between Package Gross Weight and Nominal Gross Weight.	NIST in error left out the "-" during the editorial review of the current published HB 133

Appendix G

NIST Handbook 133
Checking the Net Contents of Package Goods

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*Appendices B and D, and the Index are not included in this draft copy of Handbook 133 as there are no pending changes at this time.

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).

a. When and where to use package checking procedures?

An effective program will typically include testing at each of the following levels.

(1) 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.

(2) 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.

(3) 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)

b. 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.

(1) 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.

(2) 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.)

(3) 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 **(with the exception of textiles)**, which is usually controlled by the packer **for economic, compliance, and other reasons.**

(4) 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 **minus error**. Each sampling plan limits the number of negative package errors permitted to be greater than the MAV.

(5) 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.)

a. Why and when 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**.

WWMA	Change last sentence above to read as follows
For loss or gain of moisture**, apply** the moisture allowances after the package errors are determined.~~**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.

CWMA	Change paragraph above, first sentence
To apply ~~an~~**a moisture allowance** before determining package errors, adjust the Nominal Gross Weight. (See Section 2.3. "Basic Test Procedure")	

WWMA
Note: California officials question the need for accommodating both methods (before or after). This only presents opportunities for confusion. Recorded package errors should be ACTUAL values. Adjusted package errors on an inspection report cause concern for prosecutors when presenting the report in evidence. The MLA should be applied to the MAV and the SEL only after determining package and average errors. ***We suggest removing the first paragraph (To apply an allowance...) and rewording the second paragraph (It is also permissible to apply...) as follows:*** Apply the moisture allowance after individual package and average errors are determined. For example, a sample of a product subject to moisture loss might fail because the errors in several of the sample packages are determined to be unreasonable (i.e., the package error is greater than the Maximum Allowable Variation permitted for the package's labeled quantity) or the average error is minus and outside the Sample Error Limit. Adjust the MAV after the individual package errors are determined and adjust the SEL after average error is determined. Compare individual package errors to the adjusted MLA and the average error to the adjusted SEL.

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 to adjust the average error ~~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)

(6) 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.

a. 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.

b. 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.

c. 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.

d. 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.

e. 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 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 agency's health and safety 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.

(1) 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.

(2) 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** 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

a. 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 $^1/_6$ 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.

b. 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.

c. 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.

d. 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.

e. 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.

Step:

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 Division[1]	**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

[1]On 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.

Step:

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

f. 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.

(1) 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.

(2) 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.

(3) Shift Test

Bench Scales or Balance 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 use a test load equal to one-half capacity centered successively at four points positioned equidistance between the center and the front, left, back, and right edges of each pan as shown ~~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

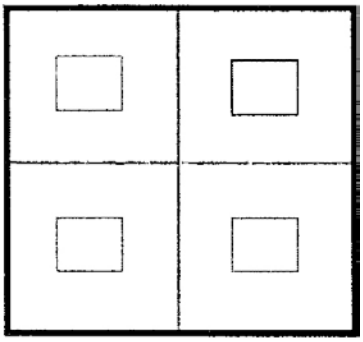
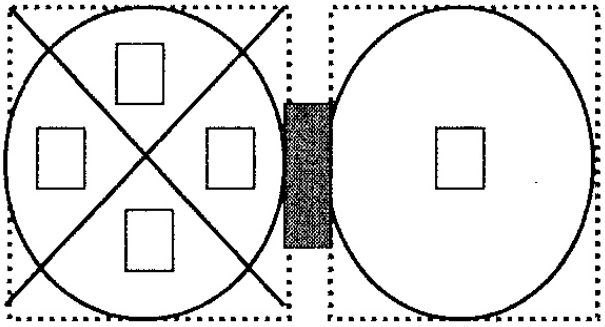


Diagram 2. Equal-Arm Balance



(4) 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.

g. 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 **Division (http://www.nist.gov/owm)** 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."

Step:

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.

2.3.1. 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.

h. 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.

2.3.2. Sampling Plans

a. 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.

b. 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.

2.3.3. Basic Inspection Procedure and Recordkeeping

a. 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).

Step:

1. Record the product identity, packaging description, lot code, location of test, and other pertinent data.

2. 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.

3. 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 is 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

Step:

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.

4. 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.

b. 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 fewer than 50 items — See Table 2-10.

c. 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.

d. How many ~~MAVs~~ unreasonable minus errors (UME's) are permitted in a sample?

To find out how many minus package errors are permitted to exceed the MAV**, (errors known as unreasonable minus errors or UME's),** ~~(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." **(refer to Appendix A)** Record this number in Box 8.

2.3.4. Random Sample Selection

a. 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.

b. 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.

c. 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.

2.3.5. Tare Procedures

a. 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.

(1) 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.

WWMA	Change note above
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, **excepting instances in which glazed or frozen foods are tested according to Section 2.6. Drained Weight for Glazed or Frozen Foods.**	
Note from California: There seems to be a conflict between this note and Section 2.6. Drained Weight for Glazed and frozen Food. If 2.6. applies to frozen food, when would there be an instance to use used dry tare? Please see our comment on Section 2.6.	

(2) 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.

(3) Wet Tare

Wet tare procedures must not be used to verify the labeled net weight of packages of meat and poultry packed at an official United States Department of Agriculture (USDA) facility and bearing a USDA seal of inspection**. 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.

b. 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.

WWMA	The following two questions and answers appear out of place. We suggest moving them behind the next two questions.
The following two questions and answers appear out of place. We suggest moving them behind the two questions (shown below). Does the inspection of aerosol containers require special procedures? How is the tare of vacuum-packed coffee determined?	

c. 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 (UPLR) 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.

d. 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): Box 13 – Box 13a + Box 1.

e. 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 B." 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.

f. How are the tare sample and the tare weight of the packaging material determined?

Step:

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 **respective package** gross weights (Block a, minus Block b, on the report form) to obtain the net weight for each package and record ~~these~~ **each** value~~s~~ in Block c, "Net Wt.," on the report form.

   Determine and record the "range of package errors" (called Rc) 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 Rt) in Box 10.

4. Compute the ratio Rc/Rt by dividing the value in Box 9 by the value in Box 10. Record the resulting value in Box 11. (Rc and Rt 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.

WWMA	
The following two questions and answers that appear above should be placed here. {*Does the inspection of aerosol containers require special procedures?* *How is the tare of vacuum-packed coffee determined?*}	

g. 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)

2.3.6. Determine Nominal Gross Weight and Package Errors for Tare Sample

a. ~~What is~~ How do I compute 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 a package's gross weight from the nominal gross weight.~~

The nominal gross weight is represented by the formula:

Nominal gross weight = average tare + labeled weight

b. How do I compute the package error?

To obtain the package error, subtract the nominal gross weight from each package's gross weight. The package error is represented by the formula:

Package error = gross weight – nominal gross weight

c. 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.

- **Standard Packages.** – Record the package error in the appropriate plus or minus column on the report form for each package opened for tare.

- **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.)

d. 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.

e. 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**, indicating the positive or negative value of the error.**

2.3.7. Evaluating Results

a. 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.

b. 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.

c. 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.

d. 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.

Step:

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:

     Sample Error Limit (Box 23)
     = Sample Standard Deviation (Box 21) x 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.

2.3.8. Moisture Allowances

a. 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.

b. What are the moisture allowances for flour, ~~and~~ dry pet food, and other products? (See Table 2-3. "Moisture Allowances.")

WWMA	Change the title of Table 2-3.
Table 2-3. Moisture Allowances **for Product in Distribution**	

Table 2-3. Moisture Allowances		
If you are verifying the labeled net weight of packages of:	**The Moisture Allowance is:**	**Notes**
Flour	**3 %**	
Dry pet food	**3 %**	**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.**
Borax	**See Section 2.4.**	

Table 2-3. Moisture Allowances		
Wet Tare Only		
If you are using Wet Tare in verifying the net weight of packages of one of the products listed below:	**The Moisture Allowance is:**	**Notice: Wet Tare must not be used in testing packages of meat and poultry subject to USDA regulations.**
Fresh poultry	**3 %**	**Fresh poultry is defined as poultry at a temperature of 3 °C (26 °F) that yields or gives when pushed with the thumb.**
Franks or hot dogs	**2.5 %**	
Bacon, fresh sausage, and luncheon meats	**0 %**	**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 Used Dried Tare are equivalent.**

~~**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.**~~

c. 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.

d. What moisture allowance is used with wet tare? when testing packages bearing a USDA seal of inspection?

Wet tare procedures must not be used to verify the labeled net weight of packages of meat and poultry packed at an official United States Department of Agriculture and bearing a USDA seal of inspection. 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]).

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 **and liquid** ~~or absorbent~~ **absorbed by** packaging materials in contact with the product, all free liquid is part of the wet tare.

e. How is moisture loss handled for products not listed in NIST Handbook 133?

Kraft: Paul Hoffman (7/09)	Change the title to read as follows:
e. How is moisture loss… "Moisture loss must be considered even when no formal allowance for the specific product is found in HB 133."	

Officials can test products for which no moisture loss guidance has been provided. If studies are a necessity they should be a collaborative effort between officials and industry. Because of the potential impact on interstate commerce, studies should be completed on a nationwide basis and not by individual jurisdictions unless circumstances justify only local consideration.

The amount of moisture loss from a package is a function of many factors, not the least of which is the product itself (e.g., moisture content, texture and density), packaging, storage conditions

(e.g., temperature, humidity, and air flow), time, handling and others. If a packaged product is subject to moisture loss, officials must allow for "reasonable" variations caused by moisture either evaporating or draining from the product. Officials cannot set arbitrary moisture allowances based solely on their experience or intuition. Moisture allowances must be based on scientific data and must be "reasonable." Reasonable does not mean that all of the weight loss caused by moisture evaporation or draining from the product must be allowed. As a result of product and moisture variability, the approach used by an official must be developed on a case-by-case basis depending on many factors to include, but not be limited to, the manufacturing process, packaging materials, distribution, environmental influence and the anticipated shelf life of the product.

NIST Handbook 130 provides a starting point for developing a workable procedure in the Interpretation and Guideline Section 2.5.6. regarding "Resolution for Requests for Recognition of Moisture Loss in Other Packaged Products." Most studies involving nationally distributed products will require that products be tested during different seasons of the year and in different geographic locations to develop a nationally recognized moisture allowance. Some studies may require the development of laboratory tests used for inter-laboratory comparisons to establish moisture content in products at time of pack or at the time of inspection.

Moisture loss or gain is a critical consideration for any net content enforcement effort and one that, in most cases, cannot be addressed solely by a field official. If moisture loss issues are to be deliberated, it is the regulatory official's responsibility to resolve the packer's concern utilizing available resources and due process procedures. To fulfill this obligation the official may be required to utilize specialized test equipment and specific laboratory procedures. Additionally, the collection of adequate test data may require product examination over a broad geographical area and consideration of a wide range of environmental factors. If a national effort is required, a coordinated effort involving industry, trade associations, weights and measures officials, and federal agencies may be required. NIST will provide technical support upon request. If studies are a necessity, they should be a collaborative effort between officials and industry and can be very time consuming depending on the product. Because of the potential impact on interstate commerce, studies must be completed on a nationwide basis and not by individual jurisdictions unless circumstances justify only local consideration.

2.3.9. Calculations

a. 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.

WWMA	Based on previous comments, we suggest removing the question and answer below.
{How is a Moisture Allowance made prior to determining the package errors?}	

b. 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.

c. 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 moisture allowance based on data obtained using a scientific method) using the following approach:

If the sample fails the Average and/or the Individual Package Requirements, both of the following steps are applied.

If the sample fails 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 Minus Errors (UMEs), only step 2 is used.

Step:

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.**

   HOWEVER,

   - **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 UME'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.**~~

d. What should you do when a sample is in the moisture allowance (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:

- Is a quality control program in place?
- What information is available concerning the lot in question?
- If net weight checks were completed, what were the results of those checks?
- 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.

Reasonable 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

a. 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 pint)
- 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.

Step:

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 straightedge. Hold the ruler or straightedge 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.

b. How is the volume determined?

Step:

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 ~~is not 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 ____ cm^3 per NIST Handbook 133

Note: (1 mL = 1 cm^3)

c. 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.

Test 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

  HOWEVER

  - For drained weight greater than 1.36 kg or (3 lb), one 30 cm or (12 in) sieve, with same specifications as above
  - **For canned tomatoes a U.S. Standard test sieve with 11.2 mm ($^{7}/_{16}$ in) openings must be used**

- 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.

Step:

1. Use Appendix E. "Standard 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.

Step:

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

WWMA	
2.6. Determining the net weight of ice-encased frozen foods and ice glazed products~~Drained Weight for Glazed or Frozen Foods~~	

a. How is the drained weight of frozen shrimp (e.g., 2.27 kg (5 lb) block of shrimp) and crabmeat determined?

WWMA	Change the above question to read:
a. How ~~is~~ **should** the ~~drained~~ **net** weight of frozen shrimp ~~(e.g., 2.27 kg (5 lb) block of shrimp), and~~ crabmeat**, meat or poultry, and similar products encased in ice and frozen into blocks or solid masses (i.e., not individually glazed) be** determined?	

When determining the net weight of frozen shrimp and crabmeat, use the test equipment and procedure provided below.

Step:

1. 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.

2. 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).

3. After thawing, drain the product on a sieve for 2 minutes and then weigh it.

WWMA	Change above paragraph, first two sentences:
When determining the net weight of frozen shrimp**, crabmeat, meat or poultry products, or similar products that are encased in ice and frozen into blocks or solid masses,** use the test equipment and procedure provided below.	

Test 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 a**n 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)

WWMA	Change above item, first sentence
(used for testing large frozen blocks of shrimp **or other products**)	

- 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.

Step:

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.

WWMA	Change the above 1st sentence to read:
Place the unwrapped frozen shrimp, ~~**or**~~ crabmeat**, or meat, poultry, or seafood product** 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).	

Step:

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.

Step:

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.

b. How is the net weight of glazed ~~raw~~ seafood and fish determined?

WWMA	Change the above question to read:
*How is the net weight of **frozen,** glazed ~~raw~~ seafood**,** ~~and~~ fish**, poultry, meat, or similar products** determined?*	

NEWMA	Comment
Section 2.6. specifically references the use of glaze with frozen seafood. Glazed chicken wings are being seen in the marketplace. It was suggested that wording be added to include other glazed products such as frozen (glazed?) chicken.	

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.

WWMA	Change the above sentence to read:
For **frozen,** glazed seafood**,** ~~**and**~~ fish, **poultry or meat products, or similar products,** determine the net weight after removing the glaze using the following procedure.	

Test Equipment

Use the equipment listed in Section 2.6. "Drained Weight for Glazed or Frozen Foods."

WWMA	Change the above sentence to read:
Use the equipment listed in Section 2.6. **Determining the net weight of frozen, ice-glazed products** ~~**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.

Step:

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~~ **pan** weight."

Step:

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 spray**ing 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~~**partial thawing of** the product. Nonetheless, remove **all** ~~the~~ice glaze, because it **may be** ~~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. **At the end of the drain time immediately transfer the entire product to the tared pan for weighing to determine the net weight.** Place the product and ~~sieve~~ pan on the ~~receiving pan~~ **scale** and weigh. Record this weight on a worksheet as the "~~sieve~~**pan** + 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~~ **pan** 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 **cleaning and drying** 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

a. 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.

b. 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."

c. 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.

d. 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."

e. 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.

f. 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).

Table 3-1. Reference Temperatures for Liquids	
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 un-chilled, such as soft-drinks and wine)	20 °C (68 °F)

3.2. Gravimetric Test Procedure for Liquids

Test 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 mL/6 = 4.8 mL (1 fl oz/6 = 0.166 6 fl oz)
  >
  > 943 g/1000 mL= 0.943 g/mL (2.07 8 lb/33.6 fl oz = 0.061 8 lb/fl oz)
  >
  > 4.8 mL x 0.943 g/mL = 4.5264 g (0.166 6 fl oz x 0.061 8 lb/fl oz = 0.010 lb)

  In this example, the 1 g (0.002 lb) scale division is smaller than the MAV/6 value of 4.5264 g (0.10 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

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.

Step:

1. 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.

2. 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).

Step:

3. 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.

4. 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.

5. 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.

6. 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.

Step:

- 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."

a. How is "nominal gross weight "determined?

Determine the "nominal gross weight" as follows:

Step:

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)

b. How are the errors in the sample determined?

Step:

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. All sample packages are compared to the nominal gross weight.

3. To convert the average error or package error from weight to volume, use the following formula:

Package Error in Volume = Package Error in Weight/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

a. 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.

b. 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

a. 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 E287-2(2007), "Standard Specification for Laboratory Glass Graduated Burets"
  - Class A pipets, calibrated "to deliver" that conform to ASTM E969-02(2007), "Standard Specification for Glass Volumetric (Transfer) Pipets"
- Volumetric measures
- Water
- Rubber bulb syringe
- Plastic disks that are 3 mm ($^1/_8$ 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 [$^1/_{32}$ in]) thick at the edge. Each disk must have a 20 mm (¾ in) diameter hole through its center and a series of 1.5 mm ($^1/_{16}$ in) diameter holes 25 mm (1 in) **apart around the periphery of the disk and 3 mm ($^1/_8$ in)** from the outer edge. **All edges must be smooth.**
- Stopwatch
- **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)**

b. How is the volume of oils, syrups, and other viscous liquids that have smooth surfaces determined?

Step:

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.**

Step:

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. How is the volume of mayonnaise and salad dressing, and water immiscible products that do not have smooth and level surfaces determined?

(1) 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.

Step:

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.

Step:

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 overfill 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

a. 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.

b. 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.

Step:

1. Make all measurements on a level surface.

2. When testing goods labeled by capacity, use water at a reference temperature of 20 °C ± 2 °C (68 °F ± 5 °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 overfill 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

a. 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."

b. 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.

c. 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.

d. What are the steps of the test procedure?

Follow steps 1 through 6 in Section 3.6. "Goods Labeled by Capacity – Volumetric Test Procedure."

e. 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.

HOWEVER

- 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

a. 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.

Test 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 (¼ 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

b. 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.

c. 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.

d. 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.

e. How is a retail audit test performed?

Step:

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)	

Step:

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 (3/8 in) from the inner rim for cans 12.5 cm (5 in) in diameter or less (and at 1.5 cm [½ 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:

$$\text{Volume} = 0.7854\ D^2H$$

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.

f. 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.

Step:

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.

Step:

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 (½ 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)

4. 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.

3.8.1. Violation Procedure

a. 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 removed by scraping into the can.

Step:

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)]

Step:

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.

Step:

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).

net weight (Column 7) x labeled volume (Column 1) ÷ volume of paint in can (Column 6)

Record this value in Column 8.

8a.* Calculate the package volume =

volume in can (Column 6) + (lid paint weight [Column 3] x
volume in can [Column 6] / net weight [Column 7]]

Record it in Column 9 of the worksheet.

Step:

9. Calculate the package error. Use the following formula if paint does not adhere to the lid:

   Package error = (Column 6 value) - (labeled volume)

   9a.* Use the following formula if paint does adhere to the lid and will not come off by scraping.

   Package error = (Column 9 value) - (labeled volume)

10. Repeat steps 1 through 9 for the second package chosen for tare.

b. 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).

c. 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

a. 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.

b. 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 E542-01(2007), "Standard Practice for Calibration of Laboratory Volumetric Apparatus."

- Appropriate solvents (water, Stoddard solvent, kerosene, alcohol, etc.)

- Caulking gun (for cartridge packed products)

c. 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.

d. How is it determined if the containers meet the package requirements?

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.

Step:

1. Weigh a calibrated pycnometer and slicker plate and record as "pycnometer weight" and record this weight and the volume of the pycnometer.

2. 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 ¾ 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.

3. Completely remove the product from the package container; clean the package container with solvent; dry and weigh it to determine the tare weight.

4. 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.

Step:

5. Clean the pycnometer and repeat steps 2, 3, and 4 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 8 and 9.

   Note: If the gravimetric procedure can be used, perform steps 7 and 9.

6. Calculate the weight of product corresponding to the labeled volume of product according to the following formula:

   Weight of Product in Pycnometer ÷ Pycnometer Volume = Product Density

7. 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.

8. Convert the package errors to units of volume using the following formula:

   Package Error (volume) =
   (Package Error [weight] x Pycnometer Volume) ÷ (Weight of Product in Pycnometer)

9. 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

a. 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. **Take three measurements (both ends and middle) of each dimension and calculate their average. Multiply the averages to obtain the compressed cubic volume.**

b. 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."

Test 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 ft^3) 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 ft^3) 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
- Straightedge, 50.8 cm (20 in) in length
- Sheet for catching overflow of material
- Level (at least 15.24 cm (6 in) in length)

c. How is it determined if the packages meet the requirements in this handbook?

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.

Step:

1. 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.

2. 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 straightedge using a zigzag motion across the top of the container.

3. 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.

Step:

4. Record the total volume.

5. 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

a. 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."

b. 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>
<tr><th colspan="6">Table 3-4. Specifications for Test Measures for Mulch and Soils</th></tr>
<tr><th rowspan="2">Nominal Volume of Test Measure</th><th colspan="3">Interior Wall Dimensions *</th><th>Marked Intervals on Interior Walls ***</th><th>Volume Equivalent of Marked Intervals</th></tr>
<tr><th>Length</th><th>Width</th><th>Height **</th><th></th><th></th></tr>
<tr><td>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)</td><td colspan="2">203.2 mm (8 in)</td><td>736.6 mm (29 in)</td><td rowspan="4">12.7 mm (½ in)</td><td>524.3 mL (32 in^3)</td></tr>
<tr><td>28.3 L (1 ft^3)</td><td colspan="3">304.8 mm (12 in)</td><td rowspan="3">1 179.8 mL (72 in^3)</td></tr>
<tr><td>56.6 L (2 ft^3)</td><td rowspan="2">406.4 mm (16 in)</td><td rowspan="2">228.6 mm (9 in)</td><td rowspan="2">1219.2 mm (48 in)</td></tr>
<tr><td>84.9 L (3 ft^3)</td></tr>
<tr><td colspan="6">Measures are typically constructed of 12.7 mm (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.

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.</td></tr>
</table>

- Dropcloth/polyethylene sheeting for catching overflow of material
- Level (at least 15 cm [6 in] in length)

c. How is it determined if the packages meet the package requirements?

Use the following procedure:

Step:

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.

Step:
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.

d. 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.

WWMA	Add in a statement regarding pelletized ice cream
Exception – Pelletized ice cream are beads of ice cream which are quick frozen with liquid nitrogen. The beads are relatively small, but can vary in shape and size. On April 17, 2009 the FDA issued a letter stating that this product is considered semisolid food, in accordance with 21 CFR 101.105(a). The FDA also addresses that the appropriate net quantity of content declaration for pelletized ice cream products be in terms of net weight.	

a. 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.

Test 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.

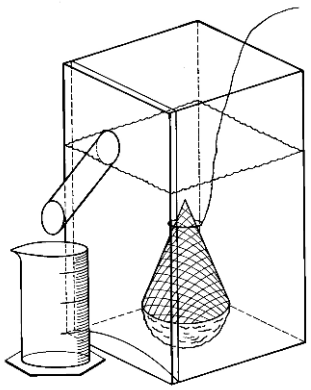


Figure 3-1. Example of a Displacement Vessel

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 procedures 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 steps to determine lot compliance.

Step:

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.)

b. How is it determined if the ice cream novelty packages meet the requirements in this handbook?

Step:

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.

Step:

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:

   Product Density = (weight in item 3) ÷ (the total water volume in step 5)
   Weight of labeled volume = (labeled volume) x (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.

c. How is "nominal gross weight" determined?

Step:

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:

   Nominal Gross Weight = Average Product Weight + Average Used Dry Tare Weight

d. How are the errors in the sample determined?

Step:

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.

Step:

3. Follow Section 2.3. "Basic Test Procedure."

To convert the average error or package error from weight to volume, use the following formula:

Package Error in Volume = (Package Error in Weight) ÷ (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

a. 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.

Test 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 cm^2 (300 in^2) 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

b. 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.

Step:

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:

$$\text{Percent of free liquid by weight} = [(\text{weight of free liquid}) \div (\text{weight of oysters + liquid})] \times 100.$$

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

a. 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.

b. 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.

c. 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:

Step:

1. Always wear safety glasses.

2. 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.

Step:

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

d. What type of measurement equipment is needed to test cylinders of compressed gas?

Test Equipment

- 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 ($1^1/_8$ 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.

3.14.1. Test Procedure for Cylinders Labeled by Weight

a. How is it determined if the containers meet the package requirements using the gravimetric test procedure?

Step:

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.

Step:

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).

3.14.2 Test Procedure for Cylinders Labeled by Volume

a. How is it determined if the containers meet the package requirements using the volumetric 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.

Step:

1. 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.

2. Using the appropriate pressure gauge, measure the pressure of each cylinder in the sample.

3. Determine the cylinder nominal capacity from cylinder data tables or from the manufacturer. (These tables must be obtained in advance of testing.)

4. Using NIST Technical Note 1079 "Tables of Industrial Gas Container Contents and Density for Oxygen, Argon, Nitrogen, Helium, and Hydrogen" (available on-line at (http://www.nist.gov/owm), determine the value (SCF/CF) from the content tables at the temperature and pressure of the cylinder under test.

5. Multiply the cylinder nominal capacity by the value (SCF/CF) obtained from the content tables. This is the actual net quantity of gas.

6. 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. Firewood

3.15.1 Volumetric Test Procedure for Packaged Firewood with a Labeled Volume of 113 L (4 ft^3) or Less

a. 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.

Test Equipment

- Linear Measure. Take all measurements in increments of 0.5 cm ($^3/_{16}$ 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.

b. 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.

3.15.2. Boxed Firewood

a. 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.

Step:

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 "d_1, d_2...etc.") along each end of the stack. Measure from the bottom of a straightedge 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.

Average Height of Stack =
(Internal Height of Box) – (sum of measurements) ÷ (number of measurements)

Step:

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.

$$\text{Average Width} = (W_1 + W_2 + W_3) \div (3)$$

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.

$$\text{Average Length} = (L_1 + L_2 + L_3 + L_4 + L_5) \div (5)$$

4. Calculate the volume of the wood within the box. Use dimensions for height, width, and length.

$$\text{Volume in liters} = (\text{height in cm x width in cm x length in cm}) \div (1000)$$

$$\text{Volume in cubic feet} = (\text{height in inches x width in inches x length in inches}) \div (1728)$$

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.

3.15.3. Crosshatched Firewood

a. 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.

Step:

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.

Step:

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:

   Volume in liters = (Avg. Height [cm] x Avg. Width [cm] x Avg. Length in [cm]) ÷ 1000

   Volume in cubic feet = (Avg. Height [in] x Avg. Width [in] x Avg. Length [in]) ÷ 1728

4. Follow Section 2.3. "Basic Test Procedure – Evaluating Results" to determine lot conformance.

3.15.4. Bundles and Bags of Firewood

a. 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.

Step:

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:

   Average Area = (Area 1 + Area 2) ÷ 2

Step:

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:

$$\text{Volume in liters} = (\text{Average Area } [\text{cm}^2] \times \text{Average Length [cm]}) \div 1000$$

$$\text{Volume in cubic feet} = (\text{Average Area } [\text{in}^2] \times \text{Average Length [in]}) \div 1728$$

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

a. 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.

b. 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.

c. 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

a. How are packages labeled by count tested?

If the labeled count is 50 items or 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."

b. How to determine if a gravimetric test procedure may 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.

Step:

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.

Step:

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

Step:

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.

Test 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 ± 1 %. Determine the lot compliance based on actual count or the violation procedure.

Step:

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.

Step:

5. Calculate the weight of the labeled count using the following formula:

   Weight of the Labeled Count =
   (labeled count x weight of items in step 4) ÷ (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.

   (Package error [weight]) =
   (actual package gross weight) − (nominal gross weight)

10. Convert the package errors in units of weight to count:

    Package error (count) = (Package error [weight] x labeled count) ÷ (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.

Step:

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."

Step:

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:

   Weight of labeled count = (labeled count) x (contents weight ÷ 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.

   Package Error (weight) = (Actual Package Gross Weight) - (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:

   MAV (weight) =
   (MAV (count) x Avg. Wt. of Labeled Count [from step 4]) ÷ (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:

Avg. Pkg. Error (count) = (Avg. Pkg. Error [dimensionless units]) x (Unit of Measure) x (Labeled Count) ÷ (Avg. Weight of Labeled Count)

4.5. Paper Plates and Sanitary Paper Products

a. 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 $^1/_{64}$ in or $^1/_{100}$ in divisions and an overall length tolerance of $^1/_{64}$ in.

    For dimensions greater than 25 in, use a 100 ft tape with $^1/_{16}$ 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.

b. How are paper products inspected?

Step:

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.

c. 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).

Step:

1. 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.

Step:

2. 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.

3. 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)

a. 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 D1907-07, "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

a. 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.

Test 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 $^{1}/_{64}$ in or $^{1}/_{100}$ in divisions and an overall length tolerance of $^{1}/_{64}$ in.

    For dimensions greater than 25 in, use a 100 ft tape with $^{1}/_{16}$ 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 (¼ in) diameter or larger, and a 4.75 mm ($^{3}/_{16}$ 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 0.001 2 mm (0.000 05 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

Step:

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.

Step:

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:

Polyethylene Sheeting

1.82 m (6 ft) x 30.48 m (100 ft)

101.6 µm (4 mil)

Step:

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:

Target Mass in Kilograms = (T x A x D) ÷ 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:

Target Weight in Pounds = T x A x D x 0.036 13

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; 0.036 13 is a factor for converting $^{g}/_{cm^3}$ to $^{lb}/_{in^3}$.

*Determined by ASTM Standard D1505-03, "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

Step:

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:

   $$(0.010\ 16\ \text{cm} \times [(1.82\ \text{m} \times 100\ {}^{\text{cm}}/_{\text{m}}) \times (30.48\ \text{m} \times 100\ {}^{\text{cm}}/_{\text{m}})] \times 0.92\ {}^{\text{g}}/_{\text{cm}^3}) \div 1000\ {}^{\text{g}}/_{\text{kg}}$$
   $$= \text{a target net mass of } 5.18\ \text{kg}$$

   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:

   $$(0.004\ \text{in}) \times [(6\ \text{ft} \times 12\ {}^{\text{in}}/_{\text{ft}}) \times (100\ \text{ft} \times 12\ {}^{\text{in}}/_{\text{ft}})] \times 0.92\ {}^{\text{g}}/_{\text{cm}^3} \times 0.03613$$
   $$= \text{a target net weight of } 11.48\ \text{lb}$$

   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.

2. Select packages for tare samples. Determine and record the gross weights of the initial tare sample.

3. Extend the product in the sample packages to their full dimensions and remove by hand all creases and folds.

4. Measure the length and width of the product to the closest 3 mm ($^1/_8$ 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 dropcloths or tarpaulins, make three length measurements along the width of the sample and three width measurements along the length of the sample.

5. Determine and record the average tare weight according to Section 2.3. “Basic Test Procedures – Tare Procedures.”

4.7.1. 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 (¼ 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.

4.7.2. 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.

4.7.3. 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

Test 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 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 $^1/_{64}$ in or $^1/_{100}$ in divisions and an overall length tolerance of $^1/_{64}$ in.

    For dimensions greater than 25 in, use a 100 ft tape with $^1/_{16}$ in divisions and an overall length tolerance of 0.1 in.

- T-square

Test Procedure

Step:

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."

Step:

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:

     Weight of the labeled measurement =
     (labeled measurement) x (contents weight) ÷ (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:

   Weight of the labeled measurement =
   (labeled measurement) x (contents weight ÷ 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.

Step:

11. Compute package errors according to the following formula:

Package error (weight) =
(actual package gross weight) − (nominal gross weight)

12. Convert the MAV to units of weight using the following formula:

MAV (weight) =
(avg. wt. of label measurements x MAV [length]) ÷ (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:

Avg. Pkg. Error (dimension) = (Avg. Pkg. Error [dimensionless units]) x (Unit of Measure) x (Labeled unit of measure) ÷ (Avg. Weight of Labeled dimension)

4.9. Baler Twine – Test Procedure for Length

Test 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 $^1/_{64}$ in or $^1/_{100}$ in divisions and an overall length tolerance of $^1/_{64}$ in.

    For dimensions greater than 25 in, use a 100 ft tape with $^1/_{16}$ 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.

Step:

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.

Step:

- 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:

   Package error (weight) = (package gross weight) − (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 hydroscopic; 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 hydroscopic 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 ¼ ft^2 (e.g., 1 ft^2, 1¼ ft^2, and 1½ ft^2). Separate the chamois into different sizes and define the inspection lot by specific sizes.

Test Equipment

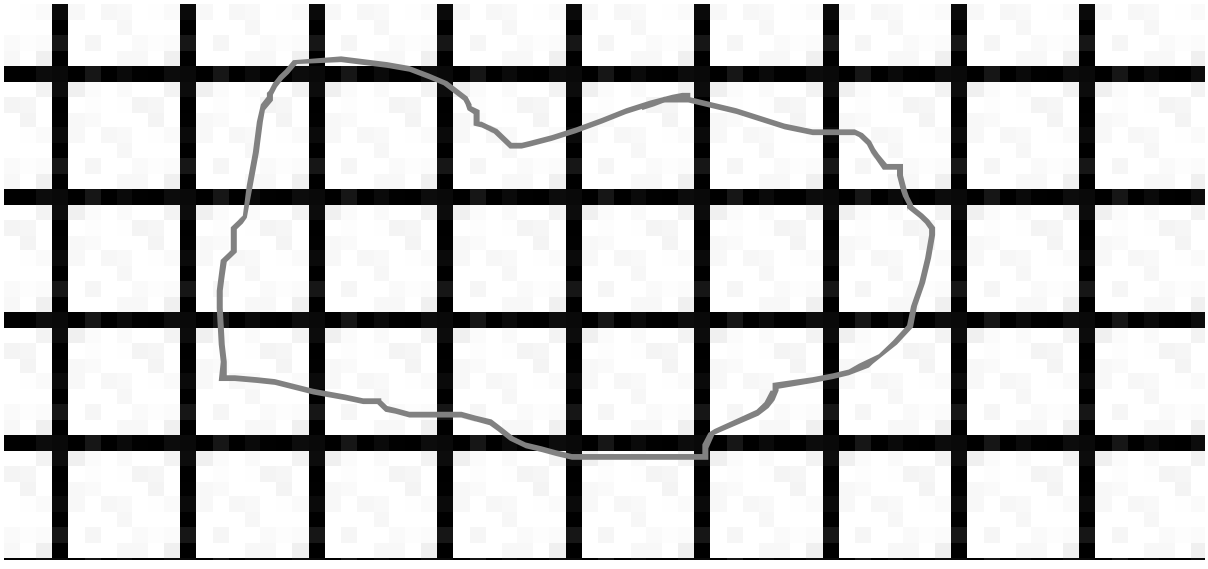
Use a transparent, flexible template that is graduated in square centimeters or square inches and that has been verified for accuracy. The template must be large enough to completely cover the chamois under test.

Template Procedures

Step:

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.



Step:
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.

Test 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

Step:
1. Remove each sample from its package and 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 from 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

Step:

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".

Appendix A. Tables

Table 1-1. Agencies Responsible for Package Regulations and Applicable Requirements

Commodity	Responsible Agency	NIST Handbook 133 Sampling Plans	Table of Maximum Allowable Variations
Meat and Poultry	U.S. Department of Agriculture/Food Safety and Inspection Service and state and local weights and measures.	1. Use Table 2-1. Sampling Plans for Category A to test packages at other than point of pack. 2. Use Table 2-2. Sampling Plans for Category B to test packages in federally inspected meat and poultry plants.	Table 2-9. U.S. Department of Agriculture, Meat and Poultry, Groups and Lower Limits for Individual Packages
Foods, drugs, and cosmetics subject to the Food, Drug, and Cosmetic Act including those packaged at the retail store level that have been in interstate commerce (e.g., seafood) or those made with ingredients that have been in interstate commerce	U.S. Food and Drug Administration and state and local weights and measures http://www.fda.gov	Use Table 2-1. Sampling Plans for Category A to test packages at all locations.	Table 2-5. MAVs for Packages Labeled by Weight Table 2-6. MAVs for Packages Labeled by Liquid or Dry Volume Table 2-7. MAVs for Packages Labeled by Count Table 2-8. MAVs for Packages Labeled by Length (Width) or Area Table 2-10. Exceptions to the MAVs for Textiles, Polyethylene Sheeting and Film, Mulch and Soil Labeled by Volume, Packaged Firewood, and Packages Labeled
Food products <u>not</u> subject to the Federal Food, Drug, and Cosmetic Act, including meat and poultry products packaged at the retail store level	State and local weights and measures http://www.nist.gov/owm		
Non-food Consumer Products	Federal Trade Commission http://www.ftc.gov		
Non-food Consumer and Non-consumer Products	State and local weights and measures		

Table 1-1. Agencies Responsible for Package Regulations and Applicable Requirements			
Commodity	**Responsible Agency**	**NIST Handbook 133 Sampling Plans**	**Table of Maximum Allowable Variations**
Alcohol and Tobacco Products	U.S. Bureau of Alcohol, Tobacco, and Firearms and state and local weights and measures http://www.atf.treas.gov		by Count with Less than 50 Items
Pesticides	U.S. Environmental Protection Agency and state and local weights and measures http://www.epa.gov		

Table 2-1. Sampling Plans for Category A

1	2	3	4	5	6
Inspection Lot Size	**Sample Size**	**Sample Correction Factor**	**Number of Minus Package Errors Allowed to Exceed the MAV ***	**Initial Tare Sample Size ****	
				Glass and Aerosol Packages	**All Other Packages**
1	1	Apply MAV	0*	2	2
2	2	8.984~~5~~			
3	3	2.484			
4	4	1.591			
5	5	1.24~~1~~2			
6	6	1.0~~5~~049			
7	7	0.925			
8	8	0.836			
9	9	0.769			
10	10	0.715			
11	11	0.672			
12 to 250	12	0.635			
251 to 3 200	24	0.422		3	
More than 3 200	48	0.29~~1~~0	1*		

* For mulch and soils packaged by volume, see Table 2-10. Exceptions to the Maximum Allowable Variations – 1 package may exceed the MAV for every 12 packages in the sample.

** If sample size is 11 or fewer, the initial tare sample size and the total tare sample size is 2 samples.
(Amended 2001)

Table 2-2. Sampling Plans for Category B
For Use In USDA-Inspected Meat and Poultry Plants Only

1	2	3	4
Inspection Lot Size	**Sample Size**	**Initial Tare Sample Size**	**Number of Packages Allowed to Exceed the MAVs in Table 2-9**
250 or Fewer	10	2	0
251 or More	30	5	

Table 2-3. Category A – Total Number of Packages to be Opened for Tare Determination Numbers Include those Packages Opened for Initial Tare Sample					
Ratio of R_c/R_t	**Total Number of Packages in Tare Sample**				
Sample Size	**12**	**24**		**48**	
Initial Tare Sample Size	**2**	**2**	**3**	**2**	**3**
If range of tare equals "zero," use Initial Tare Sample Size. If the ratio is "zero" based on a "zero" range of net weight, open all of the packages in the sample.	2	2	3	2	3
If the ratio is greater than 0 but less than or equal to 0.2	12	24	24	48	48
0.21 to 0.60	12	24	24	48	48
0.61 to 0.70	12	24	24	47	47
0.71 to 0.80	12	23	23	47	47
0.81 to 1.00	12	23	23	46	46
1.01 to 1.10	11	23	23	46	46
1.11 to 1.20	11	23	23	45	45
1.21 to 1.30	11	22	22	45	45
1.31 to 1.50	11	22	22	44	44
1.51 to 1.60	11	22	22	43	43
1.61 to 1.70	11	21	21	42	42
1.71 to 1.80	10	21	21	42	42
1.81 to 1.90	10	21	21	41	41
1.91 to 2.00	10	20	20	41	41
2.01 to 2.10	10	20	20	40	40
2.11 to 2.20	10	20	20	39	39
2.21 to 2.30	10	19	19	39	39
2.31 to 2.40	9	19	19	38	38
2.41 to 2.50	9	19	19	37	37
2.51 to 2.60	9	18	18	37	37
2.61 to 2.70	9	18	18	36	36
2.71 to 2.80	9	18	18	35	35
2.81 to 2.90	9	17	17	34	34
2.91 to 3.00	8	17	17	34	34
3.01 to 3.10	8	17	17	33	33
3.11 to 3.30	8	16	16	32	32
3.31 to 3.40	8	16	16	31	31
3.41 to 3.50	8	15	15	30	30
3.51 to 3.60	7	15	15	30	30
3.61 to 3.70	7	15	15	29	29
3.71 to 3.90	7	14	14	28	28
3.91 to 4.00	7	14	14	27	27
4.01 to 4.10	7	13	13	27	27
4.11 to 4.20	7	13	13	26	26
4.21 to 4.30	6	13	13	25	25

Table 2-3. Category A – Total Number of Packages to be Opened for Tare Determination Numbers Include those Packages Opened for Initial Tare Sample					
Ratio of R_c/R_t	**Total Number of Packages in Tare Sample**				
Sample Size	**12**	**24**		**48**	
Initial Tare Sample Size	**2**	**2**	**3**	**2**	**3**
4.31 to 4.40	6	12	12	25	25
4.41 to 4.60	6	12	12	24	24
4.61 to 4.70	6	12	12	23	23
4.71 to 4.80	6	11	11	23	23
4.81 to 4.90	6	11	11	22	22
4.91 to 5.00	5	11	11	22	22
5.01 to 5.10	5	11	11	21	21
5.01 to 5.10	5	11	11	21	21
5.11 to 5.20	5	10	10	21	21
5.21 to 5.40	5	10	10	20	20
5.41 to 5.60	5	10	10	19	19
5.61 to 5.70	5	9	9	19	19
5.71 to 5.80	5	9	9	18	18
5.81 to 5.90	4	9	9	18	18
5.91 to 6.10	4	9	9	17	17
6.11 to 6.20	4	8	8	17	17
6.21 to 6.50	4	8	8	16	16
6.51 to 6.70	4	8	8	15	15
6.71 to 6.80	4	7	7	15	15
6.81 to 7.00	4	7	7	14	14
7.01 to 7.20	3	7	7	14	14
7.21 to 7.40	3	7	7	13	13
7.41 to 7.60	3	6	6	13	13
7.61 to 8.00	3	6	6	12	12
8.01 to 8.20	3	6	6	11	11
8.21 to 8.50	3	5	5	11	11
8.51 to 8.80	3	5	5	10	10
8.81 to 9.00	2	5	5	10	10
9.01 to 9.30	2	5	5	9	9
9.31 to 9.70	2	4	4	9	9
9.71 to 10.40	2	4	4	8	8
10.41 to 10.90	2	4	4	7	7
10.91 to 11.30	2	3	3	7	7
11.31 to 12.50	2	3	3	6	6
12.51 to 13.20	2	3	3	5	5
13.21 to 13.90	2	2	3	5	5
13.91 to 16.00	2	2	3	4	4
16.01 to 19.10	2	2	3	3	3
19.11 to 19.20	2	2	3	2	3
Initial Tare Sample Size	**2**	**2**	**3**	**2**	**3**

Table 2-4. Category B – Total Number of Packages to be Opened for Tare Determination Numbers Include those Packages Opened for Initial Tare Sample		
Ratio of R_c/R_t	**Total Number of Packages in Tare Sample**	
Sample Size	**10**	**30**
Initial Tare Sample Size	**2**	**5**
If the ratio is zero, based on a "zero" range of tare, use Initial Tare Sample Size. If the ratio is "zero" based on a "zero" range of net weight, open all the packages in the sample.	2	5
If the ratio is greater than 0 but less than or equal to 0.2	10	30
0.21 to 0.40	10	29
0.41 to 0.60	10	28
0.61 to 0.80	9	26
0.81 to 1.00	8	24
1.01 to 1.20	8	23
1.21 to 1.40	7	21
1.41 to 1.60	7	19
1.61 to 1.80	6	17
1.81 to 2.00	5	15
2.01 to 2.20	5	14
2.21 to 2.40	5	13
2.41 to 2.60	4	12
2.61 to 2.80	4	11
2.81 to 3.00	4	10
3.01 to 3.20	3	9
3.21 to 3.60	3	8
3.61 to 3.80	3	7
3.81 to 4.40	2	6
If the ratio is greater than 4.40, use the Initial Tare Sample Size	2	5

Table 2-5. Maximum Allowable Variations (MAVs) for Packages Labeled by Weight

Do Not Use this Table for Meat and Poultry Products subject to USDA Regulations – Use Table 2-9.
For Polyethylene Sheeting and Film, see Table 2-10. Exceptions to the MAVs.

Labeled Quantity	Maximum Allowable Variations
Less than 36 g, 0.08 lb, or 1.28 oz	10 % of labeled quantity
36 g or more to 54 g **0.08 lb or more to 0.12 lb** 1.28 oz or more to 1.92 oz	3.6 g **0.008 lb** 1/8 oz
More than 54 g to 81 g **More than 0.12 lb to 0.18 lb** More than 1.92 oz to 2.88 oz	5.4 g **0.012 lb** 3/16 oz
More than 81 g to 117 g **More than 0.18 lb to 0.26 lb** More than 2.88 oz to 4.16 oz	7.2 g **0.016 lb** ¼ oz
More than 117 g to 154 g **More than 0.26 lb to 0.34 lb** More than 4.16 oz to 5.44 oz	9.0 g **0.020 lb** 5/16 oz
More than 154 g to 208 g **More than 0.34 lb to 0.46 lb** More than 5.44 oz to 7.36 oz	10.8 g **0.024 lb** 3/8 oz
More than 208 g to 263 g **More than 0.46 lb to 0.58 lb** More than 7.36 oz to 9.28 oz	12.7 g **0.028 lb** 7/16 oz
More than 263 g to 317 g **More than 0.58 lb to 0.70 lb** More than 9.28 oz to 11.20 oz	14.5 g **0.032 lb** ½ oz
More than 317 g to 381 g **More than 0.70 lb to 0.84 lb** More than 11.20 oz to 13.44 oz	16.3 g **0.036 lb** 9/16 oz
More than 381 g to 426 g **More than 0.84 lb to 0.94 lb** More than 13.44 oz to 15.04 oz	18.1 g **0.040 lb** 5/8 oz
More than 426 g to 489 g **More than 0.94 lb to 1.08 lb** More than 15.04 oz to 17.28 oz	19.9 g **0.044 lb** 11/16 oz
More than 489 g to 571 g More than 1.08 lb to 1.26 lb	21.7 g 0.048 lb
More than 571 g to 635 g More than 1.26 lb to 1.40 lb	23.5 g 0.052 lb
More than 635 g to 698 g More than 1.40 lb to 1.54 lb	25.4 g 0.056 lb
More than 698 g to 771 g More than 1.54 lb to 1.70 lb	27.2 g 0.060 lb
More than 771 g to 852 g More than 1.70 lb to 1.88 lb	29.0 g 0.064 lb
More than 852 g to 970 g More than 1.88 lb to 2.14 lb	31.7 g 0.070 lb

Table 2-5. Maximum Allowable Variations (MAVs) for Packages Labeled by Weight

Do Not Use this Table for Meat and Poultry Products subject to USDA Regulations – Use Table 2-9.
For Polyethylene Sheeting and Film, see Table 2-10. Exceptions to the MAVs.

Labeled Quantity	Maximum Allowable Variations
More than 970 g to 1.12 kg More than 2.14 lb to 2.48 lb	35.3 g 0.078 lb
More than 1.12 kg to 1.25 kg More than 2.48 lb to 2.76 lb	39.0 g 0.086 lb
More than 1.25 kg to 1.45 kg More than 2.76 lb to 3.20 lb	42.6 g 0.094 lb
More than 1.45 kg to 1.76 kg More than 3.20 lb to 3.90 lb	49 g 0.11 lb
More than 1.76 kg to 2.13 kg More than 3.90 lb to 4.70 lb	54 g 0.12 lb
More than 2.13 kg to 2.63 kg More than 4.70 lb to 5.80 lb	63 g 0.14 lb
More than 2.63 kg to 3.08 kg More than 5.80 lb to 6.80 lb	68 g 0.15 lb
More than 3.08 kg to 3.58 kg More than 6.80 lb to 7.90 lb	77 g 0.17 lb
More than 3.58 kg to 4.26 kg More than 7.90 lb to 9.40 lb	86 g 0.19 lb
More than 4.26 kg to 5.30 kg More than 9.40 lb to 11.70 lb	99 g 0.22 lb
More than 5.30 kg to 6.48 kg More than 11.70 lb to 14.30 lb	113 g 0.25 lb
More than 6.48 kg to 8.02 kg More than 14.30 lb to 17.70 lb	127 g 0.28 lb
More than 8.02 kg to 10.52 kg More than 17.70 lb to 23.20 lb	140 g 0.31 lb
More than 10.52 kg to 14.33 kg More than 23.20 lb to 31.60 lb	167 g 0.37 lb
More than 14.33 kg to 19.23 kg More than 31.60 lb to 42.40 lb	199 g 0.44 lb
More than 19.23 kg to 24.67 kg More than 42.40 lb to 54.40 lb	226 g 0.50 lb
More than 24.67 kg More than 54.40 lb	2 % of labeled quantity

(Amended 2004)

Table 2-6. Maximum Allowable Variations for Packages Labeled by Liquid and Dry Volume

Do Not Use this Table for Meat and Poultry Products Subject to USDA Regulations
For Mulch, see Table 2-10. Exceptions to the Maximum Allowable Variations
Use Table 2-9 for USDA –Regulated Products.

Labeled Quantity	Maximum Allowable Variations (MAVs)
3 mL or less **0.50 fl oz or less** 0.18 in^3 or less	0.5 mL **0.02 fl oz** 0.03 in^3
More than 3 mL to 8 mL More than 0.18 in^3 to 0.49 in^3	1.0 mL 0.06 in^3
More than 8 mL to 14 mL More than 0.49 in^3 to 0.92 in^3	1.5 mL 0.09 in^3
More than 14 mL to 22 mL **More than 0.50 fl oz to 0.75 fl oz** More than 0.92 in^3 to 1.35 in^3	1.7 mL **0.06 fl oz** 0.10 in^3
More than 22 mL to 66 mL **More than 0.75 fl oz to 2.25 fl oz** More than 1.35 in^3 to 4.06 in^3	3.8 mL **0.13 fl oz** 0.23 in^3
More than 66 mL to 125 mL **More than 2.25 fl oz to 4.25 fl oz** More than 4.06 in^3 to 7.66 in^3	5.6 mL **0.19 fl oz** 0.34 in^3
More than 125 mL to 170 mL **More than 4.25 fl oz to 5.75 fl oz** More than 7.66 in^3 to 10.37 in^3	7.3 mL **0.25 fl oz** 0.45 in^3
More than 170 mL to 221 mL **More than 5.75 fl oz to 7.50 fl oz** More than 10.37 in^3 to 13.53 in^3	9.1 mL **0.31 fl oz** 0.55 in^3
More than 221 mL to 347 mL **More than 7.50 fl oz to 11.75 fl oz** More than 13.53 in^3 to 21.20 in^3	11.2 mL **0.38 fl oz** 0.68 in^3
More than 347 mL to 502 mL **More than 11.75 fl oz to 17.00 fl oz** More than 21.20 in^3 to 30.67 in^3	14.7 mL **0.5 fl oz** 0.90 in^3
More than 502 mL to 621 mL More than 17 fl oz to 21 fl oz More than 30.67 in^3 to 37.89 in^3	18.6 mL **0.63 fl oz** 1.13 in^3
More than 621 mL to 798 mL More than 21 fl oz to 27 fl oz More than 37.89 in^3 to 48.72 in^3	22.1 mL **0.75 fl oz** 1.35 in^3
More than 798 mL to 916 mL More than 27 fl oz to 31 fl oz More than 48.72 in^3 to 55.94 in^3	26.0 mL **0.88 fl oz** 1.58 in^3
More than 916 mL to 1.15 L **More than 31 fl oz to 39 fl oz** More than 55.94 in^3 to 70.38 in^3	29 mL **1 fl oz** 1.80 in^3
More than 1.15 L to 1.62 L **More than 39 fl oz to 55 fl oz** More than 70.38 in^3 to 99.25 in^3	36 mL **1.25 fl oz** 2.25 in^3

Table 2-6. Maximum Allowable Variations for Packages Labeled by Liquid and Dry Volume

Do Not Use this Table for Meat and Poultry Products Subject to USDA Regulations
For Mulch, see Table 2-10. Exceptions to the Maximum Allowable Variations
Use Table 2-9 for USDA –Regulated Products.

Labeled Quantity	Maximum Allowable Variations (MAVs)
More than 1.62 L to 2.04 L **More than 55 fl oz to 69 fl oz** More than 99.25 in^3 to 124.5 in^3	44 mL **1.5 fl oz** 2.70 in^3
More than 2.04 L to 2.51 L **More than 69 fl oz to 85 fl oz** More than 124.5 in^3 to 153.3 in^3	51 mL **1.75 fl oz** 3.1 in^3
More than 2.51 L to 3.04 L **More than 85 fl oz to 103 fl oz** More than 153.3 in^3 to 185.8 in^3	59 mL **2 fl oz** 3.6 in^3
More than 3.04 L to 4.73 L **More than 103 fl oz to 160 fl oz** More than 185.8 in^3 to 288.7 in^3	73 mL **2.5 fl oz** 4.5 in^3
More than 4.73 L to 5.48 L **More than 160 fl oz to 185.6 fl oz** More than 288.7 in^3 to 334.9 in^3	88 mL **3 fl oz** 5.4 in^3
More than 5.48 L to 7.09 L **More than 185.6 fl oz to 240 fl oz** More than 334.9 in^3 to 443.1 in^3	103 mL **3.5 fl oz** 6.3 in^3
More than 7.09 L to 8.04 L **More than 240 fl oz to 272 fl oz** More than 443.1 in^3 to 490.8 in^3	118 mL **4 fl oz** 7.2 in^3
More than 8.04 L to 10.17 L **More than 272 fl oz to 344 fl oz** More than 490.8 in^3 to 620.8 in^3	133 mL **4.5 fl oz** 8.1 in^3
More than 10.17 L to 11.59 L **More than 344 fl oz to 392 fl oz** More than 620.8 in^3 to 707.4 in^3	147 mL **5 fl oz** 9.0 in^3
More than 11.59 L to 16.56 L **More than 392 fl oz to 560 fl oz** More than 707.4 in^3 to 1 010 in^3	177 mL **6 fl oz** 10.8 in^3
More than 16.56 L to 18.92 L **More than 560 fl oz to 640 fl oz (5 gal)** More than 1 010 in^3 into 1 155 in^3	207 mL **7 fl oz** 12.6 in^3
More than 18.92 L to 23.65 L **More than 640 fl oz to 800 fl oz** More than 1 155 in^3 to 1 443 in^3	236 mL **8 fl oz** 14.4 in^3
More than 23.65 L to 26.73 L **More than 800 fl oz to 904 fl oz** More than 1 443 in^3 to 1 631 in^3	266 mL **9 fl oz** 16.2 in^3
More than 26.73 L **More than 904 fl oz** More than 1 631 in^3	**1 % of labeled quantity**

(Amended 2004)

Table 2-7. Maximum Allowable Variations (MAVs) for Packages Labeled by Count	
Labeled Quantity	**Maximum Allowable Variations (MAVs)**
17 or less	0
18 to 50	1
51 to 83	2
84 to 116	3
117 to 150	4
151 to 200	5
201 to 240	6
241 to 290	7
291 to 345	8
346 to 400	9
401 to 465	10
466 to 540	11
541 to 625	12
626 to 725	13
726 to 815	14
816 to 900	15
901 to 990	16
991 to 1 075	17
1 076 to 1 165	18
1 166 to 1 250	19
1 251 to 1 333	20
1 334 or more	1.5 % of labeled count rounded off to the nearest whole number

Table 2-8. Maximum Allowable Variations for Packages Labeled by Length, (Width), or Area For Textiles, Polyethylene Sheeting and Film – Use Table 2-10.	
Labeled Quantity	**Maximum Allowable Variations (MAVs)**
1 m or less 1 yd or less	3 % of labeled quantity
More than 1 m to 43 m More than 1 yd to 48 yd	1.5 % of labeled quantity
More than 43 m to 87 m More than 48 yd to 96 yd	2 % of labeled quantity
More than 87 m to 140 m More than 96 yd to 154 yd	2.5 % of labeled quantity
More than 140 m to 301 m More than 154 yd to 330 yd	3 % of labeled quantity
More than 301 m to 1 005 m More than 330 yd to 1 100 yd	4 % of labeled quantity
More than 1 005 m or 1 100 yd	5 % of labeled quantity
Maximum Allowable Variations for Packages Labeled by Area	
The MAV for packages labeled by area is 3 % of labeled quantity.	
For Textiles, Polyethylene Sheeting and Film, see Table 2-10. Exceptions to the MAVs.	

(Amended 2004)

Table 2-9. U.S. Department of Agriculture, Meat and Poultry Groups and Lower Limits for Individual Packages (Maximum Allowable Variations)		
Definition of Group and Labeled Quantity		**Lower Limit for Individual Weights (MAVs)**
Homogenous Fluid When Filled (e.g., baby food or containers of lard)	**All Other Products**	
Less than 85 g or 3 oz		10 % of labeled quantity
85 g or more to 453 g 3 oz or more to 16 oz		7.1 g 0.016 lb (0.25 oz)
More than 453 g More than 16 oz	85 g or more to 198 g 3 oz to 7 oz	14.2 g 0.031 lb (0.5 oz)
	More than 198 g to 1.36 kg 7 oz to 48 oz	28.3 g 0.062 lb (1 oz)
	More than 1.36 kg to 4.53 kg More than 48 oz to 160 oz	42.5 g 0.094 lb (1.5 oz)
	More than 4.53 kg More than 160 oz	1 % of labeled quantity

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 (MAVs)
Polyethylene Sheeting and Film	**Thickness** When the labeled thickness is 25 µm (1 mil or 0.001 in) or less, any individual thickness measurement of polyethylene film may be up to 35 % below the labeled thickness. When the labeled thickness is greater than 25 µm (1 mil or 0.001 in), individual thickness measurements of polyethylene sheeting may be up to 20 % less than the labeled thickness. The average thickness of a single package of polyethylene sheeting may be up to 4 % less than the labeled thickness. **Weight** The MAV for individual packages of polyethylene sheeting and film shall be 4 % of the labeled quantity.
Textiles	The MAVs are: For packages labeled with dimensions of 60 cm (24 in) or more: Three percent of the labeled quantity for negative errors and 6 % of the labeled quantity for plus errors. For packages labeled with dimensions less than 60 cm (24 in): 6 % of the labeled quantity for negative errors and 12 % for plus errors.
Mulch And Soil Labeled By Volume	The MAVs are: For individual packages: 5 % of the labeled volume. For example: One package may exceed the MAV for every 12 packages in the sample (e.g., when the sample size is 12 or fewer, 1 package may exceed the MAV and when the sample size is 48 packages, 4 packages may exceed the MAV).
Packaged Firewood and Packages Labeled by Count with Fewer than 50 Items	MAVs are not applied to these packages.

(Amended 2004)

Table 2-11. Accuracy Requirements for Packages Labeled by Low Count (50 or Fewer) and Packages Given Tolerances (Glass and Stemware)			
	1	**2**	**3**
Inspection Lot Size	**Sample Size**	**For Packages Labeled by Low Count (50 or Fewer)**	**For Packages Given Tolerances (Glasses and Stemware)**
		Number of Packages Allowed to Contain Less than the Labeled Count	**Number of Package Errors that May Exceed the Allowable Difference**
1 - 11	1-11	1	0
12 - 250	12	1	0
251 - 3 200	24	2	1
More than 3 200	48	3	2

(Amended 2004)

Appendix C. Glossary

A

allowable difference. The amount by which the actual quantity in the package may differ from the declared quantity. Pressed and blown tumblers and stemware labeled by count and capacity are assigned an allowable difference in capacity. This is also called a tolerance.

audit testing. Preliminary tests designed to quickly identify potential noncompliance units.

average. The sum of a number of individual measurement values divided by the number of values. For example, the sum of the individual weights of 12 packages divided by 12 would be the average weight of those packages.

average error. The sum of the individual "package errors" (defined) (considering their arithmetic sign) divided by the number of packages comprising the sample.

average requirement. A requirement that the average net quantity of contents of packages in a "lot" equals the net quantity of contents printed on the label.

average tare. The sum of the weights of individual package containers (or wrappers, etc.) divided by the number of containers or wrappers weighed.

B

berry baskets and boxes. Disposable containers in capacities of 1 dry quart or less for berries and small fruits. See Section 4.46. in NIST Handbook 44.

C

Category A (Category B). A set of sampling plans provided in this handbook to use in checking packages that must (except when exempted) meet the "average requirement" (defined).

chamois. A natural leather made from skins of sheep and lambs that have been oil-tanned.

combination quantity declarations. A package label that contains the count of items in the package as well as one or more of the following: weight, measure, or size.

compliance testing. Determining package conformance using specified legal requirements.

D

decision criteria. The rules for deciding whether or not a lot conforms to package requirements based on the results of checking the packages in the sample.

delivery. A quantity of identically labeled product received at one time by a buyer.

dimensionless units. The integers in terms of which the official records package errors. The dimensionless units must be multiplied by the "unit of measure" to obtain package errors in terms of weight, length, etc.

division, value of (d). The value of the scale division, expressed in units of mass, is the smallest subdivision of the scale for analog indication or the difference between two consecutively indicated or printed values for digital indication or printing. See NIST Handbook 44.

drained weight. The weight of solid or semisolid product representing the contents of a package obtained after a prescribed method for removal of the liquid has been employed.

dry measure. Rigid containers designed for general and repeated use in the volume measurement of particulate solids. See Section 4.45. Dry Measures in NIST Handbook 44.

dry pet food. All extruded dog and cat foods and baked treats packaged in Kraft paper bags and cardboard boxes that have a moisture content of 13 % or less at the time of packaging.

dry tare. See UNUSED DRY TARE.

E

error. See PACKAGE ERROR.

G

gravimetric test procedure. An analytical procedure that involves measurement by mass or weight.

gross weight. The weight of the package including contents, packing material, labels.

H

headspace. The container volume not occupied by product.

I

inch-pound units. Units based upon the yard, gallon, and the pound commonly used in the United States of America. Some of these units have the same name as similar units in the United Kingdom (British, English, or Imperial units), but they are not necessarily equal to them.

initial tare sample. The first packages (either two or five) selected from the sample to be opened for tare determination in the tare procedure. Depending upon the variability of these individual tare weights as compared with the variability of the net contents, this initial tare sample may be sufficient or more packages may be needed to determine the tare.

inspection lot. The collection of identically labeled (random packages, in some cases, are exempt from identity and labeled quantity when determining the inspection lot) packages available for inspection at one time. This collection will pass or fail as a whole based on the results of tests on a sample drawn from this collection.

L

label. Any written, printed, or graphic matter affixed to, applied to, attached to, blown into, formed, molded into, embossed on, or appearing upon or adjacent to a consumer commodity or a package containing any consumer commodity, for purposes of branding, identifying, or giving any information with respect to the commodity or to the contents of the package, except that an inspector's tag or other non-promotional matter

affixed to or appearing upon a consumer commodity is not a label. See Section 2.5 in the Uniform Packaging and Labeling Regulation in NIST Handbook 130.

linear measures. Rulers and tape measures.

location of test. The place where the package will be examined. This is broadly defined as one of three general locations: (1) where the commodity was packaged, (2) a warehouse or storage location, or (3) a retail outlet.

lot. See INSPECTION LOT.

lot code. A series of identifying numbers and/or letters on the outside of a package designed to provide information such as the date and location of packaging or the expiration date.

lot size. The number of packages in the "inspection lot".

M

MAV. See MAXIMUM ALLOWABLE VARIATION

maximum allowable variation (MAV). A deficiency in the weight, measure, or count of an individual package beyond which the deficiency is considered to be an "unreasonable error". The number of packages with deficiencies that are greater than the MAV is controlled by the sampling procedure.

measure containers. Containers whose capacities are used to determine quantity. They are of two basic types: (a) retail and (b) prepackaged. Retail containers are packaged at the time of retail sale, and prepackaged containers are packaged in advance of sale. An example of a prepackaged measure container is an ice cream package.

metric or SI units. Units of the International System of Units as established in 1960 by the General Conference on Weights and Measures and interpreted or modified for the United States by the Secretary of Commerce. (See NIST Special Publication 814 – Metric System of Measurement; Interpretation of the SI for the United States and Federal Government Metric Conversion Policy)

minus or plus errors. Negative or positive deviations from the labeled quantity of the actual package quantities as measured. See PACKAGE ERROR.

moisture allowance. That variation in weight of a packaged product permitted in order to account for loss of weight due to loss of moisture during good package distribution practices. For packaged goods subject to moisture loss, when the average net weight of a sample is found between the labeled weight and the boundary of the moisture allowance, the lot is said to be in a no-decision area. Further information is required to determine lot compliance or noncompliance.

mulch. Any product or material other than peat or peat moss 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.

N

net quantity or net contents. That quantity of packaged product remaining after all necessary deductions for tare (defined) have been made.

nominal. A designated or theoretical size that may vary from the actual.

nominal gross weight. The sum of the nominal tare weight (defined) plus the declared or labeled weight (or other labeled quantity converted to a weight basis).

P

package error. The difference between the actual net contents of an individual package as measured and the declared net contents on the package label; minus (-) for less than the label and plus (+) for more than the label.

packaged goods. Product or commodity put up in any manner in advance of sale suitable for either wholesale or retail sale.

petroleum products. Gasoline, diesel fuel, kerosene, or any product (whether or not such a product is actually derived from naturally occurring hydro-carbon mixtures known as "petroleum") commonly used in powering, lubricating, or idling engines or other devices, or labeled as fuel to power camping stoves or lights. Sewing machine lubricant, camping fuels, and synthetic motor oil are "petroleum products" for the purposes of this regulation. The following products are not "petroleum products": brake fluid, copier machine dispersant, antifreeze, cleaning solvents, and alcohol.

plus errors. See MINUS OR PLUS ERRORS

principal display panel or panels. Part(s) of a label that are designed to be displayed, presented, shown, or examined under normal and customary conditions of display and purchase. Wherever a principal display panel appears more than once on a package, all requirements pertaining to the "principal display panel" shall pertain to all such "principal display panels." See Section 2.7 in the Uniform Packaging and Labeling Regulation in NIST Handbook 130.

production lot. The total collection of packages defined by the packager, usually consisting of those packages produced within a given unit of time and coded identically.

pycnometer. A container of known volume used to contain material for weighing so that the weight of a known volume may be determined for the material. If it is constructed, it is called a density cup.

R

random pack. The term "random package" shall be construed to mean a package that is one of a lot, shipment, or delivery of packages of the same consumer commodity with varying weights which means, packages of the same consumer commodity with no fixed pattern of weight.

random sampling. The process of selecting sample packages such that all packages under consideration have the same probability of being selected. An acceptable method of random selection is to use a table of random numbers.

range. The difference between the largest and the smallest of a set of measured values.

reasonable variation. An amount by which individual package net contents are allowed to vary from the labeled net contents. This term is found in most federal and state laws and regulations governing packaged

goods. Reasonable variations from the labeled declaration are recognized for (1) unavoidable deviations in good manufacturing practice, and (2) loss or gain of moisture in good distribution practice.

rounding. The process of omitting some of the end digits of a numerical value and adjusting the last retained digit so that the resulting number is as near as possible to the original number.

S

sample. A group of packages taken from a larger collection of packages and providing information that can be used to make a decision concerning the larger collection of packages or of the package production process. A sample provides a valid basis for decision only when it is a random sample (defined).

sample correction factor. ~~Students' "t" value for a one sided test at the 3 % confidence level and n is the sample size~~. **The factor as computed is the ratio of the 97.5th quantile of the student's t-distribution with (n-1) degrees of freedom and the square root of n where n is the sample size.**

sample error limit (SEL). A statistical value computed by multiplying the sample standard deviation times the sample correction factor from Column 3 of Table 2-1. Category A – Sampling Plans for the appropriate sample size. The SEL value allows for the uncertainty between the average error of the sample and the average error of the inspection lot with an approximately 97**.5** % level of confidence.

sample size (n). The number of packages in a sample.

sampling plan. A specific plan that states the number of packages to be checked and the associated decision criteria.

scale tolerance. The official value fixing the limit of allowable error for weighing equipment as defined in NIST Handbook 44.

seat. (as in "seat diameter" or "seated capacity"). The projection or shoulder near the upper rim of a cup or container that is designed to serve as the support for a lid or cover.

seated capacity. The capacity of a cup, container, or bottle, as defined by the volume contained by them when the lid or a flat disc is inserted into the lid groove that is located inside and near the upper rim of the cup, container, or bottle.

SEL. See SAMPLE ERROR LIMIT.

shipment. A quantity of identically labeled product (except for lot code) sent at one time to a single location.

slicker plate. A flat plate, usually of glass or clear plastic composition, used to determine the "level full" condition of a capacity (volumetric) measure.

standard deviation. A measure to describe the scatter of the individual package contents around the mean contents.

standard pack. That type of package in which a commodity is put up with identical labels and only in certain specific quantity sizes. Examples of goods so packed are canned, boxed, bottled and bagged foods, and over-the-counter drugs.

supplementary quantity declarations. The required quantity declaration may be supplemented by one or more declarations of weight, measure, or count, such declaration appearing other than on a principal display panel. Such supplemental statement of quantity of contents shall not include any terms qualifying a unit of weight, measure, or count that tends to exaggerate the amount of commodity contained in the package (e.g., "giant" quart, "full" gallon, "when packed," "minimum," or words of similar import). See Section 6.12 in the Uniform Packaging and Labeling Regulation in NIST Handbook 130.

T

tare sample. The packages or packaging material used to determine the average tare weight.

tare sample size. The number of packages or packaging material units used to determine the average tare weight.

tare weight. The weight of a container, wrapper, or other material that is deducted from the gross weight to obtain the net weight.

tolerance. A value fixing the limit of allowed departure from the labeled contents; usually presented as a plus (+) and minus (-) value.

U

unit of measure. An increment of weight, length, or volume so that an inspector may record package errors in terms of small integers. (The package errors are actually the integers multiplied by the unit of measure.)

unreasonable errors. Minus package errors that exceed the MAV (defined). The number of unreasonable errors permitted in a sample is specified by the sampling plan.

unused dry tare. 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.

used dry tare. 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. It is not the same as "wet tare." See also "wet tare."

V

volumetric measures. Standard measuring flasks, graduates, cylinders, for use in measuring volumes of liquids.

W

wet tare. Used packaging materials when no effort is made to reconstruct unused tare weight by drying out the absorbent portion (if any) of the tare.

Appendix E. Model Inspection Report Forms

Report Form	Page
Random Inspection Report	E-2
Random Package Inspection Report - Example	E-3
Standard Package Inspection Report	E-4
Standard Inspection Report - Example	E-5

Date	**Random Package Report**		Sampling Plan ☐ A ☐ B	Report Number
Location (name, address)	Product/Brand Identity Lot Codes		Manufacturer	Container Description

1. Labeled Quantity – enter weight for each package in column 1 below.	2. Unit of Measure	3. MAV – look up the MAV for each package with a minus error, convert it to dimensionless units and enter this value in Column 4 below.	5. Inspection Lot Size	6. Sample Size (n)
7. Initial Tare Sample Size	8. No. of MAVs Allowed	9. Range of Package Errors (Rc)	10. Range of Tare Weights (Rt)	11. Rc/Rt (9)10 =)	12. Total No. of Tare Samples
13. Avg. Tare Wt ☐ Used Dry Tare ☐ Wet Tare ☐ Unused Dry Tare			13a. ☐ Tare Correction ☐ Moisture Allowance	14. Nominal Gross Wt (Labeled Wt + 13 – 13a)

	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7	Pkg 8	Pkg 9	Pkg 10
a. Gross Wt										
b. Tare Wt										
c. Net Wt										
d. Package Error										

Product Description, Lot Code, Unit Price	Money Errors -	Money Errors +	1. Labeled Net Weight	Package Errors -	Package Errors +	4. MAV
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
			Totals			

15. Total Error	16. No. of unreasonable minus errors (compare each package error with the MAV in Col 4)	17. Is 16 greater than 8? ☐ Yes, Lot Fails ☐ No, go to 18	18. Avg. error in dimensionless units (15) 6 =)	19. Avg. error in labeled units (18 x 2 =)

20. Is 18 Zero or Plus? ☐ Yes, lot passes, go to 25 ☐ No, go to 21	21. Compute Sample Standard Deviation	22. Sample Correction Factor	23. Compute Sample Error Limit (21 x 22 =)

24. Disregarding the signs, is 18 larger than 23? ☐ Yes, Lot Fails, go to 25 ☐ No, Lot Passes, go to 25	25. Disposition of Inspection Lot ☐ Approved ☐ Rejected
Comments	Official's Signature Acknowledgement of Report

Date	**Random Package Report - Example Form**	Sampling Plan	Report Number
September 16, 1999		■ A □ B	*17*

Location (name, address)	Product/Brand Identity	Manufacturer	Container Description
L&O Market *MacCorkle Ave* *Charleston, WV 25177*	*Ground Chuck* Lot Codes: *1, 19, 99*	*Meat Department – L&O Market*	*2S Tray with soaker and plastic wrap*

1. Labeled Quantity- enter weight for each package in the column 1 below.	2. Unit of Measure	3. MAV – look up the MAV for each package with a minus error, convert it to dimensionless units and enter this value in Column 4 below.	5. Inspection Lot Size	6. Sample Size (n)
	0.001 lb		*23*	*12*

7. Initial Tare Sample Size	8. No. of MAVs Allowed	9. Range of Package Errors (Rc)	10. Range of Tare Weights (Rt)	11. Rc/Rt (9)10 =)	12. Total No. of Tare Samples
2	*0*	*10*	*1*	*10*	*2*

13. Avg. Tare Wt	13a.	14. Nominal Gross Wt (Labeled Wt + 13 – 13a)
□ Used Dry Tare □ Wet Tare ■ Unused Dry Tare *0.0205 lb*	□ Tare Correction □ Moisture Allowance *N/A*	*Label Wt + 0.020 lb*

	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7	Pkg 8	Pkg 9	Pkg 10
a. Gross Wt	*1.852 lb*	*1.223 lb*								
b. Tare Wt	*0 .020 lb*	*0 .021 lb*								
c. Net Wt	*1.832 lb*	*1.202 lb*								
d. Package Error (a – 14 =)	*-18*	*-8*								

Product Description, Lot Code, Unit Price	Money Errors -	Money Errors +	1. Labeled Net Weight	Package Errors -	Package Errors +	4. MAV
1. *Ground Chuck - 1, 19, 99 - $1.79 per lb*			*1.85 lb*	*18*		
2.			*1.21 lb*	*7*		
3.			*1.56 lb*	*8*		
4.			*1.98 lb*	*14*		
5.	*$ 0.04*		*1.07 lb*	*23*		*44*
6.			*1.55 lb*	*16*		
7.			*1.02 lb*	*2*		
8.	*$ 0.04*		*1.44 lb*	*25*		*56*
9.			*1.33 lb*	*16*		
10.			*2.03 lb*	*20*		*70*
11.			*1.73 lb*	*14*		
12.			*1.16 lb*	*11*		
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
			Totals	*174*		

15. Total Error	16. No. of unreasonable minus errors (compare each package error with 4)	17. Is 16 greater than 8?	18. Avg. error in dimensionless units	19. Avg. error in labeled units (18 x 2 =)
- 174	*0*	□ Yes, Lot Fails ■ No, go to 18	(15) 6 =) *- 14.5*	*- 0.014 lb*

20. Is 18 = Zero or Plus?	21. Compute Sample Standard Deviation	22. Sample Correction Factor	23. Compute Sample Error Limit (21 x 22 =)
□ Yes, lot passes, go to 25 ■ No, go to 21	*6.721*	*0.635*	*4.267*

24. Disregarding the signs, is 18 larger than 23?	25. Disposition of Inspection Lot
■ Yes, Lot Fails, go to 25 □ No, Lot Passes, go to 25	□ Approved ■ Rejected

Comments:	Official's Signature
Product found to contain less than the stated net contents	Acknowledgement of Report

Date	**Standard Package Report**		Sampling Plan □ A □ B	Report Number
Location (name, address)	Product/Brand Identity Lot Codes		Manufacturer	Container Description

1. Labeled Quantity	2. Unit of Measure	3. MAV	4. MAV (dimensionless units) (3) 2 =)	5. Inspection Lot Size	6. Sample Size (n)

7. Initial Tare Sample Size	8. No. of MAVs Allowed	9. Range of Package Errors (Rc)	10. Range of Tare Weights (Rt)	11. Rc/Rt (9)10 =)	12. Total No. of Tare Samples

13. Avg. Tare Wt □ Used Dry Tare □Wet Tare □ Unused Dry Tare	13a. □ Tare Correction □ Moisture Allowance □ Vacuum Pack	14. Nominal Gross Wt (1 + 13 – 13 a =)

	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7	Pkg 8	Pkg 9	Pkg 10
a. Gross Wt										
b. Tare Wt										
c. Net Wt										

-	+	-	+	-	+	-	+
1.		13.		25.		37.	
2.		14.		26.		38.	
3.		15.		27.		39.	
4.		16.		28.		40.	
5.		17.		29.		41.	
6.		18.		30.		42.	
7.		19.		31.		43.	
8.		20.		32.		44.	
9.		21.		33.		45.	
10.		22.		34.		46.	
11.		23.		35.		47.	
12.		24.		36.		48.	
Total	Total	Total	Total	Total	Total	Total	Total

15. Total Error	16. No. of unreasonable minus errors (compare each package error with 4)	17. Is 16 greater than 8? □ Yes, lot fails □ No, go to 18	18. Avg. error in dimensionless units (15) 6 =)	19. Avg. error in labeled units (18 x 2 =)

20. Is 18 = Zero or Plus? □ Yes, lot passes, go to 25 □ No, go to 21	21. Compute Sample Standard Deviation	22. Sample Correction Factor	23. Compute Sample Error Limit (21 x 22 =)

24. Disregarding the signs, is 18 larger than 23?	25. Disposition of Inspection Lot
□ Yes, lot fails, go to 25 □ No, lot passes, go to 25	□ Approved □ Rejected
Comments:	Official's Signature Acknowledgement of Report

Date	**Standard Package Report - Sample Form**	Sampling Plan: ■ A □ B	Report Number
January 20, 1999			*16*

Location (name, address)	Product/Brand Identity	Manufacturer	Container Description
Volunteer Market *18765 Alcoa Highway* *Knoxville, Tennessee 37920*	*Community Group Cookies (Thin Mints)* Lot Codes *April 1998 A&B*	*ABC Cookies Inc* *1069 Capitol Avenue* *Nashville, Tennessee 37204*	*Cardboard Box / Plastic Liner*

1. Labeled Quantity	2. Unit of Measure	3. MAV	4. MAV (dimensionless units) (3) 2 =)	5. Inspection Lot Size	6. Sample Size (n)
453 g (1 lb)	*0.001 lb*	*0 .044 lb*	*44*	*172*	*12*

7. Initial Tare Sample Size	8. No. of MAVs Allowed	9. Range of Package Errors (Rc)	10. Range of Tare Weights (Rt)	11. Rc/Rt (9)10 =)	12. Total No. of Tare Samples
2	*0*	*24*	*2*	*12*	*2*

13. Avg. Tare Wt	13a. Tare Correction	14. Nominal Gross Wt (1 + 13 – 13 a =)
■ Used Dry Tare □ Wet Tare □ Unused Dry Tare *0 .014 lb*	□ Moisture Allowance □ Vacuum Pack *N/A*	*1.014 lb*

	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7	Pkg 8	Pkg 9	Pkg 10
a. Gross Wt	*1.052 lb*	*1.026 lb*								
b. Tare Wt	*0.015 lb*	*.013 lb*								
c. Net Wt	*1.037 lb*	*1.013 lb*								

-	+	-	+	-	+	-	+
1.	*38*	13.		25.		37.	
2.	*12*	14.		26.		38.	
3.	*8*	15.		27.		39.	
4.	*4*	16.		28.		40.	
5. *3*		17.		29.		41.	
6. *2*		18.		30.		42.	
7.	*12*	19.		31.		43.	
8. *3*		20.		32.		44.	
9.	*4*	21.		33.		45.	
10. *1*		22.		34.		46.	
11. *0*		23.		35.		47.	
12.	*6*	24.		36.		48.	
Total *9*	Total *84*	Total	Total	Total	Total	Total	Total

15. Total Error	16. No. of unreasonable minus errors (compare each package error with 4)	17. Is 16 greater than 8?	18. Avg. error in dimensionless units. (15) 6 =)	19. Avg. error in labeled units (18 x 2 =)
+ 75	*0*	□ Yes, lot fails ■ No, go to 18	*+ 6.25*	*+ 0.006 lb*

20. Is 18 = Zero or Plus?	21. Compute Sample Standard Deviation	22. Sample Correction Factor	23. Compute Sample Error Limit (21 x 22 =)
■ Yes, lot passes, go to 25 □ No, go to 21			

24. Disregarding the signs, is 18 larger than 23?	25. Disposition of Inspection Lot
□ Yes, lot fails, go to 25 □ No, lot passes	■ Approved □ Rejected

Comments:	Official's Signature
Lot Passes	Acknowledgement of Report

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Appendix H

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 I

FDA Decision on Pelletized Ice Cream

(Letter Dated April 17, 2009)

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DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration
College Park, MD 20740

APR 17 2009

Cary Frye
Vice President
Regulatory Affairs
International Dairy Foods Association
Milk Industry Foundation
National Cheese Institute
International Ice Cream Association
1250 H Street NW, Suite 900
Washington, DC 20005

Dear Ms. Frye:

This is in response to your July 10, 2008 letter to the Food and Drug Administration (FDA) and a follow up to the June 27th meeting at the National Institute of Standards and Technology (NIST) seeking assistance on how to determine the appropriate net quantity of content statement for pelletized ice cream and the appropriate measurement, i.e. volume excluding the external air versus net weight. You also asked FDA for clarification on the appropriate serving size for these products.

You stated in your letter that the International Ice Cream Association believes the net quantity of content statement for pelletized ice cream and frozen desserts should be a volumetric declaration that excludes the external air. You stated that, as we discussed at the June 27th meeting at NIST, ice cream and frozen desserts are sold by units of fluid measure and, therefore, the declared net quantity of contents for pelletized ice cream and frozen desserts should be expressed in fluid ounces. Further, you stated that the ice cream industry's position is that the method of sale and the net quantity of contents for pelletized ice cream be declared in fluid ounces without any external air surrounding the pellets of ice cream or flavoring.

By way of background, the FDA enforces the Federal Food, Drug, and Cosmetic Act (FFDCA) and certain provisions of the Fair Packaging and Labeling Act (FPLA). The FFDCA requires that all labeling and packaging of food products, including the net quantity of contents statement, be truthful, informative, and not deceptive. The FPLA is concerned with the labeling of packaged consumer goods for retail sale to enable consumers to obtain accurate information about the quantity of contents and to facilitate value comparisons. Compliance with these laws and the regulations promulgated under the authority of these laws is secured through periodic inspections of facilities and products, analyses of samples, educational activities, investigations of consumer trade complaints, and legal proceedings.

Provisions of 21 CFR 101.105(a) specify that the declaration of quantity of contents shall be in terms of weight if the product is solid, semisolid, or viscous, or a mixture of solid and liquid. Thus, it would appear that traditional ice cream products, being semisolid foods, would be declared by weight. However, provisions of §101.105(a) also provide that if there is a firmly established general consumer usage and trade custom of declaring the contents of a liquid by weight, or a solid, semisolid, or viscous product by fluid measure, it may be used. Because there appears to be a firmly established general consumer usage and trade custom of expressing quantity of contents declarations on traditional ice cream products in terms of volume, the agency has not required industry to revise their declarations to be expressed in terms of weight.

Pelletized ice cream is a unique and totally new ice cream product that is emerging in the marketplace. Because it is a semisolid food, in accordance with 21 CFR 101.105(a), the appropriate net quantity of content declaration for these products would be net weight. In addition, there is not a firmly established general consumer usage and trade custom of expressing the quantity of contents declaration in terms of volume on pelletized ice cream.

As you know, pelletized ice cream is manufactured at very low temperatures using a nitrogen process and consists of thousands of small beads of ice cream of varying sizes. Moreover, because there is variation in the diameter of the pieces, settling in the package, and the absence of a test procedure, FDA believes that a net quantity of content declaration using a volume measurement would be difficult for manufacturers to determine and confirm and for regulatory officials to test. In addition, density variations occur when inclusions are added to packages of pelletized ice cream. Because these inclusions such as cookie bits, themselves, vary in size and weight, using gravimetric testing to verify the declared volume of a sample may not be practical.

FDA believes that a net weight approach would eliminate the need to develop a new test procedure that could be time consuming and require expensive test equipment. It appears that because of the uniqueness of these products, a net weight declaration would be an easier measurement to test than a volume declaration. Furthermore, it is FDA's understanding that these products have been sold by net weight from at least one manufacturer in the United States for more than a year and there is no record of any consumer complaints regarding the method of sale. Therefore, FDA believes that the net quantity of content statement on pelletized ice cream should be declared in terms of net weight. We would expect manufacturers of pelletized ice cream to revise their labels to reflect a net weight declaration during the next printing cycle and encourage all marketers of pelletized cream to modify their labels with a net weight declaration within one year from the issue date of this letter.

Page 3 - Cary Frye

With regards to your request for guidance in identifying the serving size that should appear in the nutrition facts panel for pelletized ice cream, we point out that FDA regulations in 21 CFR 101.12 establish reference amounts customarily consumed and how to use these reference amounts to declare serving sizes. In 21 CFR 101.12(b), Table 2, the reference amount for ice cream, ice milk, frozen yogurt, sherbet, bulk and novelty frozen desserts (e.g., bars, sandwiches, cones) is a half cup with the equivalent metric quantity in parentheses. While we acknowledge that pelletized ice cream is a unique and totally new ice cream product, we believe that the half cup serving size is appropriate for this product. Therefore, the serving size for pelletized ice cream is a half cup with the equivalent weight in grams.

If you have additional questions, do not hesitate to contact us.

Sincerely yours,

Geraldine A. June
Supervisor
Product Evaluation and Labeling Team
Office of Nutrition, Labeling,
and Dietary Supplements
Center for Food Safety
and Applied Nutrition

cc:
Kenneth S. Butcher
NIST Weights and Measures Division
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Appendix J

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

Fuel Specifications Subcommittee (FSS)
A Proposed Method of Sale and Quality Specification for Hydrogen Vehicle Fuel

Summary of Current Information

The Chairman of the FSS is: Robert W. Boyd
Linde North American, Inc.

a. Initially the proposed method of sale and quality specification for hydrogen vehicle fuel was presented at the Western (WWMA) and Southern (SWMA) Weights and Measures Association Annual Meetings in the fall of 2008. The proposal was adopted with a recommendation that it be submitted as an Informational item on the National Conference of Weights and Measures (NCWM) Laws and Regulations agenda at the 2009 Interim Meeting which was held January 11 - 14, 2009 in Daytona Beach, Florida. This item was also presented at the two remaining regions, the Central (CWMA) and Northeastern (NEWMA), Annual Conferences in the spring of 2009. The proposal was again presented at the 2009 NCWM Annual Conference, held July 12 - 16, 2009 in San Antonio, Texas.

b. The recommendations of the FSS based on the subcommittee's April 2009 review of the proposed method of sale for hydrogen engine fuel are:

   i. The FSS agreed to use the current proposal as a foundation for the fuel quality standard for hydrogen. The FSS will continue to consider further refinement of the definitions for hydrogen vehicle fuel based on input from SAE should they be deemed necessary to finalize the standard.

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).

   ii. The FSS further 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 about all aspects of 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 proposal 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 2. 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

[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

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.

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 (GGE) units 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. (See Figure 1 [pg 5] for an example of how the unit measurement may appear on the dispenser, and see Figure 2 [pg 7] on how the street signs will display the unit price). 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 "HXX" be used to represent Hydrogen vehicle fuel and the capital "H" precede the "XX" which represents the service pressure of the hydrogen fuel offered for sale (expressed in the SI unit megapascal [MPa]).

[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.

Product Identity

The FSS agreed to support the use of the capital letter "H" as the symbol for hydrogen instead of H_2 to 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 bar[5] (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.

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). Typical values encountered for dispenser of service pressures in pascals, bar and pounds are 35 MPa (350º bar) (approximately equivalent to 5 000 psi) and 70 MPa (700 bar) (approximately equivalent to 10 000 psi). The FSS agreed that in using the SI unit for pressure, the pascal would standardize industry practice and enable it to easily present this 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, when unit pricing is based on features 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).

[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.



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. The purpose of the graphic 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.

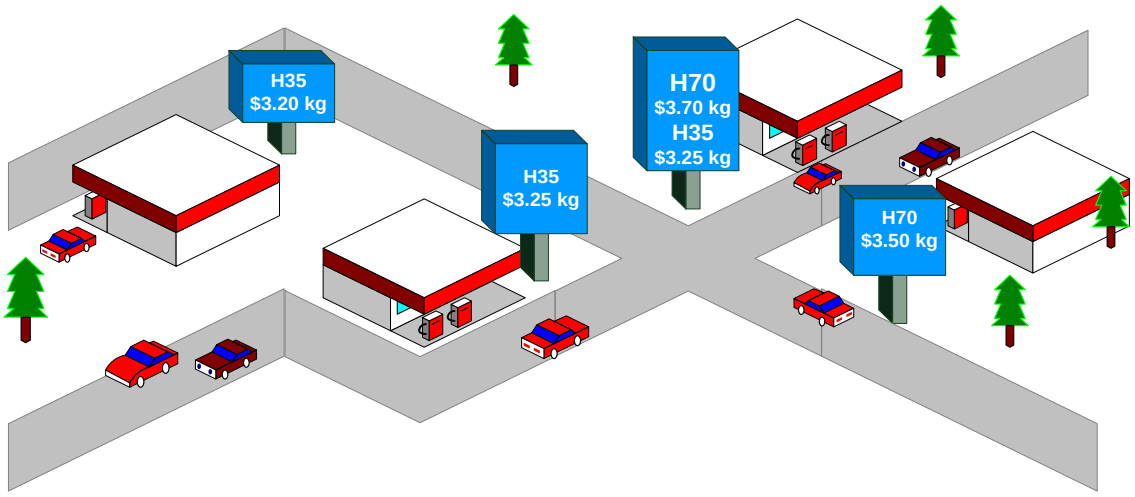


Figure 2. Showing the use of the Uniform Unit of Measurement and Posting of Product Identity, and Service Pressure to Enable Value Comparison

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 FSS supports the proposal to be included in NIST Handbook 130: Section IV: Uniform Regulation for Method of Sale of Commodities. The FSS presented the following recommendation for consideration by the 2009 NCWM Laws and Regulations Committee. This modified version includes a change to paragraph 2.XX.4.2 to include the units of megapascals.

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)~~ (expressed in megapascals) at which the dispenser(s) delivers hydrogen fuel (e.g., H35 or H70).

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.

[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)

Proposed Specification for Hydrogen Fuel

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

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 be included in NIST Handbook 130 Section IV. Uniform Regulations Part G. Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulations Section 2. Standard Fuel Specifications 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 energy conversion device in which fuel and an oxidant react to generate energy without consumption of its electrodes or electrolyte.

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

   1.XX. Internal Combustion Engine. – a device used to generate power by converting chemical energy bound in the fuel into mechanical work to power a vehicle.

Cite the appropriate reference for the hydrogen fuel quality standard below that was developed by the California Division of Measurement Standards in NIST Handbook 130 Section IV. Uniform Regulations Part G. Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulations Section 2. Standard Fuel Specifications as follows:

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	mg/kg	Maximum	to be specified
11	Total Allowable Non-Hydrogen, Non-Helium, Non-particulate constituents	100	ppm v/v	Maximum	to be specified
12	Total Non-Hydrogen 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. Total Gases = Sum of all impurities listed on the table except particulates.
c. 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.

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.

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

7 http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=54560. (Viewed 9/2/09)

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 (lower heating value). 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 will these artificial comparison tools be periodically reviewed to ensure they provide an equitable means of ensuring reasonable and reliable comparisons between fuels.

Appendix K

Briefing by the 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.

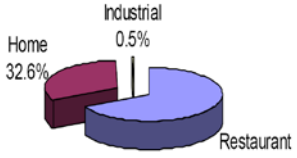


Data compiled by NOAA Fisheries

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



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

[redacted] Clearwater, 5/17/06, substituted ponga for grouper.
[redacted], St. Petersburg, 6/27/06, substituted basa, pangasius fish for grouper.
[redacted], Pinellas Park, 7/12/06, substituted cod for grouper.
[redacted] Pinellas Park, 7/18/06, substituted pollock and basa for grouper.
[redacted] Oldsmar, 7/27/06, substituted pangasius fish for grouper.
[redacted] Pinellas Park, 9/20/06, substituted ponga for grouper and trout.
[redacted], 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 therefore; 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.





- 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: 86-532-80999580
FAX: 86-532-80999380
EMAIL: joinseafoods@yahoo.com
Website: www.joinseafoods.com

LOS ANGELES OFFICE:
TEL: 1-626-336-3218
FAX: 1-626-336-3230

PRODUCT OF CHINA

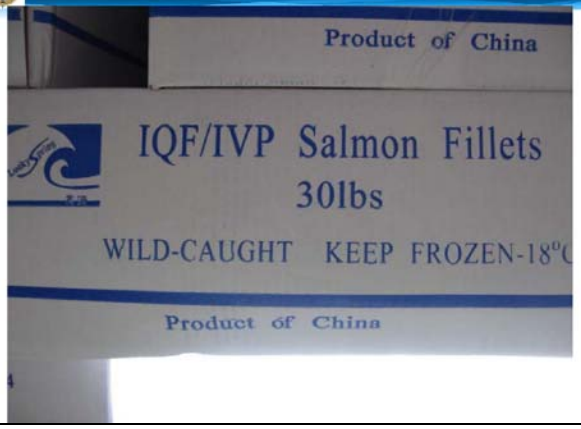
2008-09-30

CHANNEL CATFSIH: JUST RELEASED BY FDA

CHANNEL CATFISH IQF, 15LBS CARTON
BRAND: XIHE
90%NW 5-7/7-9OZ FOB PFS CHICAGO $1.80/LB
95%NW 5-7/7-9OZ, FOB PFS HOUSTON: $1.90/LB
100%NW3-5/5-7OZ, FOB PFS NEWARK: $2.00/LB
100%NW3-5/5-7OZ, FOB PFS NORFOLK: $2.00/LB

Pollock Fillet	2/4, 4/6, 6/8 4x10 KG	70%	FOB Dalian	$0.82
	skinless, boneless, chem-free	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

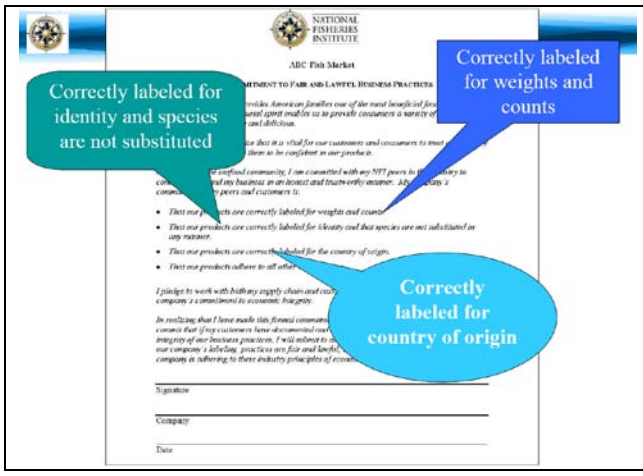




Economic Integrity Initiative

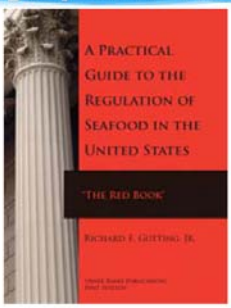
- In 2006, NFI Board approved an Economic Integrity Initiative.
- Goal to increase consumer confidence in seafood products
- Economic disadvantage to "follow the rules"
- Develop a process for accountability





Economic Integrity Initiative

NFI members are provided with easy access to the "rules"



Better Seafood Bureau

- System to report unresolved challenges
- Call-center established to document unresolved situations of economic fraud.

1-866-956-4BSB

What's happening now

- we were recently informed of an offer that you made to a U.S. importer offering **90 - 95% net weight on channel catfish**
- This communication appears to constitute an offer to collude to violate U.S. law. We ask that you reconsider such offers to U.S. businesses.
- .. send a copy of this letter to officials in the U.S. Food and Drug Administration,
- ..providing a copy of this letter to the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ) and to the Commercial Minister of the Chinese Embassy in Washington, DC.

Member Response

- It is illegal to offer product and to sell product in the United States that is less then 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 then 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

Report of the Specifications and Tolerances Committee

Todd Lucas, Chairman
Ohio Department of Agriculture
Weights and Measures

Reference
Key Number

300 INTRODUCTION

This is the final report of the Committee on Specifications and Tolerances (S&T) (hereinafter referred to as the "Committee") for the 94th Annual Meeting of the National Conference on Weights and Measures (NCWM). The report is based on the Interim Report offered in the NCWM Publication 16, "Committee Reports," testimony at public hearings, comments received from the regional weights and measures associations and other parties, the addendum sheets issued at the Annual Meeting, and actions taken by the membership at the voting session of the Annual Meeting.

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. Voting items are indicated with a "**V**," or if the item was part of the Voting Consent calendar by the suffix "**VC**" after the item number. Items marked with an "**I**" after the reference key numbers are Information items. Items marked with a "**D**" after the key numbers are Developing items. The Developing designation indicates that an item, while it has merit, may not be adequately developed for action at the national level. Items marked "**W**" have been withdrawn from consideration. Items marked with a "**W**" will generally be referred to the regional weights and measures associations because they either need additional development, analysis, and input or did not have sufficient Committee support to bring them before NCWM. Table B lists the appendices to the report, Table C identifies the acronyms for organizations and technical terms used throughout the report, and Table D provides a summary of the results of the voting on the Committee's items and the report in entirety.

This report contains recommendations to amend National Institute of Standards and Technology (NIST) Handbook 44, 2009 Edition, "Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices." Proposed revisions to the handbook are shown in **bold face print** by ~~**striking out**~~ information to be deleted and **<u>underlining</u>** information to be added. New items proposed for the handbook are designated as such and shown in **bold face print**.

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.

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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.		

"Handbook 44" (HB 44) means the 2009 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"

Note: NIST does not imply that these acronyms are used solely to identify these organizations or technical topics.

Table D
Voting Results

Reference Key Number	House of State Representatives		House of Delegates		Results
	Yeas	Nays	Yeas	Nays	
Consent Calendar	38	0	41	0	Adopted
320-1A	2	37	1	30	Failed
320-1-B	0	37	1	30	Failed
330-2	38	0	32	0	Adopted
331-2	29	8	33	7	Adopted
300 (Report on its Entirety Voice Vote)	38	0	38	0	Adopted

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.

After the 2009 Interim Meeting, the Committee agreed that the proposal ***was not ready*** for a vote and consequently did not include proposed language in its Interim and Annual Reports. However, the Committee agreed to keep this item on its agenda with the expectation that proposed languages will be submitted for the 2010 Interim Meeting.

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.

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 device must be equipped with an approved audit trail, or that a physical seal is required to be broken before any metrological adjustments to comply G-S.8. 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 proposal as revised in 2008 stated 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 that it is 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 Central Weights and Measures Association (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 2008 voting session, the Committee 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 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 2009 NCWM Interim Meeting open hearing, the committee reviewed comments from the fall 2008 Western Weights and Measures Association (WWMA), CWMA, and Northeastern Weights and Measures Association (NEWMA) meetings that supported the language in the Committee's Interim Agenda and recommended that this item move forward as an Informational item to allow further review, comments and recommendations by the other regional associations, and other interested parties.

The SWMA heard no specific recommendations for change to the proposal during its 2008 Annual Meeting open hearings. The SWMA heard that the SMA plans to further review the item and may have additional recommendations to propose for consideration. The Committee supported 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 SWMA recommended maintaining this as an Informational item on its agenda.

At its 2008 fall meeting, the SMA supported the intent of the item and suggested an alternate proposal for consideration.

At the 2009 Interim Meeting, WMD added that it had received comments questioning how the application of a physical seal (as recommended by the manufacturer and listed on the Certificate of Conformance [CC]) ensures that the calibration and configuration modes are disabled. Specifically, 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. Provision for Sealing Electronic Adjustable Components 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. Security Seal 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 (CoC), 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 language proposed in the 2009 Interim Agenda 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 mechanical automatic temperature compensation (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 device with a physical seal as a method of sealing (e.g., a specially designed sealing pin on the aforementioned mechanical ATC element) or design the device with an electronic method of sealing (i.e., an approved audit trail).

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 address the following concerns:

1. Avoid language that allows the indication of usable metrological values while a device is 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; for example, using a lock and wire seal for the mechanical adjustments and an audit trail for electronic adjustments.
3. Recognize that some specific 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 its method of sealing is 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 recommended that this item remain Informational. See the 2008 NCWM Annual Report for additional background information.

After the 2009 Interim Meeting, the NIST technical advisor developed language that could be further developed by the regional weights and measures associations, National Type Evaluation Technical Committee (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. The NIST WMD proposal would reformat G-S.8.1. for easier reading, recommended language for device indications and recorded representations while in the adjustment mode, and proposed language to recognize that devices may have both audit trails and physical seals for different components of a device (e.g., a physical seal for meter adjustments and an event counter for blend settings).

G-S.8. Provision for Sealing Electronic Adjustable Components. *– A device shall be designed with provision(s) for**:*** **.**

(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, 201X]

(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)

At its 2009 Annual Meeting, the CWMA supported the intent of the SMA proposed language from its 2009 spring meeting and believed that the specific wording should be thoroughly reviewed and that the terms “calibration and configurations modes” are not widely understood. The CWMA suggested that the definitions for the word “adjustment” and “adjustment mode” from the 1993 white paper on Audit Trails be included in HB 44 so that the proposed SMA language might read “. . . the calibration and/or configuration adjustment modes . . .”

At its 2009 Annual Meeting, NEWMA supported the intent of this item. However, NEWMA is concerned that this item is getting over-complicated and asks the Committee to consider requiring that a simple enunciator indicating the device is in "cal mode" might be sufficient.

At the 2009 Annual Meeting, the Committee reviewed comments from the SMA 2009 spring meeting supporting the intent of the items submitted the revised proposal to the Committee. Stephen Patoray, Consultants on Certification (CoC) submitted comments and additional background information on how some devices can have external access to the adjustment mode after the application of a physical seal (and is not equipped with an audit trail). In his letter to the Committee, he states that some devices are designed with a switch (not momentary) or jumper inside the case (that enables or disables external access to the adjustment mode). This switch or jumper has two positions, on or off. When the switch is in the **off position**, the device cannot be put into a calibration or configuration adjustment mode and is in the normal weighing mode. When the switch is in the **on position**, the device shows no apparent indication of being in anything other than the normal weighing mode. However, with a certain sequence of keyboard entries, and possibly a password from the keyboard, the indicating element can be placed into calibration or configuration adjustment mode. After the steps are completed from the keyboard and the operator is done with whatever adjustments in calibration or configuration are needed, the device will return to normal weighing mode. The switch is still **on**. The instructions say (or the design provisions state) that the switch is to be turned off before the case is put back together and the device is sealed. In jurisdictions where a registered service technician is able to seal a device, he/she can decide not to turn the switch off. The device works normally. However, upon his/her return, the service technician does not need to break the seal on the case to enter the calibration/configuration mode; they only need to enter the keystroke sequence (or possibly the password) from the keyboard. This saves them time by not having to remove the seal and the case to flip the switch or set the switch to on position. This is not how the device was "designed" to work, but this is a method that has been in use in many indicating elements for many years. One could argue this is an enforcement issue.

CoC added that the NTEP labs were and still are in a bad position. If an applicant for an NTEP CC describes the method of how the device is to be sealed, this is what the lab evaluator is going to evaluate. While in some cases, the lab evaluator may attempt to simulate other scenarios, it is not possible to ask the lab evaluator to attempt to evaluate all possible scenarios that could happen with a device in the field. Also, it was/is the opinion of some of the lab evaluators that they have no clear method or description in HB 44 to not allow a design as described above. However, all lab evaluators believe that the method described above does not provide a truly "effective method of sealing." That is why several years ago the NTEP labs asked for clarification of G-S.8. To date there has been much work on this item, with several failed attempts to rewrite this section, but at this time, this is still an Informational item and there are still indicating elements out in the field with this ineffective method of sealing. There is the appearance that the device is sealed with a physical seal that must be broken; however, the device can be calibrated or configured from the keyboard because the proper method of sealing has not been followed by registered service technicians.

CoC believes there may be nothing wrong with the **current** G-S.8. wording, as part of the general code. However, this issue does need to be addressed in each of the individual or specific codes. There may be several solutions for newly designed devices, but it is not the role of HB 44 to attempt to actually put design constraints on manufacturers only to place requirements that must be met by some type of design solution.

During the 2009 NCWM Annual Meeting, the Committee received comments during the open hearing that no action may be needed and that the existing language in HB 44 is sufficient. Additional comments indicated that other proposals are overly complex. Oregon and Maryland believe that amended requirements for sealing are needed by the NTEP labs and field officials in order to consistently interpret and apply sealing requirements.

The Committee believes that all parties agree with the intent of the proposal. Both the WMD and SMA proposals include language that restates the existing language in G-S.8. but is essentially reformatted for clarification. Additionally, both proposals include new requirements for providing indications when a device is in adjustment mode. WMD included further language to address devices that may have more than one method of sealing.

The Committee recommended that this item remain "Informational."

See the 2008 NCWM Annual and 2009 Interim Reports for additional background information.

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 Software 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 Annual Meeting, the Committee heard comments from the former 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 items 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 Meeting, 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, Mettler-Toledo speaking on behalf of the added that the SMA can only provide limited responses. The 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 Meter Manufacturers Association (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:

1. do not contain measuring elements;

2. can be replaced with compatible equipment and display devices purchased from any number of sources; and

3. 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.

At its 2009 Spring Meeting, the SMA opposed this item restating its point that there is no longer a technological basis for making this distinction in device types.

At its 2009 Spring Meeting, the Software Sector stated that it seems resistance to this item stems not from a disagreement with the intention, but from either a misunderstanding of the applicability or unrelated concerns over marking requirements. Further discussion was related to how to best present the opinion/goals of the Sector to the interested external parties, such as the NCWM standing committees and the individual states. Some discussion on the wording of the definitions took place as well, with the slightly modified version being discussed. However, no consensus was reached on any language change. The Sector did agree that including the reason(s) for proposing these definitions as part of the effort to educate/promote external parties would be beneficial; and that the Sector will attempt to explain the reasoning/intent of the proposed definitions together with/as part of the action items from its 2009 meeting.

At their 2009 spring meetings, the CWMA and NEWMA supported this item as being Informational and understands a report is coming from the Software Sector, which should be reviewed prior to any further recommendations. The CWMA heard comments from SMA in opposition of this item. Additionally, Stephen Patoray, Consultants on Certification (CoC), strongly supported the proposed definitions and stated the Sector needed to continue to work on this item.

During the 2009 NCWM Annual Meeting, the Committee considered the comments from the SMA on the language in the Committee's Interim Report and the report from Stephen Patoray responding to the Software article in the Spring NCWM newsletter. The Committee agreed to keep this item Informational to allow updated comments from the regional weights and measures associations and other interested parties based on information in the summary of the March 2009 meeting of the Software Sector.

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. – <u>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:</u>

All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect **<u>and manufactured prior to January 1, 201X</u>**, 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)

Required Marking	Full Mechanical Devices and Separable Mechanical Elements	Type P Electronic Devices and Separable Elements	Type U Electronic Devices and Separable Elements
Name, initials, or trademark of the manufacturer or CC holder	Hard-Marked	Hard-Marked or Continuously Displayed	Hard-Marked, Continuously Displayed, or Via Menu (display) or Print Option (8)
Model identification information that positively identifies the pattern or design of the device (1)	Hard-Marked	Hard-Marked or Continuously Displayed	Hard-Marked, Continuously Displayed, or Via Menu (display) or Print Option (8)
Non-repetitive serial number (2)	Hard-Marked	Hard-Marked or Continuously Displayed	Not Acceptable
Software version or revision (3)	Not Applicable	Hard Marked (5), Continuously Displayed, or by Command (operator action) (6)	Continuously Displayed or Via Menu (display) or Print Option (8)
Certificate of Conformance number or corresponding CC Addendum (4)	Hard-Marked	Hard-Marked or Continuously Displayed	Hard-Marked (7) or Continuously Displayed
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.			

(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 Sector's tasks is to develop a clear understanding of the use of software in today's weighing and measuring instruments.

During its 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 included this item on its 2009 Interim Agenda.

After the 2008 Annual Meeting, WMD reviewed the following Software Sector Proposal to amend G-S.1. Identification and/or G-S.1.1. Location of Marking Information for Not-Built-for-Purpose, Software-Based Devices 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 separates 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 as shown in the Committee's 2008 Annual Report) 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.). SMA 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-chairman Jim Pettinato (FMC Technologies) 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.

At the 2009 spring Software Sector Meeting, it was noted by several Sector members that the perceived scope of the original proposal has been extended by the modifications made by WMD and now appears to exceed both the purview and the intent of the Sector, and it has become difficult to discern its intentions. Based on the fact that the proposed table seems to have actually made the Sector's intent less clear, it was proposed by the chair to revisit this item in relation to the current text of G-S.1. to clarify exactly what real changes to Handbook 44 would be required to achieve the intent of the Sector. It was also noted that there was some validity to the SMA argument that there is no justification for differentiation of marking requirements based on device type (P or U). After additional lengthy discussions, the following modified versions of G-S.1 and or G-S.1.1 were drafted:

G-S.1. Identification. – All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect **and manufactured after 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 ~~***not built-for-purpose software-based***~~ ***software that is not part of a Type P (built-for-purpose) device.****;*
[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 ~~***not built-for-purpose***~~ ***software-based electronic*** *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~~ Method of Marking Information for ~~Not Built For Purpose~~ all Software-Based Devices. – *For ~~not built for purpose, software based~~ devices **manufactured after 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

(d) 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**)

The Sector noted that though currently it is allowable to display the CC number via a menu, there has been some challenges locating this information in the field due to the vagueness of the term "easily recognized." Hence, since it is left to the interpretation of the NTEP laboratory to ascertain whether a device's method for displaying the CC number meets the requirements, this vagueness has not been addressed in this new recommendation.

John Roach (California NTEP Lab) indicated that if the proposed table, or some version thereof, is not eventually included as part of G-S.1. that it may be useful to incorporate a suitable table into Publication 14.

The Software Sector concluded that it does not wish to debate the merits of general marking requirements beyond that related to software identification and wishes only to address concerns related specifically to software. The Sector feels its proposed changes above better reflect the Sector's position. The Sector suggests that the following simplified version may better suit the purpose if WMD, and the Committee believes a table outlining general marking requirements would clarify the intent of paragraph G-S.1.

Table G-S.1.~~a~~ Identification for Devices Manufactured on or after January 1, 201X

Required Marking	Full Mechanical Devices and Separable Mechanical Elements	Electronic Devices, Software Based
Manufacturer or CC holder ID	**Hard Marked**	**Hard Marked, Continuously Displayed, or Via Menu (display) or by command or operator action**
Model identification	**Hard Marked**	**Hard Marked, Continuously Displayed, or Via Menu (display) or by command (operator action)**
Serial number	**Hard Marked**	**Hard Marked, Continuously Displayed** [1]
Metrologically Significant Software version	**Not Applicable**	**Continuously Displayed, Via Menu (display) or by command (operator action)** [2]
Certificate of Conformance number	**Hard Marked**	**Hard Marked or Continuously Displayed, or Via Menu (display) or by command (operator action)**[3]

[1]**Type 'U' devices need not have a non-repetitive serial number.**

[2]**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).**

[3]**If the Certificate of Conformance number is to be displayed via menu and/or submenu, the means of access must be easily recognizable. In addition, instructions on how to obtain the remaining required information not hard-marked or continuously displayed shall be included on the NTEP CC.**

(Added 201X)

Note that this new version of the table reflects the aforementioned changes proposed for the language in paragraph G-S.1. as well, homogenizing Type P and Type U requirements, with the exception of the serial number requirement being waived for standalone software. It was also noted that much of the information previously included in the separate proposed "Table G-S.1. "Notes on Identification For Devices Manufactured on or after January 1, 201X" was redundant as it is already stated verbatim in the text of G-S.1; hence the Sector questions the benefit of the WMD - proposed separate Table G-S.1.

In an April 2009 letter to the Committee, Stephen Patoray, CoC agrees with the recommendation of the Software Sector. In order for CoC to fully endorse this recommendation, CoC suggests one change for the NOTE in G-S.1.1. to read as follows:

> ***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.*

In the "***Note***" for paragraph G-S.1.1., there remains one item that is inconsistent with all other requirements for marking. It is noted that it indicates **only** the information in G-S.1. (a), (b), and (d) which intentionally leaves out information in G-S.1. (c) Serial Number. It is the position of CoC that there should be NO limitation, which is any different from other markings, on the marking of the serial number of a device in the General Code. As written, it would require only the serial number to be permanently marked or continuously displayed. Since this is the General

Code Section of HB 44, CoC sees no reason to create this limitation. CoC recommends that this can be handled in the device specific code if there are any issues that might arise with allowing the serial number to be display via menu. CoC stated that is could fully support this item incorporating the above change.

At its 2009 Annual Meeting, the CWMA agreed with comments from weights and measures officials that there is a need to easily identify the software for the proposed software-based devices, especially during field inspections for "Type U" devices. They believe that a uniform or standard method for easily accessing identification information is needed to aid field inspections. The SMA stated there is no distinction between the proposed Type P and Type U devices and marking requirements should be the same for both devices. It was reported that the Software Sector had met a few weeks before the CWMA Annual meeting and that the Sector recommendations would be submitted to the committee and its report posted on the NCWM web site prior to the NCWM Annual Meeting. Consequently, the CWMA recommends this item remain Informational.

At the 2009 NEWMA Annual Meeting, the members received similar comments from SMA and the Software Sector and took no position on this item pending its member review of the Software Sector's report.

At the 2009 NCWM Annual Meeting, the Committee reviewed the recommendations in the previous paragraphs from:

- the 2009 meeting of the Software Sector,
- a report of the 2009 spring meeting of the SMA opposing the marking requirement differences for "Type P" and "Type U" devices, and
- comments from Stephen Patoray, CoC, supporting the Software Sector's position with his suggested changes.

During the open hearings, the Committee received comments from the SMA, Stephen Patoray, and the Chairman of the Software Sector restating their previous positions and recommendations.

NIST WMD commented that some terminology in both the Software Sector's proposed "Table G-S.1. Identification" may need to be further defined. For example, what is meant by the term "hard-marked?" WMD believes that "hard marked" is the same as "permanently marked," which is already used in other sections of HB 44. If Committee believes a table outlining general marking requirements would clarify the intent of G-S.1., WMD recommends that the words "hard marked" be replaced by "permanently marked".

Consequently, the Committee agreed that this item remain Informational and that the regional weights and measures associations review the above information and provides the Committee with comments and recommendations.

Additional background information on this item can be reviewed in the Committee's 2008 Final Report.

310-4 W G-N.3. Verification of Testing Standards

(This item was withdrawn)

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. Testing Apparatus. – Testing Apparatus, including field standards, used to verify compliance of weighing and measuring devices with National Institute of Standards and Technology (NIST) Handbook 44 will meet the specifications of the NIST 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 (See Appendix A. Fundamental Considerations).

(Added 2009)

Delete corresponding paragraphs in the Scales Code, Automatic Bulk-Weighing Systems Code, and the Automatic Weighing Systems Code (N.1.3.)..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 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 proposed change to the General Code was adopted. The language in paragraph G-N.3. Verification of Standards will provide guidance for device codes that do not specify the suitability and use of standards in the specific codes.

At the 2009 NCWM Interim Meeting, the Committee heard comments form 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 theses 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 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.

At their 2009 Annual Meetings, the CWMA supported this item and recommended striking the word "additional" since it is redundant in the sentence. NEWMA opposed this item stating that:

- Some of the NIST Handbook 105 Series are out-of-date,
- There are concerns that the State Director must "approve" all standards not covered in the Handbook 105 series (including OIML and ASTM weights for Class I and II scales) and is concerned that it may have far reaching legal ramifications,
- The language should not conflict with the language on Appendix A - "Fundamental Considerations," and
- There is a lack of a justification for the proposed language in the General Code when the same information is located in the "Fundamental Considerations."

At the 2009 NCWM Annual Meeting, the Committee heard some comments in opposition to referencing the NIST 105-Series Handbooks, with those members citing concerns that the NCWM does not control development of those documents and questioning whether "due process" is provided in their update. One member in opposition also indicated concerns that some of the NIST 105-Series Handbooks may at times be in need of updating. The CWMA also suggested eliminating the word "additional" from the proposed language.

NIST WMD clarified that the process for developing and updating the NIST 105-Series Handbooks allows for any interested party to participate. NIST WMD noted that the basis for "due process" is to ensure that affected parties receive adequate notification and have opportunity to comment on proposed changes. The current process to develop the 105-Series Handbooks provides for this. Participants in revisions to various NIST 105-Series Handbooks have historically included representatives from weights and measures regulatory agencies, industry, and users and have included NCWM members in these groups. The process is an open one in which all affected parties are notified and invited to participate; diverse interest categories are solicited and sought to achieve balance; notification of the project, updates, and comments are distributed through multiple mechanisms such as the NIST Website, newsletters, meetings, and direct mailings. Views, comments, and objections are collected, compiled, addressed, and circulated. The final technical and editorial decisions rest with NIST to resolve conflict and ensure technical accuracy. The consensus process is used throughout the development process and comments and publications can be submitted at any time. There is also a precedent for referencing other standards such as ASTM standards. In considering whether or not to delete the term "additional," WMD also suggested that the language remain consistent with corresponding references in the Fundamental Considerations.

There will be times in which changes will need to be made to a NIST 105-Series Handbook in order to bring it up to date. A lag between the time when the need for update is recognized and the time when the update is completed is common to most standards, including HB 44.

In response to a question regarding the reference to who can approve "other suitable and designated standards," the Committee confirmed that the "Director" does refer to the weights and measures director in a jurisdiction as referenced in NIST Handbook 130.

The Committee noted that the NIST Handbook 105-Series Handbooks are referenced in Appendix A - Fundamental Considerations; therefore, including the reference to the NIST 105-Series in the proposed G-N.3. is consistent with the other references in HB 44. Consequently, the Committee modified the proposal as outlined in the recommendation.

During the voting session, the Committee continued to receive comments opposing the need for this proposal and when this item was brought up for discussion. The Committee responded that similar language is already in several HB 44 weighing codes. The Committee recognized that there was insufficient support for this item and withdrew it from its agenda prior to asking for a vote.

310-5 W G-T.1. Acceptance Tolerances

(This item was withdrawn)

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

(This item was not adopted)

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 ± 0.25 d. [Nonretroactive as of January 1, 2010]

(b) A "center-of-zero" condition shall either automatically be maintained to ± 0.25 d or less or have an auxiliary or supplemental "center-of-zero" indicator that defines a zero-balance condition to ± 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 ≤ 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 ≥ 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:

1. ensure a tare feature operates in a manner that increases the accuracy of net weight determinations,

2. state clearly what information and values are permitted and required for indicated and recorded representations of net weight and tare weight, and

3. 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 the 2009 NCWM Interim Meeting, the SMA suggested that the proposal be Withdrawn since the item began with a NTETC WS 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 were incorporated in the individual items where the terms first appear.

Item 320-1A in the Committee recommendation 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.

At its 2009 SMA Spring Meeting, the SMA recommended the item be withdrawn. The SMA added that the item began with an NTETC WS item dealing with the proper rounding of a tare value, on multiple range devices, when changing ranges. The WS discussions lead to the development of the "mathematically correct" item 320-2 in the 2008 S&T Agenda that was subsequently adopted and the creation of the Tare Work Group. The work group's 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 their efforts to include harmonization to OIML R76 requirements related to tare. SMA stated that these changes do not address any problem and can only lead to confusion in the current regulatory and product development fields.

At its 2009 Annual Meeting, the CWMA supported this as a Voting item. During the CWMA discussions of this item, statements were made that HB 44 is supposed to be a field manual for officials, users and service agents. The CWMA S&T Committee responded that the introduction in Handbook 44, Part S states, "Handbook 44 is designed to be a working tool for federal, state, and local weights and measures officials, the equipment manufacturers, installers and service agencies/agents." Therefore the recommendation for S.2.1.6 would benefit the enforcement community and manufacturers by providing additional guidance in the design of these devices. Existing paragraph S.2.1.6 does not specify that motion detection and zero setting requirements are applicable when using scales with combined zero/tare key. Additionally the purposed amendment for "tare-balancing mechanism" clarifies that the manually entered tare weights (preset tares) should not be confused with tare values determined by a weighing device.

During its 2009 Annual Meeting, NEWMA supported this item and recognizes that it is a complicated and important issue and agreed that it is important that HB 44 supports the testing being performed by the NTEP labs.

During the 2009 Annual meeting, SMA restated its opposition to this item. WMD restated its support the tare proposals submitted by the Tare Work Group on the NTETC Weighing Sector and agrees that all proposals for tare and applicable definitions provide the following benefits:

- Ensures that tare operates in a manner that increases the accuracy of net weight determinations,
- Clarifies the definitions for the various terms that are currently used for tare,
- Identifies and formalizes the definitions for the different types of tare weight values whether they are determined at the time objects are weighed (i.e., tare) or tare weight values are determined prior to the time objects are weighed (i.e., preset tare),
- Reduces the possibility of multiple and incorrect interpretations of General Code paragraphs G-S.2 Facilitation of Fraud and G-S.5.1. General (which states " Primary indications and recorded representations shall be clear, definite, accurate, and easily read under any conditions of normal operations of the device") by clearly stating what information and values are permitted and required for indicated and recorded representations of net, tare, and preset tare weight, and
- Provides additional support for the requirements for the operation of tare and preset tare, indications recorded representation of tare during NTEP evaluation that are currently based on interpretations of

General Code requirements and NCWM Report of the 65th Committee on Specifications and Tolerances agenda item 320-1 Tare (Pages 246-218).

The Committee considered the positions of the CWMA, SMA, and NEWMA, and the comment from Ed Williams, California Division of Measurement Standards, proposing deleting the words "to the public" since "direct sale is adequately defined in Appendix D-Definitions. The Committee agreed that NTEP needs additional support from HB 44 in evaluating tare features, and decided to keep the item as Voting, and delete the words "to the public" in the proposal. Replace the recommendation shown in the Committee's recommendation. No changes were proposed to the remaining language in the Committee recommendation.

During the discussion of this item during the voting session, Darrell Flocken, Mettler-Toledo, expressed his opposition to all of the tare proposals and supports the SMA position that the tare proposals are not needed for HB 44. He added that much of the language is still confusing and not well understood by Conference members and cited examples in the above proposal. For example, what is meant by "the accuracy of the zero/tare setting shall be not more than ± 0.25 d," and "a center-of-zero condition shall either automatically be maintained to ± 0.25 d or less or have an. . . ."

Items 320-1A and 320-1B were not adopted and consequently, the Committee recommends that the NTETC WS, at its August 2009 meeting, discuss and provide the Committee with an update on the WS position on the remaining Tare Informational proposals for the Committee's 2010 Interim Agenda.

For additional background information, refer to the Committee's 2008 Annual Report.

320-1B V S.2.3. Design of Balance, Tare, Level, Damping, Arresting Mechanisms, and Appendix D – Tare-weighing Mechanism.

(This item was not adopted)

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 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) ± 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 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 Item 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.

During the 2009 Annual Meeting, the Committee received no additional comments on this proposal. However, "Tare: Items 320-1A and 320-1B were not adopted and consequently, the Committee recommended that the NTETC WS, at its August 2009 meeting, discuss and provide the Committee with an update on the WS position on the remaining Tare Informational proposals for the Committee's 2010 Interim Agenda.

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.

(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 "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.

(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)

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 recommended that this proposal remain an Informational item in its Interim Report and suggested 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.

During the 2009 Annual Meeting, the Committee received no additional comments on this proposal. However, "Tare" items 320-1A and 320-1B were not adopted and consequently, the Committee recommended that the NTETC WS, at its August 2009 meeting, discuss and provide the Committee with an update on the WS position on the remaining Tare Informational proposals for the Committee's 2010 Interim Agenda.

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. to 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 recommended that this proposal remain an Informational item in its Interim Report.

During the 2009 Annual Meeting, the Committee received no additional comments on this proposal. However, "Tare" items 320-1A and 320-1B were not adopted and consequently, the Committee recommended that the NTETC WS, at its August 2009 meeting, discuss and provide the Committee with an update on the WS position on the remaining Tare Informational proposals for the Committee's 2010 Interim Agenda.

320-2 V T.N.4.6. Time Dependence (Creep) for Load Cells During Type Evaluation

(This item was adopted)

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) 0.5 times the value of the load cell verification interval **(**0.5 v) for Class I, II, and IIII load cells

(b) 0.5 times the value of the load cell verification interval **(**0.5 v) for Class III **load cells with 4000 or fewer divisions**,

(c) 0.83 times the value of the load cell verification interval (0.83 v) for Class III load cells with more than 4000 divisions, or

(d) 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 United States and European marketplace, a Class III scale with 5000 divisions is more common in the U.S. 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 $^5/_3$ to maintain consistency in the level of performance between the United States 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 $^5/_3$ 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 WS 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.

At its 2009 Spring Meeting, the SMA restated its support for this item.

After the 2009 Interim Meeting, the Committee received written comments on this item from Stephen Patoray, Consultants on Certification (CoC). CoC stated that it does not support this change. The main reason is there has been significant effort by many members of NCWM (e.g. industry, regulators and NIST) to support harmonization with OIML Recommendations and make changes to HB 44 to harmonize when they made sense. The words found in T.N.4.7. and T.N.4.7.(a) currently match those found in OIML R 60 load cells. These changes were well discussed before they were adopted. CoC asks, what has changed now, that requires this change in T.N.4.7 (a)? Is there no longer support for harmonization with international recommendations?

CoC suggested that the Committee must also make changes in other places in HB 44 which were also recently harmonized with OIML Recommendations, so as not to create conflicts with the Committee recommendation. Paragraph T.N.4.5.1. (c) states that the complete scale must not exceed 0.5 e after a load has been on the scale for 30 minutes. Since ALL creep comes from the load cell, if the requirement in T.N.4.7. (a) is changed to 0.83 v, then the requirement in T.N.4.5.1. (c) will also need to be changed to 0.83 e.

Also, HB 44 recently changed S.2.1.3.2. (b) AZT for all scales other than III L devices. This too was an attempt to harmonize with international recommendations. CoC stated that there is no coincidence with the 0.5 v in creep on a load cell, the 0.5 e in creep for a scale and the 0.5 e (scale division) for AZT. With AZT active, it ensures that an indication will return to zero if a load is left on a scale for 30 minutes or less and will automatically track the zero. If T.N.4.7. (a) is changed to 0.83 v, then the requirement in S.2.1.3.2. (b) will also need to be changed to 0.83 e.

At their 2009 Annual Meetings, both CWMA and NEWMA reviewed the comments from SMA and CoC and supported the Committee recommendation. The associations also agreed that the specifications for zero-tracking and tolerance for creep recovery in the scale code may also need to be looked at for alignment with this item.

In his May 2009 letter to the Committee, John Elengo stated that this proposal will relax the performance requirements of devices of all accuracy classes and resolutions across the board in order to address the specific shortfall of certain manufacturers to achieve NTEP Certification for their Class III, 5000d devices. This is supported

by the preponderance of NTEP Certificates for Class III, 3000d devices and questions the need to relax tolerances for 3000d scales. John Elengo is concerned that to do so may open the U.S. market to dumping by others.

John added that the proposed relaxation will also remove the competitive advantage that exists for those manufacturers who already have NTEP Certificates for Class III, 5000d devices. From a historical perspective, high-resolution devices are a carry-over from the days when accuracy classes were tied to a percent of load tolerance. The user was convinced that, for example, it was better to purchase a scale with a 1-pound graduation to measure a 5000 pound load than to buy a scale with a 2-pound graduation; yet the tolerance requirement for each was identical at 5 pounds. For that reason, in attempting to harmonize with internationally accepted step tolerances the U.S. added a fourth step to the Class III tolerance and also created Class IIIL. Should a relaxation be allowed, it should only be specific to Class III, 5000d and up devices and not be applied across the board.

During the 2009 Annual Meeting, the Committee considered the positions of the SMA, CoC, Mettler-Toledo, and John Elengo. The Committee concurred with the concerns in John Elengo's letter that loosening the creep recovery tolerance across the board may open the U.S. market to dumping by other load cell manufacturers.

The Committee is sensitive to statements from the load cell manufacturers stating that they did not recognize the full impact on load cell compliance during type evaluation testing based on the language that was adopted in 2006. The manufacturers have also stated that the current tolerance places new load cells at a competitive disadvantage with load cells that were evaluated prior to the adoption of this tolerance and are not required to be resubmitted for reevaluation to compliance with the new tolerances.

NIST WMD and SMA restated their comments that there were no creep recovery requirements prior to the language that was adopted in 2006. The Committee agreed that the proposed increase in the creep recovery tolerance is more acceptable than the load cell manufacturers' 2008 request for an emergency item that would have removed the creep recovery tolerance from HB 44 for both scales and load cells. WMD added that load cell test data used in the determination of compliance rates discussed in the Interim Report was collected by NIST, which is one of the two laboratories utilized by NTEP to certify load cell compliance with performance requirements.

The Committee agrees with the comments that the relaxation of tolerances may impact existing zero-tracking and creep recovery requirements for scales and may result in increased rejection rates unless the language is amended. The Committee encourages the NTETC WS or other interested parties to submit proposals that address areas affected by this change.

The Committee amended the proposal to read as shown in the above recommendation to limit the range of load cells in the proposed change in creep recovery tolerances. The Committee selected the 4000 division breakpoint 4000 scale divisions is the point where HB 44 deviates from OIML R 76 and R 60 tolerances.

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 WS 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 and NCWM Publication 14 has no test to determine if the device submitted for evaluation has such a function, or if it is sealable. Additionally, NTEP reported that, on a scanner/scale that had been submitted for NTEP evaluation, the automatic zero-setting feature was discovered and found to work 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 an "automatic zero-tracking mechanism," it is not allowed. Additionally, the NTETC WS 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 WS 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 HB 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 WS 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 WS 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 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 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 NTETC WS prior to the cutoff date for submitting items to the Committee. The responses to the ballot indicated that eight WS 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 for a vote. Ted Kingsbury, Measurement Canada (MC), 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 United States/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 WS ballot results and comments it received during the open hearing. The Committee agreed that there was no clear consensus among the WS members and recommended 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."

At its 2009 Spring Meeting, SMA opposed the language in the Interim Report and took the position that to be fair to the buyer and seller, the recommendation should include the ability to zero the indication in both a positive and negative direction.

During their 2009 Annual Meetings, CWMA and NEWMA heard comments from SMA in opposition of this item. Other comments supporting the proposal indicated there is a potential to zero off a load intended to be weighed if the feature were allowed to be operate in the positive direction. It was also reported that test weights were inadvertently zeroed during a routine increasing-load by several NTEP certified scanner/scales that were configured with this feature (i.e., zero-setting was configured to operate in the positive direction). Consequently, the CWMA agreed that automatic zero-setting mechanism should operate only in a negative condition or that the feature be prohibited, and they recommended the item stay "Informational." NEWMA supports the continued review, comments, and work on this item.

During the 2009 NCWM Annual Meeting open hearing, the Committee heard support of the SMA position on this item from several scale manufacturers. WMD stated that if the Committee chooses to allow automatic zero-setting feature, the language should be consistent with R 76 in regards to the stipulation that only the negative weight indication permitted to automatically rezero and added that there is too great a potential for a load that is intended to be weighed to be unintentionally (or fraudulently) zeroed. Should the Committee choose to not allow this feature, WMD recommends that the Committee develop a proposal that expressly prohibits the automatic zero-setting

feature. In either case, access to enable or disable the feature should be protected by an approved security means on any scale that can be configured with this feature. Additionally, the Committee agrees that the WS needs support from HB 44 in order to evaluate the feature if the requirement is adopted or verify that it can be disabled if the feature is to be prohibited on weighing devices.

The Committee agreed to leave this proposal on the agenda as an Informational item and requested that the NTETC WS discuss the comments and suggestions from the 2009 Interim and Annual Meetings and provide additional feedback to the Committee on the recommendation that either supports the proposal or recommends language for HB 44 prohibiting the feature.

321 BELT-CONVEYOR SCALE SYSTEMS

321-1 V UR.3.2.(c) Maintenance; Zero-Load Tests

(This item was adopted)

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** ~~**S**~~**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 actions to be taken as a result of the zero-load test is shown in the following table:

Change in Zero Reference Point (Δ 0)	Action to be taken
If the change in zero is less than ± 0.25 % (Δ 0 < 0.25%)*	Perform zero adjustment and proceed to simulated load test
If the change in zero is ± 0.25 % to ± 0.5 % (0.25% ≤ Δ 0 ≤ 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 ± 0.5 % (Δ 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.

(Amended 2002 and **2009)**

The action to be taken as a result of the **simulated or** material test ~~**or simulated load test**~~ is **shown in the following table** ~~**as follows**~~:

Change in Reference Point established in N.3.3. (b)	**Action to be taken**
If the error is less than 0.25 % (Δ N.3.3. (b) < 0.25%)	**No Action**
If the error is at least 0.25 % but not more than 0.6 % (0.25% ≤ Δ N.3.3. (b) ≤ 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 ± 0.25 %, a span correction shall be made and the official with statutory authority notified..** (Amended 1991)
If the error is greater than 0.6 % but does not exceed 0.75 % (0.6% < Δ N.3.3. (b) ≤ 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 ± 0.25 %, a span correction shall be made, the official with statutory authority shall be notified, and an official test shall be conducted.** (Amended 1991)
If the error is greater than 0.75 % (Δ N.3.3. (b) > 0.75%)	**An official test is required.** (Amended 1987)

(Amended 1987 **and 2009**)

Background/Discussion: At its 2007 Annual Meeting, the WWMA received a proposal from the Belt-Conveyor Scale Work Group (BCS WG) to amend paragraph U.R.3.2. Maintenance. The BCS WG stated that 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 agreed 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 reviewed and discussed this 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.

After the Interim Meeting, the NIST technical advisor developed tables, which were based on a suggestion during the open hearing. The tables represent the bulleted language in UR.3.3.(c) and were submitted to the BCS WG for its recommendations and additional comments.

The CWMA and NEWMA heard no comments on this item at their 2009 Annual Meetings. Steve Cook, NIST stated the BCS WG had not yet completed its report to the NCWM S&T Committee and that it would be submitted prior to the 2009 NCWM annual meeting. The CWMA and NEWMA also received a comment from a representative of the WWMA (Jack Kane, MT) supporting of all voting items in the Belt-Conveyor Scale Systems Code. Having limited experience with these devices, the CWMA took no position on this and remaining belt-conveyor scale items while NEWMA stated it would support the recommendations and comments from the experts in the WG.

At the 2009 Annual Meeting, the Committee reviewed the comments and recommendations from the February 2009 meeting of the Belt-Conveyor Scale Work Group. The WG agreed with the revised recommendation and supported the use of the tabular format as being easier to read. The WG also recommended combining the fourth and fifth bulleted items for the actions to be taken "as a result of the simulated or material test" in the Committee's Interim Report in the fourth row of the applicable table since both actions are based on the same test results ("If the error is greater than 0.6 % but does not exceed 0.75 %").

During the open hearing, the Committee heard from the State of Montana that it has an active participant in the Belt-Conveyor Scale WG and that it supports all the belt-conveyor scale items in the Interim Report. The Committee also received comments during the open hearing from Bill Ripka, Thermo Ramsey, supporting the proposal and the recommendations from the WG. The Committee agreed with the WG recommended changes and consequently amended the proposal as shown in the Committee recommendation.

(See also the Committee's 2008 Annual Report for additional background information in Developing Item 360-2 Part 3 Item 1.)

321-2 I 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 ± 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)**

Background/Discussion: At its 2007 Annual Meeting**,** the WWMA received a proposal from the Belt-Conveyor Scale Work Group (BCS WG) to amend paragraph N.3.1.4. The BCS WG stated that 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 three-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.

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 February 2008 meeting. 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 Meeting, the WWMA heard comments that the item is sufficiently developed and is an improvement over the existing language in HB 44. The Committee agreed and recommended 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 adding that the current language in HB 44 stating the current three 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.

At the 2009 Annual Meeting, the Committee received comments and recommendations from the February 2009 meeting of the BCS WG. The members of the WG came to general agreement that with regard to these systems, the conveyor belt needs to be uniform (minimum variations in the weight per unit of length of the belt), but the statement as it exists in the Committee's Interim Report is not well understood. The variation during a revolution of the belt is most important and will exhibit the most impact for BCS applications that may use a portion of a belt revolution to deliver a weighment (e.g., 2.5 belt revolutions). This could occur when loading individual trucks or railcars or in some cases could occur with the quantity for verification testing. For large quantities such as loading a unit train the error becomes insignificant.

The BCS WG reported that, after their meeting adjourned, an extended session of the meeting took place with a smaller group. The smaller group developed an amended proposal. However, the smaller group recommended that this item not go forward as a Voting item, but be given Informational status to allow more time to consider developing a revised proposal and to conduct additional research the appropriate tolerance. The entire BCS WG was polled on the smaller group's recommendation. Two responses agreed with the recommendation that this item needed further review and development and its status be made "Informational."

During the open 2009 hearing, the Committee received comments from Bill Ripka, Thermo Ramsey and NIST WMD supporting the recommendation from the BCS WG. The Committee agreed that with the WG that this item needs more time to conduct additional research to determine the appropriate tolerance and revise the proposal and agreed to keep this item on its agenda as Informational.

(See also the Committee's 2008 Annual Report for additional background information in Developing Item 360-2 Part 3 Item 2.)

321-3 V S.1.3.1. For Scales Installed After January 1, 1986 (Value of the Scale Division)

(This item was adopted)

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)

Background/Discussion: 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.

During the 2009 NCWM Annual Meeting, the Committee received comments from the February 2009 meeting of the meeting of the Belt-Conveyor Scale Work Group and Bill Ripka, Thermo Ramsey, expressing continued support of this item as presented in the Committee's Interim Report and recommended this item proceed as a Voting item.

321-4 W S.1.6.1 Zero-load Indicator

(This item was withdrawn)

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 WWMA S&T 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.

At the 2009 NCWM Annual Meeting, the Committee reviewed comments and recommendations from the February 2009 meeting of the Belt-Conveyor Scale Work Group. The members of the WG initially supported the recommendation and discussed the need for an associated user requirement to be developed that would require that zero-balance condition be maintained during operation. Further discussion took place where it was stated that the +/- 0.12% of rated scale capacity specified in the proposal would occupy a large portion of the value of the tolerance applied to the device. Paul Chase, Consultant, pointed out that this value was twice the allowable tolerance applied during a zero test.

Alabama Weights and Measures questioned what would be required of the operator when the device indicated an out-of-zero balance condition prior to the weighing process, and they expressed their concerns about requiring the operator to maintain the device within limits of an established zero reference. Alabama Weights and Measures added that it is their belief that the owner/operator should be required to act upon a significant change of the zero reference in such a manner which would include an inspection of the device to determine the cause of the shift in zero.

Additional discussion included the possibility of requiring that there be some type of interlock mechanism to prevent the initiation of a transaction until the zero reference has been established and the scale is ready to deliver. The WG generally agreed that if the requirement included a mandatory interlock mechanism, which would prevent totalization at times when the zero reference was subject to a significant shift, then the development of any user requirement would be unnecessary. The question was then raised as to whether or not this would present manufacturers with a significant change in design to overcome; a number of the manufacturers present at the meeting felt that this would be a relatively simple change to make in software portion of their devices. Consequently, the WG recommended that this item be Withdrawn and formed a subgroup to further develop the proposal and an associated user requirement if necessary.

During the open hearing, the Committee received comments from Bill Ripka, Thermo Ramsey, and WMD supporting the recommendation from the WG. The Committee agreed that with the WG and WMD recommendation that this item needs additional development and a consensus proposal from the WG and to Withdraw this item from the agenda.

321-5 V N.2. Conditions of Tests, N.2.1. Initial Verification and N.3.2. Material Tests

(This item was adopted)

Source: 2008 Western Weights and Measures Association (WWMA)

Recommendation: Amend NIST HB 44 Section 2.21. paragraph N.2., N.2.1., and N.3.2. 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, the inspector shall check the zero setting and adjust as necessary.**

(Amended 1986 and 2004 **and 2009)**

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:**

(a) normal use flow rate,

(b) 35 % of the maximum rated capacity, and

(c) 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**~~**a**~~ **minimum of four test runs may be conducted at only one flow rate if evidence is provided that the system**~~**s**~~ **is used** ~~to operates~~ **at a single flow rate and that rate does not vary by more than ± 10%** ~~**5%**~~ **of the normal flow rate that can be developed at the installation for at least 80 % of the time.**

(Added 2004) (Amended 2009)

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: NIST 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. Many hours are required to complete the initial verification testing due to the requirement in HB 44 Section 2.21. paragraph N.2.1. that states that tests (runs) are to be performed at three flow rates and that they must be of 10 minute durations. This presents problems 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) presented 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 BCS WG to be an unfair performance standard. At its February 2008 meeting, WG recommended that HB 44 be amended as shown in the Committee's Interim Report.

NIST WMD has also 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 test run at each flow rate), or nine (three test runs 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 proposal to amend paragraph 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 reviewed and 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 Interim Report 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.

During the 2009 NCWM Annual Meeting, the Committee received comments and recommendations from the February 2009 meeting of the Belt-Conveyor Scale Work Group. The WG recommended amending the language in N.2.1. to reflect wording similar to that found in N.2.2. Subsequent Verifications is used as shown below. The WG also recommended increasing the allowable variation in normal flow rate to coincide with a similar exception in OIML R 50. Also the group believes the reference to T.1.1. is unnecessary and recommends that the reference be removed.

During the open hearing, the Committee received a comment from Bill Ripka, Thermo Ramsey, supporting the amended recommendation from the WG and editorial suggestions from WMD.

The Committee also heard a comment from Steve Malone stating that Nebraska could not support the proposal since only two test runs were required to verify that the scale could repeat within tolerances and is different than the current language in paragraph N.3.1. Materials Test. The NIST Technical Advisor reported to the Committee that this issue was discussed by the BCS WG. Similar comments were by Alabama Weights and Measures. Consequently, the WG recommended adding language to the proposal to require a **minimum** of two test runs during the initial verification since at total of six test runs are required if all three flow rates are verified. In the case where only one flow rate is tested, a minimum of four test runs are conducted.

The Committee supported the recommendations from the WG and editorial suggestions from WMD and agreed to amend paragraphs N.2. and N.2.1. the proposal to read as shown in the Committee recommendation above.

The Committee made no changes to the proposal to amend paragraph N.3.2. Material Test.

321-6 V T.1.1. Tolerance Values – Test of Zero Stability

(This item was adopted)

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** material~~**s**~~ 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 **zero-load** test. **If the ~~total~~ range of zero adjustments during a complete (official) verification test exceeds 0.18 % of the totalized load at full scale capacity for the duration of the zero-load test, the official with statutory authority may establish an interval for zero-load testing during normal operation.**

(Added 2004) **(Amended 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 (USNWG) 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 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.

During the 2009 NCWM Annual Meeting, the Committee reviewed comments and recommendations from the February 2009 meeting of the Belt-Conveyor Scale Work Group. During the meeting, the belt-conveyor scale manufacturers commented that the Master Weight Totalizer (MWT) is typically disabled during the zero-load test and recommended that the reference to MWT be deleted since there are other indicating devices (e.g., before and after zero reference numbers) that will display the change in zero. The WG agreed that the current language in HB 44 should be modified to allow other types of indicating devices to verify compliance and submitted a proposal recommending that the reference to the MWT be deleted.

During the open hearing, WMD agreed with the WG recommendation and offered some editorial suggestions to the proposal to clarify that the reference to the total range of adjustments to zero applies to any two zero-load test results conducted during an official test and that the 0.18 % tolerance is also based on the totalized load at full scale

capacity for the duration of the zero-load test. Bill Ripka, Thermo Ramsey, stated that he supported the recommendations from the WG and WMD.

The Committee agreed with the WG and WMD comments and suggestions, and amended proposal shown in the Committee's recommendation.

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

(This item was adopted)

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 ± 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.3.1.2~~3~~. 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 **immediately before conducting the simulated-load or materials test** until three consecutive zero-load tests each indicate an error which does not exceed ± 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 **and 2009**)
>
> **N.3.1.3~~4~~. 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 (± 3 d) from its initial indication during one complete belt revolution.
>
> (Added 2002) (Amended 2004)

Add new paragraph S.3.1.1. as shown below:

> ***S.3.1.1. Automatic Zero-Setting Mechanism. The automatic zero-setting mechanism shall indicate or record any change in the zero reference.***
> ***[Nonretroactive as of January 1, 2010]***
> **(Added 2009)**

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.

During the 2009 NCWM Annual Meeting, the Committee received comments and recommendations from the February 2009 meeting of the Belt-Conveyor Scale Work Group. The WG agreed the language regarding obscuring any change in zero by the automatic zero setting mechanism in the proposed paragraphs S.3.1.1 and N.3.1.2 is confusing and not necessary. The WG recommended that the last sentence in N.3.1.2. be deleted and that paragraph S.3.1.1. be amended since all the manufacturers that currently hold NTEP Certificates of Conformance stated that the zero reference is always recorded into memory as part of the audit trail information or indicated by the integrator.

The Committee agreed that S.3.1.1. should be formatted consistent with other HB 44 nonretroactive requirements rather than referencing a specific date in the WG's proposed language. Additionally, the Committee agreed with the comments and recommendation from the WG and amended the proposal to read as shown in the Committee's recommendation.

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 a**~~**A**utomatic zero-tracking **and automatic zero-setting** mechanism**s** ~~**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 Publication 14 has no test to determine if the device submitted for evaluation has such a function, or if it is sealable. Additionally, NTEP reported that, on a scanner/scale that had been submitted for NTEP evaluation, the automatic zero-setting feature was discovered and found to work 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 2008 NTETC WS 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 WS 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 between drafts).

At the 2009 NCWM Interim Meeting, 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.

See agenda Item 320-3 for additional discussions and background information on the development of this proposal.

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 it 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 NTETC WS 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 WS 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.

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 W S.2.2. Tare, S.2.2.1. Scale Interval and Capacity, S.2.2.2. Accuracy, and S.2.2.3. Damping

(This item was withdrawn)

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 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) ± 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.

During the 2009 Annual Meeting, the Committee received no additional comments on this proposal. However, "Tare: items 320-1A and 320-1B were not adopted. Consequently, the Committee Withdrew the corresponding items in 324 Series Voting items" and recommended that the NTETC WS discuss and provide the Committee with an update on the WS position on the remaining Tare Informational proposals at its August 2009 meeting for the Committee's 2010 Interim Agenda.

324-2B W S.2.2.4. Combined Zero-setting and Tare-balancing Mechanisms (0/T Key)

(This item was withdrawn)

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.

During the 2009 Annual Meeting, the Committee received no additional comments on this proposal. However, "Tare: items 320-1A and 320-1B were not adopted. Consequently, the Committee Withdrew the corresponding items in 324 Series Voting items" and recommended that the NTETC WS discuss and provide the Committee with an update on the WS position on the remaining Tare "Information" proposals at its August 2009 meeting for the Committee's 2010 Interim Agenda.

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 in the 2009 Committee's Interim and Annual Reports.

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 WS clarify the proposed language and consider providing examples of indications and recorded representations when multiple tares are used to determine net weights and provide the justification for limiting the acceptable words and abbreviations for the word "Net."

During the 2009 Annual Meeting, the Committee received no additional comments on this proposal. However, "Tare: Items 320-1A and 320-1B were not adopted in the Committee's 2009. Consequently, the Committee Withdrew the corresponding items in 324 Series Voting items" and recommended that the NTETC WS discuss and provide the Committee with an update on the WS position on the remaining Tare Information proposals for the Committee's 2010 Interim Agenda.

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 and what constitutes "consecutive tare operations." Consequently, the Committee recommended that this proposal remain an Informational item and suggested 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.

During the 2009 Annual Meeting, the Committee received no additional comments on this proposal. However, "Tare: Items 320-1A and 320-1B in the Committee's 2009 agenda were not adopted. Consequently, the Committee Withdrew the corresponding items in 324 Series Voting items" and recommended that the NTETC WS discuss and provide the Committee with an update on the WS position on the remaining Tare "Information" proposals for the Committee's 2010 Interim Agenda.

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:

- whether or not itemized indications and recorded representations and required for each tare; and
- whether or not 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 recommended that this proposal remain an Informational item and suggested that the WS further clarify the proposed language and consider providing examples of indications and recorded representations of preset tare in consecutive tare transactions and provide the justification for limiting the acceptable words and abbreviations for the words "Preset Tare."

During the 2009 Annual Meeting, the Committee received no additional comments on this proposal. However, "Tare: Items 320-1A and 320-1B were not adopted in the Committee's 2009. Consequently, the Committee Wwithdrew the corresponding items in 324 Series Voting items" and recommended that the NTETC WS discuss and provide the Committee with an update on the WS position on the remaining Tare "Information" for the Committee's 2010 Interim Agenda.

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)

Renumber 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.~~2~~3. 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 a~~n~~ **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~~**or** 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.~~3~~4. 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~~ Use~~d~~ 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~~ Use~~d~~ 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, ~~A~~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.~~2~~3. Recorded Representations (Invoices, Receipts, and Bills of Lading).

(a) A**n** ~~**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 in^3 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 ºF. 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 ºC rather than 15 ºC. 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 ºC vs. 15 ºC, gravity to be used?);
5. connection to L&R item; and
6. possible perpetuation of fraud.

NEWMA recommends this item be made a Developing item.

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 ºC:**

  - The Committee changed all references to 15 ºC to correspond with the proposals on the L&R Committee's agenda for method of sale. The Committee acknowledged that 15.56 ºC is an exact conversion for 60 °F. However, the Committee agreed that 15 ºC 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.)

Based on comments heard from the floor during the 2009 Annual Meeting, the Committee acknowledged that additional work may be needed to specific sections of the proposed changes to the code. Points raised and discussed by the Committee include the following:

- There was a question of whether to reference "15 °C" or "15.56 °C." The Committee agreed that industry practice has been to use "15 °C" and that this is the reference used internationally; consequently, they believe it should be kept as "15 °C." This is also supported by the L&R Committee's 2009 Interim Report which references a statement by the Meter Manufacturers' Association indicating that 15 °C is used internationally and industry would likely follow that convention should SI units be used.

- Clarification is needed for the differences between wholesale devices and systems. Specific paragraphs in question were S.1.6.8. and S.2.7.2.

- Clarification is needed for how S.2.7.2. applies to electronic registers that can only indicate in terms of compensated quantities when the compensator is activated; the compensator would need to be activated and an additional run completed in order to view an uncompensated reading.

- Review the use of the term "invoice" and consider if the term is well understood for retail transactions which have typically used terminology such as "printed receipt" or recorded representation.

- Review the language in the VTM code under Item 331-2 and consider where changes might be needed to ensure consistency.

The Committee decided to keep the status of this item as an Informational item and acknowledges that some jurisdictions are already facing the imminent possibility of such equipment in their jurisdictions. The Committee believes that these standards are necessary whether or not the issue of a model method sale regulation is adopted in NIST Handbook 130 since weights and measures jurisdictions may decide to permit this equipment based upon their individual State laws or regulations.

330-2 V N.4.4. Pour and Drain Times for Hand-held Test Measures

(This item was adopted.)

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 (± 5 seconds) pour followed by a 10-second drain with the measure held at a 10-degree to 15-degree angle from vertical.

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 Item 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 (± 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.

At the 2009 Annual Meeting, the Committee reported that it had heard continued concerns from CWMA members that service companies frequently do not use proper drain procedures for hand-held test measures. Additionally, Steve Malone, NE, noted that most service agents do not have a copy of the NIST 105-Series Handbooks. NIST WMD pointed out that HB 105-3 requires marking of pour and drain times and noted that other NIST Handbooks

and test procedures already include these references, including the NIST Examination Procedure Outlines and training materials. Other CWMA members cited problems getting service companies to consistently use these procedures and some noted that inclusion of the paragraphs would further encourage new inspectors to follow proper procedures. NEWMA does not support this item. Ross Andersen, New York, stated that he had initially objected to this item, noting that he might choose to reference a standard with a different drain time; however, since the proposal is now to reference specific pour and drain times he can support it. In response to comments from CWMA and NEWMA, the Committee agreed to strike the phrase "during use" from the end of N.4.4.1. in its original proposal as reflected in the modified proposal in the recommendation above.

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), **~~T~~t**he 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
(2) Club member discounts
(3) Discount for prepaying cash (to prevent "drive-offs")
(4) Prepay at the cashier for credit sales
(5) Discounts for purchasing store products
(6) Discounts for purchasing a service (e.g., carwash)
(7) Targeted group discounts (e.g., Tuesday – ladies 5 cents off per gallon)
(8) Full service
(9) Self service
(10) Progressive discounts based on volume of motor-fuel purchased
(11) Coupons for discounts on immediate or future purchases
(12) Rebates (e.g., use of oil company credit card)
(13) Day-of-the-week discounts

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 a status of Developing to an Informational status. 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

(This item was withdrawn.)

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 a Developing item 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 HB 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 in^3 rather than 3 in^3.

(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 a Developing item.

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 withdrew 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) **~~0.4~~0.2 %** for mechanical automatic temperature-compensating systems; and

(b) **~~0.2~~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 Item 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 HB 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.

Following the 2009 Interim Meeting, the Committee reiterated 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.

At the 2009 NCWM Annual Meeting, the Committee reported receiving additional VTM test data from the State of Maine. This data supports the proposed change to the tolerances; the change would not impact the compliance rate for the devices included in these tests. The Committee noted that to date it has received only data in support of the proposed change.

The Committee heard opposition from the Meter Manufacturers Association and received a letter from David Rajala (Veeder-Root) expressing similar concerns over the proposed change to the tolerances. Both expressed concerns over the test procedures and test equipment that might be used by some jurisdictions, noting that, should non-NIST traceable thermometers or improper test procedures be used, the proposed tolerances would be too small.

As noted in its Interim Report, the Committee has received only data in support of the proposed change. The Committee has not received any data indicating that the proposed change would pose a compliance problem. Given the comments received at the Annual Meeting, the Committee decided to maintain this as an Informational item to allow for the submission of additional input and data. Once again, 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

(This item was adopted.)

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**~~ **activated** 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 **or deactivated**, nor may a compensated device be replaced with an uncompensated device **or system**, 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-compensate 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~~1. 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.

At the 2009 NCWM Annual Meeting, the Committee reported that it heard a question regarding whether or not non-automatic means of temperature compensation was permitted. The Committee noted that when the code was modified to include references to temperature compensation, the original intent was to require that compensation be done automatically. The original proposal to add requirements for automatic temperature compensation to the VTM code was modeled after corresponding requirements for wholesale meters in the Liquid-Measuring Devices code. The 2000 NCWM S&T Final Report indicates that reference to a proposed paragraph on "invoices" and a paragraph related to "nonautomatic" temperature compensation were intentionally removed from the original proposal(s) which added temperature compensation requirements to the VTM code.

The Committee heard questions in the open hearings regarding metering systems that can be set up to deliver a single product in either a compensated or non-compensated mode; for example, when one product code is selected, the system operates in a compensated mode and when another code for the same product is selected, the system operates in a non-compensated mode. Such equipment might be used to serve multiple jurisdictions with differing temperature compensation requirements. The Committee received similar comments in a letter from Dave Rajala, Veeder-Root, who outlined several scenarios and raised concerns about how any proposed requirements would affect companies using such equipment. The Committee felt that a key issue is ensuring that displayed and printed indications clearly indicate whether or not a given quantity is temperature compensated. Based on comments heard in past testimony and Committee discussions, the Committee believes that jurisdictions are able to handle differing temperature compensation requirements in neighboring jurisdictions on a case-by-case basis.

The Committee also heard comments that the reference requiring a compensator to be connected and operable at all times appeared to conflict with the proposed UR.2.5.1.2. (which include provisions for a compensator to be deactivated at the end of a 12-month period). Consequently, the Committee agreed to modify the proposal as outlined in the Recommendation and recommended this item move forward as a Voting item as amended. The Committee plans to address the comments regarding the sales of temperature compensated volumes in one jurisdiction and non-compensated volumes in a neighboring jurisdiction in the continued development of item 331-3 (which is a proposal to add new paragraph UR.2.5.1.X. Condition of Use).

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 VC S.1.1.3. Value of Smallest Unit and S.1.1.6. Proving Indicator

(This item was adopted.)

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 ft^3**) on utility-type meters**, sizes 1 in and smaller,** or

(b) **500 L (100 gal, 10 ft^3) on utility-type meters, sizes 1½ in and 2 in**, or

(c) 0.2 L ($^1/_{10}$ gal, **$^1/_{100}$ ft^3**) on batching meters delivering less than 375 L/min (100 gal/min, **13 ft^3/min**), **or**

(d) 5 L (1 gal, **$^1/_{10}$ ft^3**) on batching meters delivering 375 L/min (100 gal/min, **13 ft^3/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 a proving indicator. The individual graduations on a mechanical (analog) **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 electronic (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 cateogries: 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 m^3, 1.0 m^3, and 10 m^3 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 ft^3. For meters 1½ in and 2 in, test hands have graduations with resolution down to 1.0 gal or 0.1 ft^3. 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 recommended 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.

After deliberations during the 2009 NCWM Annual Meeting, the Committee agreed to maintain the proposed changes to paragraph S.1.1.3. as originally shown in NCWM Publication 16 and as reflected in the Recommendation.

However, based on a suggestion from California Division of Measurement Standards, the Committee agreed to delete the references in paragraph S.1.1.6. to digital and mechanical type indicators from its original proposal. Consequently, the Committee deleted the originally proposed S.1.1.6. and replaced it with the language shown in the Recommendation above.

The Committee made no change to the proposed change to the definition for "proving indicator" from the proposal shown in its Interim Report.

The Committee acknowledged concerns raised by Mike Sikula, representing NEWMA, over references to specific indicator sizes and comments from Juana Williams, NIST WMD, encouraging a review of terms used in the code to determine if additional definitions might be needed to promote clarity and understanding of the terminology. The Committee concurred with these comments, noting that a review of terminology to ensure consistency and understanding might be needed. The Committee noted that its proposal to expand the definition of "proving indicator" to include a reference to the Water Meters Code might help in this regard and is open to additional suggestions to improve understanding and use of the code.

336-2 W T.1.1. Repeatability

(This item was withdrawn.)

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	ft^3
Less than 5/8	8	100	10
5/8	15	100	10
5/8 x ¾	15	100	10
¾	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	**ft^3**		**gal**	**ft^3**
Less than 5/8	**2**	**40**	**4**	**¼**	**20**	**2**
5/8	**2**	**40**	**4**	**¼**	**20**	**2**
5/8 x ¾	**2**	**40**	**4**	**¼**	**20**	**2**
¾	**3**	**40**	**4**	**½**	**20**	**2**
1	**4**	**40**	**4**	**¾**	**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 is 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 ft^3. For meters 1½ in and 2 in, test hands have graduations with resolution down to 1.0 gal or 0.1 ft^3. 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 that 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 Non Utility-Type Water Meters
Normal Tests

Meter Size (inches)	Rate of Flow (gal/min)	Maximum Rate	
		Meter Indication/Test Draft	
		gal	ft^3
Less than 5/8	8	50	5
5/8	15	50	5
¾	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 Utility-Type Water Meters Normal Tests			
Meter Size (inches)	**Rate of Flow (gal/min)**	**Maximum Rate**	
		Meter Indication/Test Draft	
		gal	**ft^3**
Less than 5/8	**8**	**100**	**10**
5/8	**15**	**100**	**10**
5/8 x ¾	**15**	**100**	**10**
¾	**25**	**100**	**10**
1	**40**	**100**	**10**
1½	**50**	**300**	**40**
2	**100**	**500**	**40**

(Table Added 201X)

Table N.4.2. Flow Rate and Draft Size for Non Utility-Type Water Meters 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	**ft^3**		**gal**	**ft^3**
Less than or equal to 5/8	2	10	1	1/4	5	1
¾	3	10	1	1/2	5	1
1	4	10	1	3/4	5	1
1½	8	50	5	1½	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 Utility-Type Water Meters 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	**ft^3**		**gal**	**ft^3**
Less than 5/8	**2**	**10**	**1**	**¼**	**10**	**1**
5/8	**2**	**10**	**1**	**¼**	**10**	**1**
5/8 x ¾	**2**	**10**	**1**	**¼**	**10**	**1**
¾	**3**	**10**	**1**	**½**	**10**	**1**
1	**4**	**10**	**1**	**¾**	**10**	**1**
1½	**8**	**100**	**10**	**1½**	**100**	**10**
2	**15**	**100**	**10**	**2**	**100**	**10**

(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 ⅓ 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 ⅔ 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 ¼ 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 ft^3. For meters 1½ in and 2 in, test hands have graduations with resolution down to 1.0 gal or 0.1 ft^3. 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).

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 at the 2008 Annual Meeting, Jeff Humphreys, Los Angeles County, California, 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 ⅝ 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 acknowledged 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 to the Committee for five new 5/8 in positive displacement meters. 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 5/8in 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 recommended 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.

At the 2009 Annual Meeting, Tina Butcher, NIST Technical Advisor, reported that the Committee received additional information on this item. These items are available from the Committee upon request and include the following:

- Spreadsheet with data submitted by five water meter manufacturers on December 17, 2008 (inadvertently excluded from the supplemental information published in Publication 16)
- February 12, 2009, Letter from Five Water Meter Manufacturers to Todd Lucas & Ed Williams
  - Including 3 Addendum Sections
- February 23, 2009, Letter from Five Water Meter Manufacturers to Todd Lucas & Ed Williams
  - Including Spreadsheet Attachment with "February" "Manu C Data"
- March 5, 2009, Letter from Todd Lucas & Ed Williams Responding to February 12, 2009, Mfg Letter
- March 19, 2009, Letter from Five Water Meter Manufacturers to Todd Lucas & Ed Williams
  - Including March 19, 2009, Spreadsheet with "March" PD Meter Data
  - Including March 19, 2009,Spreadsheet with "March" Multi-Jet Meter Data
- May 5, 2009 Letter from Five Water Meter Manufacturers to Todd Lucas & Ed Williams
  - Including May 5, 2009, Spreadsheet with "April/May" PD Meter Data
- June 23, 2009, Letter from Five Water Meter Manufacturers to Todd Lucas & Ed Williams
- Current HB 44, AWWA, and Proposed Changes – Comparison from NIST Technical Advisor, Tina Butcher (Note: An update to Table N.4.Y, Intermediate Flow Rates was made on June 25, 2009, to correct the entry for the test draft size of the 1 in meter.)
- Comments from NIST Technical Advisor, Tina Butcher – Submitted to Participants for Consideration at the May 14, 2009, Meeting of CA DMS, S&T Representatives Kristin Macey and Brett Saum, and Water Meter Manufacturers
- Excerpts from draft revisions to ISO/CD 4064 which is being revised to incorporate certain provisions of OIML R 49 in an effort to promote harmonization of those documents – per Ralph Richter, NIST WMD

During its agenda review, the Committee heard a report from Kristin Macey, California Division of Measurement Standards (DMS), on an intercomparison conducted by DMS since the 2009 NCWM Interim Meeting involving 18 California counties. Kristin provided summaries of the data collected during the inter-comparison; this data is available upon request from the Committee and will be included in the Committee's final report. Kristin also reported that California DMS and several California counties met with representatives of several water meter manufacturers on May 14, 2009, in an effort to further review and discuss concerns of both manufacturers and regulators regarding water meter testing requirements.

The Committee heard comments from George DeJarlais, Badger Meter, who indicated that Item 336-3 addresses issues with basic accuracy tests; however, water meter manufacturers have more pressing concerns with the requirements for repeatability requirements. The Committee also heard comments from Andre Noel, Neptune, who echoed George's comments and expressed concern that meters 1 in and smaller are having difficulty meeting the current requirements. He also stated that 1½ in and 2 in meters will not meet the type approval requirements. Andre noted that his comments represent the views of five water meter manufacturers, including (in addition to Neptune) Badger, Elster Amco, Master Meter, and Sensus. He also stated that water meter manufacturers are

excluded from participating in their own code. Both manufacturers who were present reported disappointment that Item 336-2 was withdrawn and noted that they are still studying the data from California, which they received during the Committee's agenda review session.

Jeff Humphreys, Los Angeles (LA) County, California, acknowledged problems with testing at the lower flow rates. He went on to express concern about the quality of multi-jet meters they are encountering. The positive displacement meters that they are testing appear to meet the needs of the marketplace with a good compliance rate. Jeff also provided additional data to the Committee that was collected by LA County over the period of January to June 2009; this information will be included in the Committee's final report.

Ed Williams, California DMS, indicated that in its review of the data collected, California has observed some validity to the concerns over the requirements for repeatability tests. Both Jeff and Ed encouraged the Committee to do a thorough review of the full range of test requirements for these meters, including not only basic accuracy tests, but also repeatability test requirements.

During the Committee's work session, Kristin Macey (representing California DMS) and the water meter manufacturers present agreed to work to further review requirements for water meter testing with the goal of identifying changes or modifications to the scope of this item (336-1) in time for review by one or more of the fall 2009 regional weights and measures associations.

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 john.barton@nist.gov	•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	•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)

NIST Weights and Measures Division (WMD) Contact List for International Activities	
Contact Information	**Responsibilities**
Mr. Steven Cook (LMDG) (301) 975-4003 steven.cook@nist.gov	•R 76 "Non-automatic Weighing Instruments"
Dr. Charles Ehrlich (ILMG) (301) 975-4834 charles.ehrlich@nist.gov	•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	•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	•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"
Mr. Ralph Richter (ILMG) (301) 975-3997 ralph.richter@nist.gov	•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)
Dr. Ambler Thompson (ILMG) (301) 975-2333 ambler@nist.gov	•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"
Ms. Juana Williams (LMDG) (301) 975-3989 juana.williams@nist.gov	•R 81 "Dynamic Measuring Devices and Systems for Cryogenic Liquids" •R 139 "Compressed Gaseous Fuels Measuring Systems for Vehicles"

NIST Weights and Measures Division (WMD) Contact List for International Activities			
Contact Information		**Responsibilities**	
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.

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[1]

Brett Saum, San Luis Obispo County, California
Kristin Macey, California
Steve Giguere, Maine
Kenneth Ramsburg, Maryland
Vicky Dempsey, Montgomery County, OH[2]

Ted Kingsbury, Measurement Canada, Technical Advisor
Steven Cook, NIST, Technical Advisor
Tina Butcher, NIST, Technical Advisor

Specifications and Tolerances Committee

[1] Todd Lucas was unable to attend the July 2009 Annual Meeting. The senior Committee member, Brett Saum served as Chairman in his absence.
[2] Vicky Dempsey served on the Committee at the July 2009 Annual Meeting filling in for Todd Lucas, OH as the representative for the CWMA

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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 Typical Vehicle-Tank Meters on Product Depletion Tests, Except Milk Meters Refer to T.4. for meters with maximum flow rates not listed.	
Meter ~~Size~~ Maximum Flow Rate	**Maintenance and Acceptance Tolerances**
~~**Up to, but not including, 50 mm (2 in)**~~ **114 LPM (30 GPM)**	~~**1.70 L (104 in^3)[1]**~~ **0.57 L (0.15 gal) (34.6 in^3)[1]**
~~**From 50 mm (2 in) up to, but not including, 75 mm (3 in)**~~ **225 LPM (60 GPM)**	~~**2.25 L (137 in^3)[1]**~~ **1.1 L (0.30 gal) (69.3 in^3)[1]**
~~**75 mm (3 in) or larger**~~ **378 LPM (100 GPM)**	~~**3.75 L (229 in^3)[1]**~~ **1.9 L (0.5 gal) (115 in^3)[1]**
758 LPM (200 GPM)	**3.8 L (1.0 gal) (231 in^3)[1]**
[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 Typical Vehicle-Tank Meters on Product Depletion Tests, Except Milk Meters Refer to T.4 for meters with flow rates not listed.	
Meter ~~Size~~ Maximum Flow Rate	**Maintenance and Acceptance Tolerances**
~~Up to, but not including, 50 mm (2 in)~~ **114 LPM (30 GPM)**	**~~1.70 L (104 in^3)[1]~~** **0.57 L (0.18 gal) (41.6 in^3)[1]**
~~From 50 mm (2 in) up to, but not including, 75 mm (3 in)~~ **225 LPM (60 GPM)**	**~~2.25 L (137 in^3)[1]~~** **1.1 L (0.36 gal) (83.2 in^3)[1]**
~~75 mm (3 in) or larger~~ **378 LPM (100 GPM)**	**~~3.75 L (229 in^3)[1]~~** **1.9 L (0.6 gal) (139 in^3)[1]**
758 LPM (200 GPM)	**3.8 L (1.0 gal) (231 in^3)[1]**
[1] Based on a test volume of at least the amount specified in N.3.	

(Table Added 2005) **(Amended 201X)**

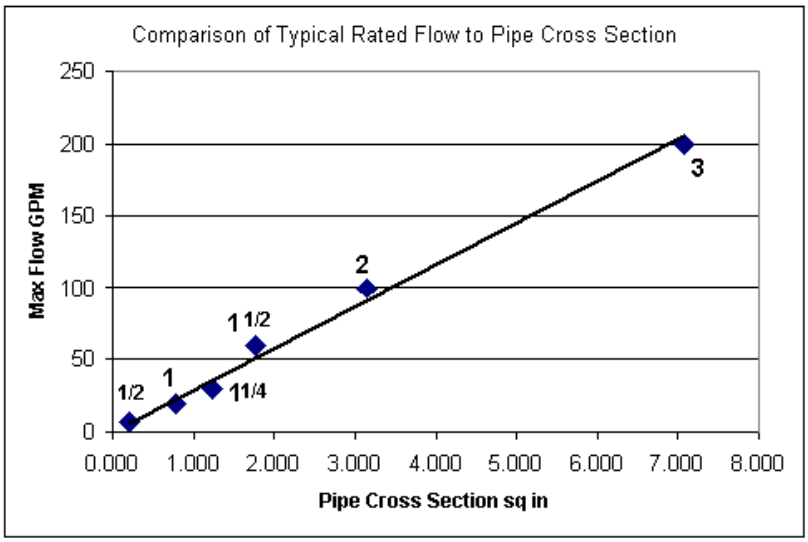
Background/Discussion: This item was submitted to NEWMA at its 2008 Interim Meeting as an alternative to Item 331-1 (S.5.7. Meter Size) in 2008 Publication 16. It would base the tolerances for the product depletion test on a percentage of the maximum flow rate rather than meter size. Justification provided 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 in^3) 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 in, 1½ in, 2 in and 3 in 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 in meter, rated at 40 gpm 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 in 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.

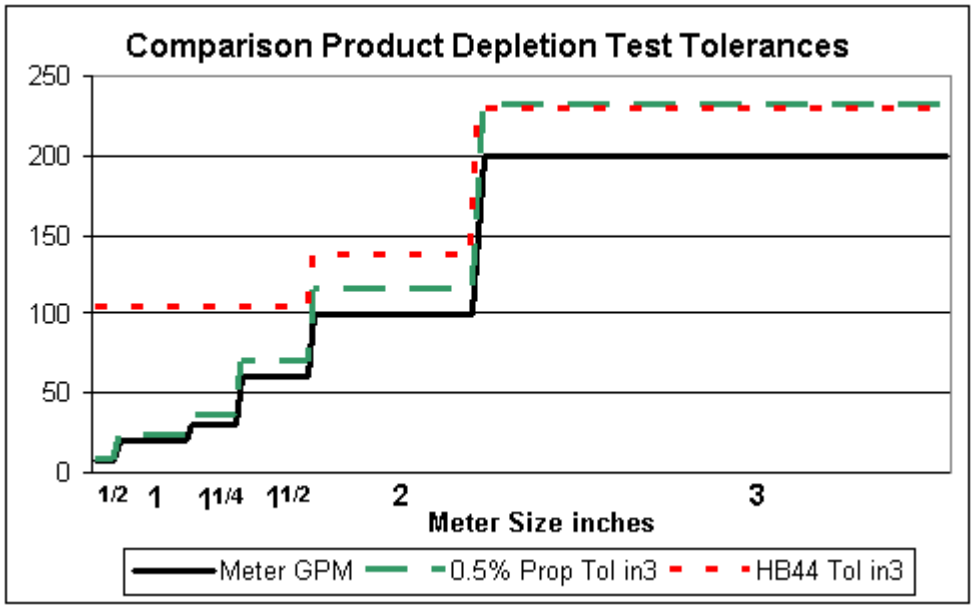
The submitter also noted the following:

> We recognize that the tolerances proposed will reduce the tolerances for meter sizes 2 in 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 in (100 gpm) meter the tolerance would be 139 in^3, virtually identical to the existing tolerance.

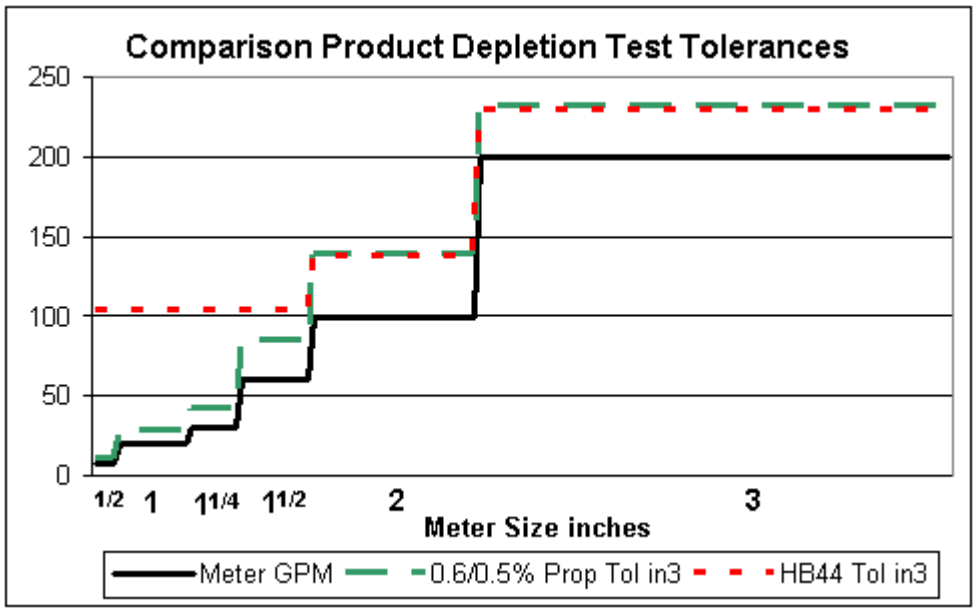
The submitter also provided the following supporting graphics:



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 ºC vs. 60 ºF 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 ºF reference. I find it highly unlikely that this will change in our lifetimes. In addition, if I understand it correctly, using the 15 ºC would require anyone who wishes to change to liters at 15 ºC to deliver 0.07 % more product for the equivalent volume in gallons at 60 ºF. That is simply the physics, because 15 ºC is 0.56 ºC colder than 60 ºF. 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 ºF (15.56 ºC). Until the U.S. is willing to change its entire infrastructure to liters and retool the equipment for a 15 ºC 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 ºC 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 ºC 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 nor 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

MASTER METER

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.

SENSUS
METERING SYSTEMS

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:RKI: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 (¼ 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 %
Average	***–4.45 %***	***–4.32 %***	***–0.14 %***
Std Dev	***0.036461744***	***0.049867807***	***0.0460693***

WATER METER TEST RESULTS: JANUARY > 08 - JULY > 08															
						Meters Failing Tolerances within Passed Lots					Meters Failing Tolerances within Failed Lots				
Make	**Model**	**Size**	**Lots**	**Meters Tested**	**Meters Passed**	**Min. Flow**	**Int. Flow**	**Max. Flow**	**Total Fails**	**Misc. 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	¾ 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	¾ 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	¾ 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 ¾ in**	**Amco C-700 1 in**	**Badger RCDL25 5/8 in**	**Kent C-700 5/8 in**	**Neptune T-10 5/8 in**	**USA 140_F 5/8 in**	**Master Meter MM3C 5/8 in**	**Master Meter MM4 ¾ in**	**Master Meter MM5 C 1 in USG**	**Master Meter FAM 5/8 in USG**	**Master Meter FAM ¾ in**	**Perfor-mance 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

(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						
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			
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						
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

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 accurcy result fails to meet HB 44 accuracy requirements
-- individual accurcy result fails to meet manufacturer's internal controls for accuracy requirements

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)

Report of the Professional Development Committee (PDC)

Ross Andersen, Chairman
New York Weights and Measures
Albany, New York

Reference
Key Number

400 INTRODUCTION

This is the report of the Professional Development Committee (hereinafter referred to as the "Committee" or PDC) for the 94th Annual Meeting of the National Conference on Weights and Measures (NCWM). This report is based on the Interim Report offered in NCWM Publication 16, testimony heard at public hearings, comments received from the regional weights and measures associations and other parties, the addendum sheets issued at the Annual Meeting, and actions taken by the membership at the voting session of the Annual Meeting. The informational items presented below were adopted as presented when the Committee's report was approved.

Table A identifies the agenda items in the report by reference key number, item title, and page number. 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 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 report.

Table A
Index to Reference Key Items

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Table B
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Table C
Voting Results

Reference Key Number	House of State Representatives		House of Delegates		Results
	Yeas	Nays	Yeas	Nays	
No Voting Items					

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

401 EDUCATION

401-1 I National Certification Program (NCP)

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.

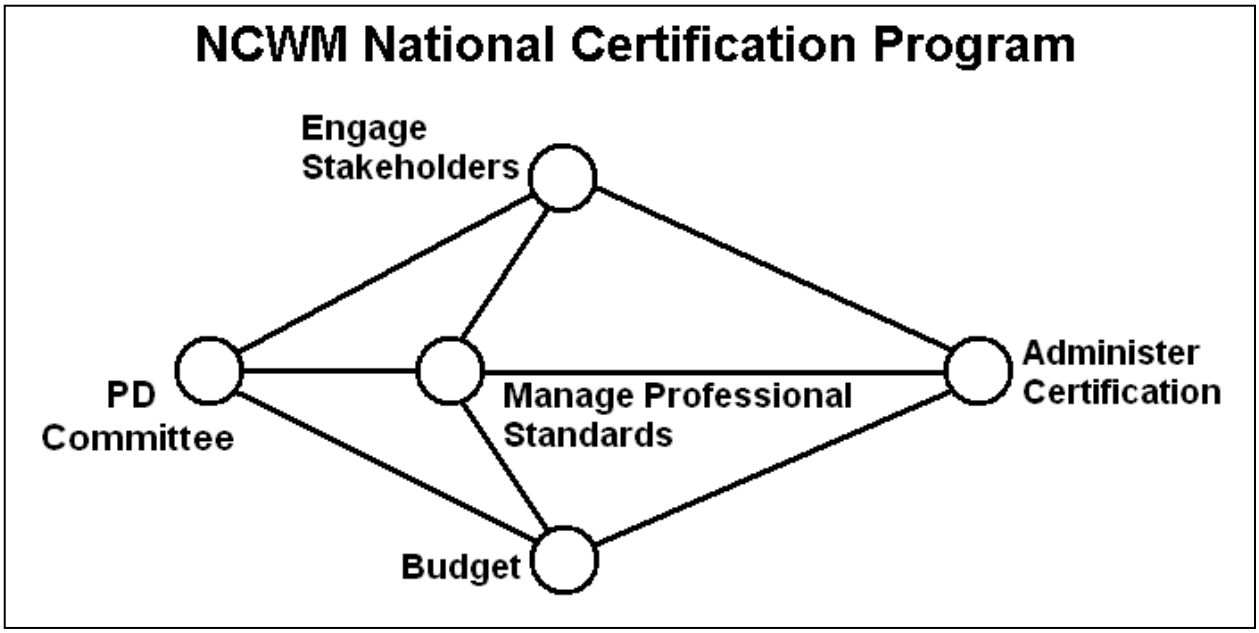
Discussion: The PDC encourages each regional association to dedicate a portion of their Annual Meeting to the National Certification Program (NCP).

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 NCP, Critical Component Analysis, and an action plan of the components of the NCP. The Committee presents a draft of this document below.

National Conference on Weights and Measures
National Certification 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 Certification 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.

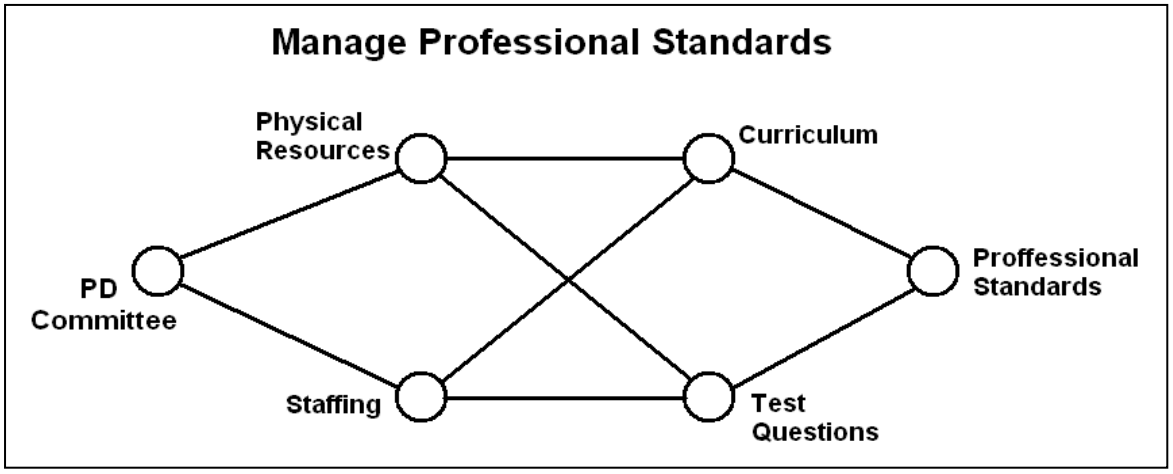


The Committee sees its task as one of managing four critical elements that come together as a certification program (as depicted above). Each bubble in the figure represents a milestone that must be reached in order to complete the objective. Those four main elements are:

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, not the NCWM, will conduct the training. 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.



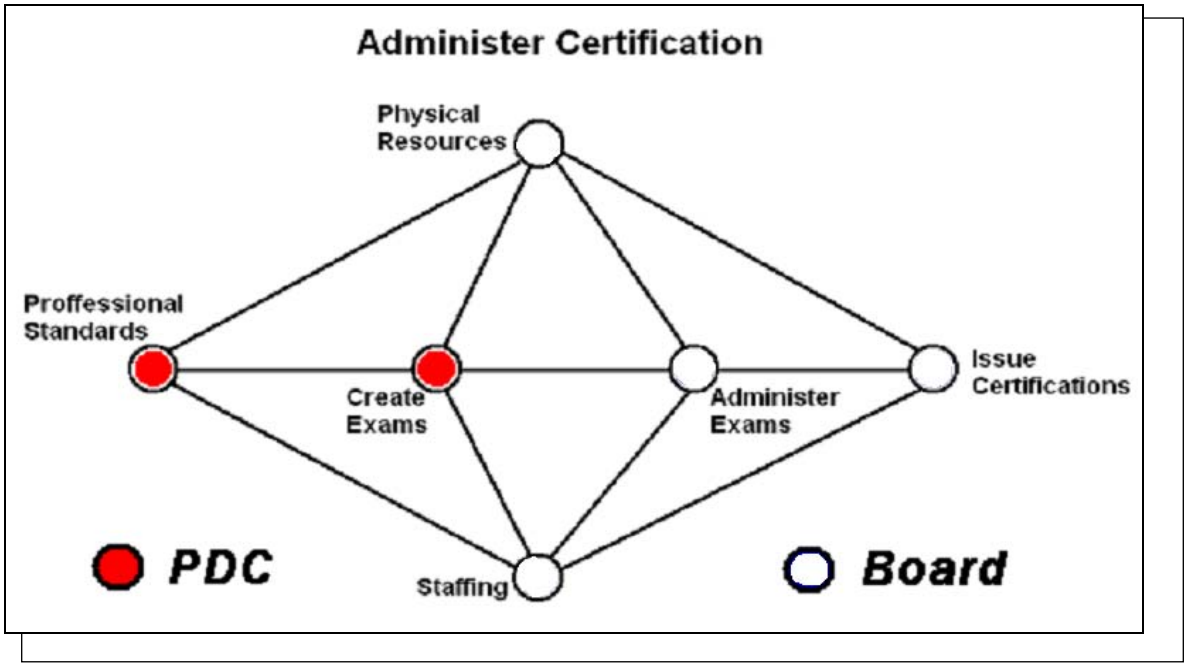
Administer Certification – involves tasks necessary to create certification exams, administer those exams, and issue certifications to those who qualify. The Committee will manage staffing, both paid and volunteer, and physical resources to secure the exams and record and issue the certificates.

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.

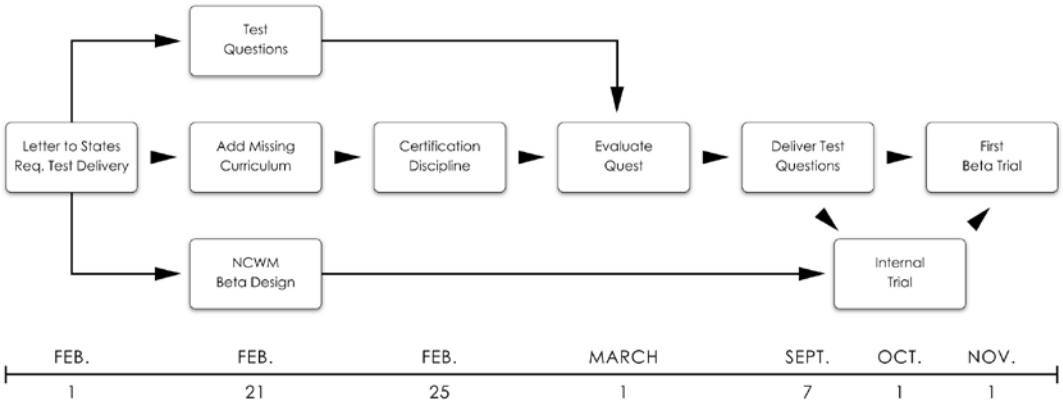
The Central Weights and Measures Association (CWMA) PDC Committee at their 2008 fall meeting proposed changing the name of the program to the National Certification Program. They further made recommendations regarding the creation of a standard like HB 130 or HB 44 that might be the mechanism to document 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 retail motor fuel devices (RMFDs), small capacity Class III scales, package checking, and VTMs. See Item 401-4 for details of the proposed certification program. The plan below shows action items and target dates for the first certification area (tentatively RMFDs).



Discussion: The Committee received compliments on its work thus far and a suggestion 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.

At the 2009 Annual Meeting, the Committee formally changed the name of the program to the National Certification Program (NCP) to reflect that the program offers certification and not training.

The steps outlined in the timeline developed at the 2009 Interim Meeting are being implemented. The Board of Directors has contracted with an online testing company. The format of the test and the details of test-result reporting are being worked out. Development of test questions is slightly behind schedule. The guide to writing test questions required revision to accommodate the format needed for an online test. The anticipated beta testing for the retail motor fuel device (RMFD) curriculum will be ready for evaluation in November 2009. This item received no comments.

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.

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 Item 401-1 for timeline on completion.)

At the 2009 Annual Meeting the Committee reported it considers the curriculum segments to be the critical element of the certification program. They set the standards to which the candidate will be tested. The National Training Curriculum Outline is already available online on the NCWM website. The actual curricula for Segment 4.2 *Introduction to Device Control*, Segment 4.4 *Dynamic Liquid Measuring Systems – General*, and Segment 4.4.1 *Retail Motor Fuel Dispensers (RMFD)* will be posted as soon as possible. Using these three documents plus the table found on page PDC–8 of Publication 16, jurisdictions would be able to prepare their staff to take the RMFD test and/or evaluate the strengths and weakness of their training programs based upon those curricula. In addition, the Committee will be developing the segments for small capacity class III scales, package checking, and vehicle tank meters. These segments will be posted online as they are developed.

Discussion: The significance of the levels outlined in Appendix A was explained in response to a question from the floor. No other comments were received 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: The Committee is charged with the 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 are completed.

At the 2009 Annual Meeting the Committee reported that no action is being taken on this item while the Committee concentrates on curriculum development and the establishment of the certification program.

Discussion: No comments were heard 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).

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, *Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality* or HB 44, *Specifications, Tolerances and Other Technical Requirements for Weighing and Measuring Devices,* 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 Item 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 Item 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's 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 RMFDs 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 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

At the 2009 Interim Meetings, the AMC 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.

At the 2009 Annual Meeting, the Committee identified three pieces critical to the Certification Program:

- Standards as defined by the curriculum
- Certification Discipline - weighting of the curriculum segments (see example on page PDC-9)
- Evaluation of competence - the test

The first two steps are completed for the retail motor fuel devices (RMFDs) test, and the Committee is busy developing the actual test. The Committee asked State Directors for test questions and would like to thank California, New Hampshire, Massachusetts, New York, and the Central Weights and Measures Association for their assistance in providing questions. The questions must now be evaluated, assigned to the relevant curriculum segments, and formatted according to the requirements of the online testing company.

The first test on RMFDs will be a beta test. The purpose of the beta test is to introduce online testing procedures, to troubleshoot any possible difficulties, and to help the Committee evaluate test questions in terms of weighting them for difficulty and curriculum coverage. The initial plan is to require a passing score of 85 % on a two hour, 50-question test. In answer to the question from the floor on whether there would be a time-out function, the answer is "no." The test-taker must commit two hours to taking the test in one session. However, the results will be informational, and no certificates will be issued based upon the results of the beta test.

There was a question from the floor on whether it would be better to concentrate on core competencies rather than developing difficulty levels. The Committee responded that the overall objective is to develop an exam that challenges the test taker with reasonable and fair questions so that a passing score is truly indicative of competence in the respective discipline. The goal is not to have overly difficult questions but to have questions that cover the breadth of issues included in the curricula.

The look and feel of the first test were demonstrated at the open hearing by presenting attendees with samples of test questions. Typical questions will be a multiple choice, fill-in-the-blank, and situational questions where the answer is either "Yes" (if the device is in compliance as described) or a citation of the section of the handbook being violated (if the device is not in compliance in the situation described.)

A question was asked about the fees for the test. There will be no fee for the beta test. The Board will make the decision regarding the cost of testing, and whether the fees will vary for members vs. non-members, service people vs. regulatory personnel when the certification program is operational.

The Committee is working with the test company to develop a report that can be provided to both the test taker and a designated other such as the state certification coordinator or state director. The report would detail the score for each segment of the test as well as the over-all test score. The report will not identify specific questions that were missed within any given segment, nor will correct answers be provided.

The integrity of the test questions is going to be protected by blocking screen prints and copy functions during the administration of the test. A recommendation was made to have at least three versions of the test available to allow for retests. Randomizing the selection of test questions will ensure that no one takes the same test twice and eliminate the need for creating multiple versions of the same test.

Jurisdictions and service companies will be encouraged to participate in the beta test within the limits of participation set by the board. The Committee will make an announcement when the Committee is ready to accept volunteers for the beta test.

Although no certificates will be issued based upon the test results, the Committee feels that participating jurisdictions will benefit by being able to evaluate the success of their training programs, and by having the opportunity to familiarize their staff with the experience of online testing. The Committee will benefit by using the evaluation programs of the testing service to evaluate the difficulty and appropriateness of each test question as well as the overall effectiveness of the test and the testing process.

Interest was expressed from the floor in having state-specific testing. The Committee feels that questions on State Program Scope and Overview will necessarily be state-specific. However, that is a refinement that needs to be addressed by the Committee and the Board at a later date.

A comment was received from the floor that if the PDC Committee still needs additional questions, a request could be put out on the various NIST and NCWM list serves.

Finally, the Committee appreciates the many positive comments received on the progress of the Certification Program.

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

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.

At the 2009 NCWM Annual Meeting, technical sessions were presented on Investigative Techniques, Fuel Volatility, and on Diesel Emission Fluid (DEF). The Committee solicited the body for suggestions for next year's presentations.

Just prior to the 2009 Annual Meeting, the Committee sent a letter asking the Associate Membership Committee (AMC) for video equipment funding to record future technical presentations. The intention is to provide an online library.

Discussion: The AMC announced from the floor that they had approved the request for funding at their meeting.

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 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 and Consumer Services
WWMA	Dennis Ehrhart, Arizona Department of Weights and 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.

The Committee wants to make sure that regions remember to submit safety articles to the NCWM staff by the dates listed on page PDC-12 so that the articles can be included in the newsletter.

The Committee also urges people to continue to submit incident reports to their regional safety coordinators.

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.

All segments of the PDC publication will be posted online as they are developed. New pages within the NCWM website will be created for the curriculum disciplines and segments so that interested parties can easily find and utilize this material.

Guidelines for operation of the Certification Program still need to be developed and will be posted online when they are completed.

DISCUSSION: No comments were received on this item.

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 Weights & 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 been 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 statue 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.

Report of the National Type Evaluation Program (NTEP) Committee

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 report for consideration by the 94th National Conference on Weights and Measures (NCWM). This consists of the Interim Report presented in NCWM Publication 16 as amended in the Addendum Sheets issued during the Annual Meeting that was held July 12 - 16, 2009, in San Antonio, Texas. The Committee considered communications received prior to and during the 94th Annual Meeting that are noted in this report.

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 Committee's Interim Meeting Agenda. A voting item is indicated with a **"V"** after the item number or, if the item was part of the consent calendar, by the suffix "**VC**." An item marked with an **"I"** after the reference key number is an information item. 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. Table B lists the appendices to the report, and Table C provides a summary of the results of the voting on the Committee's items and the report in entirety.

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. Requirements that are proposed to be nonretroactive are printed in *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 they were submitted and may, therefore, contain references to inch-pound units.

Table A
Index to Reference Key Items

Reference Key Number		Title of Item	Page
500		**INTRODUCTION**	1
1.	I	Mutual Recognition Arrangement (MRA)	3
2.	I	Mutual Acceptance Arrangement (MAA)	3
3.	I	NTEP Participating Laboratories and Evaluations Reports	4
4.	I	NTETC Sector Reports	5
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	6
6.	I	Conformity Assessment Program	6
7.	I	NCWM Publication 14, NTEP Administrative Policy, Section S.1.c. (VCAP)	8
8.	V	NTEP Policy for Issuing Certificates of Conformance (CC) for Software	14

Table B
Appendices

Appendix	Title	Page
A	NTETC Grain Analyzer Sector Meeting Summary	A1
B	NTETC Measuring Sector Meeting Summary	B1
C	NTETC Weighing Sector Meeting Summary	C1
D	NTETC Software Sector Meeting Summary	D1
E	Verified Conformity Assessment Program (VCAP) FAQs	E1

Table C
Voting Results

Reference Key Number	House of State Representatives		House of Delegates		Results
	Yeas	Nays	Yeas	Nays	
Item 8	34	0	19	0	Passed

Table D
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]	UT	Utilizing Participant
DoMC	Declarations of Mutual Confidence	WD	Working Document[3]
IP	Issuing Participant		

[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 weighing labs agreed that expanding the MRA should be considered and Measurement Canada expressed willingness to consider a proposal from NCWM. The NTEP Administrator will ask for additional input during the 2009 meetings of the NTETC Weighing and Measuring Sectors.

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 the time 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) was held on June 17 – 19, 2009, in Berne, Switzerland. Major topics included whether to allow data from manufacturers' test laboratories (obtained under "unsupervised" conditions) as part of the MAA process, and whether to accept laboratories in three countries into the MAA program for OIML R 76 (nonautomatic weighing instruments) and OIML R 60 (load cells). While the manufacturers' test data issue was not resolved at the CPR meeting, a way of possibly moving forward was developed, which is to poll CPR members to better understand the minimum requirements they would have for assessing the impartiality of manufacturers' test labs (MTLs), as well as the minimum requirements that an MTL must meet so that those MTLs that were excluded would not have a basis for complaint. CPR members will also be polled on their view of a possible compromise, where a minimum requirement on "frequency of supervision" of an MTL could be established. The three countries that had applied for admission into the MAA were approved, which is anticipated to soon lead to a large increase in the number of OIML MAA Certificates that are issued. NCWM was represented at the CPR meeting by Jim Truex. John Barton and Charles Ehrlich of NIST also attended 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 ensure 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.

NTEP Administrator, Jim Truex, reported that incoming applications remain strong and all labs are busy. He reported there is no backlog concern for measuring devices but the brick and mortar weighing labs still report about a three-month backlog.

2009 NTEP Meetings Remaining:

• NTETC Grain Analyzer Sector	August 19 - 20, 2009	Kansas City, Missouri
• NTETC Weighing Sector	August 25 - 27, 2009	Columbus, Ohio
• NTETC Measuring Sector	October 2 - 3, 2009	Clearwater Beach, Florida

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 was 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
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100 Bureau Drive, Stop 2600
Gaithersburg, MD 20899-2600

Phone: (301) 975-2196
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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
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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 was 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
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100 Bureau Drive, Stop 2600
Gaithersburg, MD 20899-2600

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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 or Annual Meetings. 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."

During the Annual Meeting a decision was made to keep the timeline above for load cell manufacturers with NTEP certificates but to delay the timeline by six months for "private label" load cell certificate holders. The following timeline was developed.

NTEP VCAP Timeline – Load Cell Private Label Certificate Holders				
Jul 2008 - Dec 2008	**Jan 2009 - Jun 2010**	**Jun 2010 - Sept 2010**	**Jun 2010 - Nov 2010**	**Nov 2010**
Refine VCAP procedures	CC holders 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	Ensure 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.				

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**~~ **at one or more sites as required to verify compliance.**

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 <u>are limited</u> 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 <u>VCAP auditor</u>.

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. **Verification can also take place by testing of the finished device to verify that it is unchanged from 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., **Acceptable Quality Level** AQL or equivalent, or meet the minimum requirements as defined in ~~**Appendix A**~~**Section 4** of this document.

1.4.2. Devices shall be **selected and** 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 versions 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~~**3**. 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~~**4**. 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 Number	2007 NAICS, U.S. Code	2007 North American Industry Classification 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**~~**a completed "Systems Audit Checklist"** to NCWM.~~**, as defined in the VCAP Administrative Policy, Section S.1.c. This report**~~**Submitted documents** must contain a clear statement of compliance as a result of the VCAP audit.

3. NCWM Responsibilities:

3.1. **For new certificate holders, E**~~**e**~~nsure that VCAP certification has been ~~**met**~~**completed,** within a one year cycle of **the first** maintenance fee, **but not to exceed 18 months** (example: if ~~**VCAP**~~**NTEP** certified in July **2011, VCAP** certification would be required by November ~~**of the following year**~~ **2012).**

~~**3.2. Verify that new customer/new certificate have process capability audit successfully completed prior to receiving certificate from NTEP.**~~

3.~~3~~**2**. 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~~**3**. 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**, which could be one or more sites**.

At the 2009 Annual Meeting the Committee agreed with suggestions to change several sections of NCWM Publication 14, NTEP Administrative Policy, Section S.1.3., VCAP procedures. Please take note that this replaces early versions of the VCAP requirements distributed by NCWM and contained in Publications 15 and 16. The Introduction, Sections 1.2.3., 1.4.1., 1.4.2., 2.5., 3.1. and the Definition were all amended. Sections 1.16.3. and 3.2. were deleted from previous documents and subsequent sections were renumbered. The text above indicates the changes made to the version shown in NCWM Pub 16.

8. V NTEP Policy for Issuing Certificates of Conformance (CC) for Software

Source: NTETC Software Sector

(This item was adopted.)

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 standalone 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

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Appendix A

National Type Evaluation Technical Committee
Grain Analyzer Sector

August 20, 2008 – Kansas City, Missouri
Meeting Summary

Agenda Items **Page**

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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
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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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1135 M Street, Ste. 110
Lincoln, NE 68508
Phone: (402) 434-4880
Fax: (402) 434-4878
Website: http://www.ncwm.net

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Don Onwiler
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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 through 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 through 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 2001and 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	a) No less than 8 samples should come from the lowest two-thirds of the 6 % moisture range. b) No less than 2 samples should come from the highest one-third of the 6 % moisture range. c) Samples should represent a distribution of test weights per Bushel (TW) that minimizes the correlation between TW and moisture.
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:

$$SD = \sqrt{\frac{\sum_{i=1}^{n}\sum_{j=1}^{3}(P_{ij} - \overline{P}_i)^2}{2n}}$$

where,

P_{ij} = predicted test weight per bushel for sample *i* and replicate *j*

$\overline{P}_i$ = 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:

$$SDD = \sqrt{\frac{\sum_{i=1}^{n}(d_i - \overline{d})^2}{n-1}}$$

where,

$d_i = \overline{P}_{1i} - \overline{P}_{2i}$

$\overline{P}_{1i}$ = average of three replicates for sample *i* on instrument 1

$\overline{P}_{2i}$ = average of three replicates for sample *i* on instrument 2

$\overline{d}$ = 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 % 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 %.

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.

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, DICKEY-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[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.

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.

*[**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 January 24, 2008), 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	jim.truex@ncwm.net
G. Diane Lee	NIST Technical Advisor	diane.lee@nist.gov
Jack Barber	Technical Advisor	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	08/08 GMM Sector Agenda Item 7
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	08/08 GMM Sector Agenda Item 8
Appendix C	Amend to add additional data fields for TW data and to update instructions for submitting data to reflect current practice.	GMM-41	08/08 GMM Sector Agenda Item 9
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	08/08 Grain Moisture Meter Sector Agenda Item 10

Appendix B

National Type Evaluation Technical Committee
Measuring Sector

October 3 - 4, 2008 – Atlanta, Georgia
Annual Meeting Summary

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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 CO_2 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 NH_3 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 NH_3 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 NH_3 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 manufacture 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 meetings. 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 materials 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 (Liquid 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.):

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 automatically disables the access, including external and remote access, to the calibration and configuration mode, or

(b) The ***calibration and configuration adjustments, including external and remote access, are protected by an approved audit trail, 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)

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 Wotthlie 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 CO_2**

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 CO_2 in order to guide correct certification for liquid CO_2. Categorizing liquid CO_2 in the family of cryogenic products was considered, but the typical temperature of liquid CO_2 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 CO_2 as a compressed liquid and to increase the maximum density for compressed liquids to 1.1 to include the typical density of liquid CO_2.

Discussion: Marc Buttler summarized the history of the issue, noting that there is currently nothing in the Product Families Table to address CO_2. 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 CO_2 and Dick had suggested that it be addressed as a compressed liquid. Marc noted that CO_2 exists at temperatures well above the threshold specified in NIST Handbook 44 for "cryogenics," citing typical temperature ranges of –50 ºC to –30 ºC. The Sector discussed typical temperature and pressure ranges for liquid CO_2 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 CO_2 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 CO_2 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 NH_3 and considered how this might impact the inclusion of CO_2 in an existing product family. If CO_2 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 CO_2. Will Wotthlie pointed out that CO_2 has not previously been included in the Product Families Table and suggested an alternative might be to create a separate category for CO_2 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 CO_2 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 CO_2.

Conclusion: The Sector agreed to table the issue until more data is available to suggest the best approach to use for including CO_2 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 Table 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.

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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 ºF) Centipoises/Centistokes**	**Specific Gravity (60 ºF)**
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 JP8	1.82 cps	0.76
	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.X.X. Product Families and Typical Product Characteristics			
Product Group	**Liquid Name**	**Viscosity (60 ºF) Centipoises/Centistokes**	**Specific Gravity (60 ºF)**
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
	Guardsman		1.12
	Harness		1.11

Table X.X.X. Product Families and Typical Product Characteristics			
Product Group	**Liquid Name**	**Viscosity (60 ºF) Centipoises/Centistokes**	**Specific Gravity (60 ºF)**
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~~		

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Appendix 2 – Attachment #2 from 2008 Measuring Sector Agenda

Test Requirements for Product Families

Table X.X.X. Test Requirements for Product Families	
Product Family	**Flowmeter Test Requirements**
Normal Liquids	**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 ºC);** **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** **Mass Flowmeters – Use Test B** **Positive Displacement Flowmeters – Use Test C** **Turbine Flowmeters – Use Test E** **Other Flowmeter Types – Use Test A**
Heated Products (above 50 °C)	**Magnetic Flowmeters – Use Test F** **Mass Flowmeters – Use Test D** **Positive Displacement Flowmeters – Use Test D** **Other Flowmeter Types – Use Test A**
Compressed Liquids	**Mass Flowmeters – Use Test D** **Positive Displacement Flowmeters – Use Test D** **Turbine flowmeters – Use Test E** **Other Flowmeter Types – Use Test A**
Cryogenic Liquids and Liquefied Natural Gas	**Mass Flowmeters – Use Test D** **Turbine flowmeters – Use Test D** **Other Flowmeter Types – Use Test A**
Compressed Gases	**Mass Flowmeters – Use Test D** **Other Flowmeter Types – Use Test A** **Note: CNG is only included in Section 3.37. Mass Flow Meters of Handbook 44.**

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.~~2~~1. 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**~~**Meters** ~~**(Test C unless otherwise noted)**~~	**Turbine Meters** ~~**Product Family & Test Requirements (Test A unless otherwise noted)**~~
Test B Normal Liquids Includes the following for Mass Flow Meters: Fuels, Lubricants, Industrial and Food-Grade Liquid Oils, Solvents General, Solvents Chlorinated, Alcohols, Glycols, and Water Mixes Thereof, Water,	**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)*	**Test C** Fuels, Lubricants, Industrial and Food-Grade Liquid Oils	**Test E** ~~**permitted**~~ Fuels, Lubricants, Industrial and Food-Grade Liquid Oils
		Test C Solvents General	**Test E** ~~**permitted**~~ Solvents General
		Test C Solvents Chlorinated	**Test A** Solvents Chlorinated
		Test C Alcohols, Glycols, & Water Mixes Thereof	**Test E** ~~**permitted**~~ Alcohols, Glycols, & Water Mixes Thereof
	Test D Water (Tap, Potable & Nonpotable), ~~Water Mixes of Alcohols & Glycols,~~		
		Test D ~~**permitted**~~ Water	**Test D** ~~**permitted**~~ Water

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~~ Meters ~~(Test C unless otherwise noted)~~	Turbine Meters ~~Product Family & Test Requirements (Test A unless otherwise noted)~~
(continued) Juices, Beverages, Clear Liquid Fertilizers, Crop Chemicals, Flowables Suspensions Fertilizers, Liquid Feeds, Chemicals	(continued) Glycols, and Water Mixes Thereof, Juices, Beverages, Clear Liquid Fertilizers, Crop Chemicals, Suspensions Fertilizers, Liquid Feeds, Chemicals	**Test C** Clear Liquid Fertilizers	**Test A** Clear Liquid Fertilizers
		Test C Crop Chemicals 1	**Test A** Crop Chemicals 1
		Test C Crop Chemicals 2	**Test A** Crop Chemicals 2
		Test C Flowables	**Test A** Flowables
		Test C Crop Chemicals 3	**Test A** Crop Chemicals 3
		Test C Crop Chemicals 4	**Test A** Crop Chemicals 4
		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 **Note:** If a meter is certified for anhydrous ammonia the same meter type may also be certified for LPG without further testing.	**Test A** NH_3 Anhydrous Ammonia **Note:** If a meter is certified for anhydrous ammonia the same meter type may also be certified for LPG without further testing.
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~~Meters ~~(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/m^3 (or 998 kg/m^3)

[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 **cP**~~eps~~	0.72
	Distillate		
	Gasoline	0.28 **cP**~~eps~~	0.72
	Fuel Oil (#1, #2, #3, #4)	8 to 88 **cP**~~cPs.~~	0.9
	Kerosene	1.94 **cP**~~eps~~	0.75
	Light Oil	13.47 **cP**~~eps~~	0.86
	Spindle Oil		
	Lubricating Oils	20 to 1000 **cP**~~cPs.~~	0.80 to 0.90
	SAE Grades	192 to 3626 **cP**~~eps~~	0.9
	Bunker Oil	11 200 **cP**~~eps~~	0.99
	6 Oil (#5, #6)	66 to 13 000 **cP**~~cPs.~~	0.9
	Crude Oil	3 to 1783 **cP**~~eps~~	0.79 to 0.97
	Asphalt	100 to 5000 **cP**~~cPs~~	
	Vegetable Oil	133 **cP**~~eps~~	0.92
	Biodiesel above B20	10.12 **cP**~~eps~~	0.86
	Avgas	1.5 to 6 **cP**~~cPs.~~	
	Jet A	1.5 to 6 **cP**~~cPs.~~	
	Jet A-1	1.36 **cP**~~eps~~	0.76
	Jet B	1.5 to 6 **cP**~~cPs.~~	
	JP4	1.02 **cP**~~eps~~	0.76
	JP5	1.94 **cP**~~eps~~	0.76
	JP7 JP8	1.82 **cP**~~eps~~	0.76
	Cooking Oils	9.93 **cP**~~eps~~	0.92
	Sunflower Oil	90.1 **cP**~~eps~~	0.93
	Soy Oil	90.6 **cP**~~eps~~	0.93
	Peanut Oil	11 **cP**~~cPs.~~ to 110 **cP**~~cPs~~	0.9 to 1.0
	Olive Oil	116.8 **cP**~~eps~~	0.92
	Corn Oil	4.0 **cP**~~eps~~	0.91
Normal Liquids, Solvents General	Acetates	0.44 **cP**~~eps~~	0.93
	Acetone	0.34 **cP**~~eps~~	0.8
	Esters		
	Ethylacetate	1.36 **cP**~~eps~~	0.96
	Hexane	0.34 **cP**~~eps~~	0.66
	MEK	0.45 **cP**~~eps~~	0.81
	Toluene	0.62 **cP**~~eps~~	0.87
	Xylene	0.86 **cP**~~eps~~	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 **cP**~~eps~~	1.6
	Methylene-Chloride	0.46 **cP**~~eps~~	1.34
	Perchloro-Ethylene	1.0	1.6
	Trichloro-Ethylene	0.6 **cP**~~eps~~	1.47
Normal Liquids, Pure Alcohols, Alcohols, Glycols & Water Mixes Thereof	Ethanol	1.29 **cP**~~eps~~	0.79
	Methanol	0.64 **cP**~~eps~~	0.80
	Butanol	3.34 **cP**~~eps~~	0.81
	Isopropyl	2.78 **cP**~~eps~~	0.79
	Isobutyl	4.54 **cP**~~eps~~	0.81
	Ethylene glycol	25.5 **cP**~~eps~~	1.19
	Propylene glycol	54 **cP**~~eps~~	1.04
Normal Liquids, Water	Tap Water	1.0 **cP**~~eps~~	1.0
	Deionized	1.0 **cP**~~eps~~	1.0
	Demineralized	1.0 **cP**~~eps~~	1.0
	Potable	1.0 **cP**~~eps~~	1.0
	Nonpotable	1.0 **cP**~~eps~~	1.0
Normal Liquids, Clear Liquid Fertilizers	Nitrogen Solution		
	28 %, 30 % or 32 %		
	20 % Aqua-Ammonia		
	Urea	1.0 **cP**~~eps~~	1.89
	Ammonia Nitrate	11.22 **cP**~~eps~~	1.16 to 1.37
	N-P-K solutions		
	10-34-0	48 **cP**~~eps~~	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 **cP**~~eps~~	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 **cP**~~cps~~	1.25
	Molasses plus Phos Acid and/or Urea (Treacle)	2882 **cP**~~cps~~	1.1 to 1.3
Normal Liquids, Chemicals	Sulfuric Acid	1.49 **cP**~~cps~~	1.83
	Hydrochloric Acid	1.0 to 0.80 **cP**~~cps~~	1.1
	Phosphoric Acid	161 **cP**~~cps~~	1.87
	Asphalt	100 to 5000 **cP**~~cPs~~	
Compressed Liquids, Fuels and Refrigerants, NH_3	LPG		
	Propane	0.098 **cP**~~cps~~	0.504
	Butane	0.19 **cP**~~cps~~	0.595
	Ethane		
	Freon 11	0.313 **cP**~~cps~~	1.49
	Freon 12	0.359 **cP**~~cps~~	1.33
	Freon 22	1.99 **cP**~~cps~~	1.37
	Anhydrous Ammonia	0.188 **cP**~~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 **cP**~~cps~~	0.66
	Liquefied Nitrogen	1.07 **cP**~~cps~~	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 NH_3 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 ºC.
- 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.

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Appendix 4 – 2008 Measuring Sector Meeting Attendees

'08 Measuring Sector Meeting Attendees

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'08 Measuring Sector Meeting Attendees

DoubleTree Club Hotel Atlanta – Atlanta, Georgia October 3 - 4

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Appendix C

National Type Evaluation Technical Committee
Weighing Sector

September 23 - 25, 2008 – St. Louis, Missouri
Meeting Summary

Agenda Items

Load Cell Items C3

1. Publication 14 Force Transducer (Load Cell) Family and Selection Criteria C3
2. Load Cell Creep and Creep Tests and (Pub 14) C4
   - 2.(a) Pub 14 Force Transducers Table 5. Loading Times, Reduction Factors, and Force Transducers Section II, Item 5 ..... C4
   - 2.(b) Pub 14 Force Transducers Section II, Item 3 and Table 5. Loading Times C5

Carryover Items C6

3. In-Motion Railway Track Scale C6
4. Recommended Changes to Publication 14 Based on Actions at the 2008 NCWM Annual Meeting C6
   - 4.(a) G-A.1. and Appendix D – Definition of Equipment C7
   - 4.(b) Scales Code S.1.1.1.(b) Digital Indicating Elements C7
   - 4.(c) Scales Code S.1.2.1., S.2.3., T.N.2.1., and AWS Code S.1.1.1. ..... C7
   - 4.(d) Scales Code S.2.1.5. Initial Zero-Setting Mechanism C7
   - 4.(e) Scales Code S.2.4. Level-Indicating Means and S.2.4.1. Vehicle On-Board Weighing Systems C8
5. Add New and Amended Tare Definitions and Tare Requirements C8
6. Minimum Size of Weight and Units Indications C8
7. Hopper Scale Design Parameters – Technical Policy C9
8. Method of Sealing – Setup and Verification of Calibration/Configuration Access C10
9. S.1.1.(c) Zero Indication (Sleep/Screen Saver/Power Save Modes) C11
10. Vehicle and Railway Track Scales C11

New Items C17

11.(a) Publication 14 Clarification on Section 66.(c) Permanence Tests C17
11.(b) Publication 14 Clarification on Section 66.(c) Waiving of Permanence Tests C17
12. Correction to Scale Tickets C18
13. Stored Tare for "Weigh-in/Weigh-out" Applications C19
14. Money Values in Other Than 1-Cent Intervals C19
15. Suitability of Pressure Sensitive Security Seals C19
16. Identification of ECRS C20
17. Automatic Zero-Tracking vs. Automatic Zero-Setting C20
18. Capacity – Markings and Display C23
    - Part 1 – Capacity x Division, Multiple Units of Measure C24
    - Part 2 – Minimum Piece Weight and Sample Size C24

Next Sector Meeting C25

Table B
Appendices

Appendix	Title	Page
A – Recommendations for Amendments to Publication 14		**C27**
Agenda Item 1.	Force Transducer (Load Cell) Family and Selection Criteria	C27
Agenda Item 2.	Force Transducer	C28
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.	C29
Agenda Item 4.(e)	Amend Level-Indicating Means	C30
Agenda Item 8.	Method of Sealing	C31
Agenda Item 9.	S.1.1.(c) Zero Indication (Sleep/Screen Saver/Power Save Modes)	C31
Agenda Item 11.(a)	Clarification on Section 66.(c) Performance and Permanence Tests	C36
Agenda Item 11.(b)	Clarification of Section 66.(c) Waiving of Permanence Tests	C37
Agenda Item 13.	Stored Tare for "Weigh-in/Weigh-out" Applications	C37
Agenda Item 14.	Money Values in Other Than 1-Cent Intervals	C38
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Agenda Item 18.	Capacity – Markings and Display: *Part 2 (MSS and MPW):*	C39
B – Attachments		**C41**
Attachment for Agenda Item 2		C41
Attachment for Agenda Item 17		C48
C – Attendees		**C50**

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 Fruechte 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 x mpe and mpe is defined as p_{lc} x 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) x (0.7) x (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) x 1.5 v. Therefore the tolerance for creep is 1.5 x 1.0 = 1.5 v, or 1.5 x 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 Forte 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 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 Item 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 Item 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 Item 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 Item 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 Item 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 *Weights and Measures 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) tend 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;
- nmax;
- lowest input signal, μV/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, emin;
- 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 Publication 14 in 2004 in 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 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 cannot 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 Ad hoc 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 Ad hoc 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 ft. 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 Railcarts and Test Weight Railcars. 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 7 ft (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 if 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-axles on steel wheels, with the following design characteristics:

a. All metal construction.
b. Loading points must not exceed 7 ft (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 if 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 (½ 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 ft 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 % of the loads must be above 20 % of scale capacity; and
- 50 % of the loads must be above 50 % 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 tests 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 labs 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-by-side vehicle scale CCs and they have never questioned permanence test on a "new design." It the case of the side-by-side with a CC, this manufacturer believes that the permanence test should not 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 applications. The labs agreed that the scale's first weight, stored in a "temporary memory" that is automatically deleted from memory after the net weight is determined, is not considered 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 the language from the NTEP lab meeting did not need additional development (except to change the word "tare" to "weighment" 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 manufacturers 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 barcode 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 that 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 of 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-tacking 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 division 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.

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 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 capacities by division at one time, (like on a sticker) no matter what unit of weight is 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 weighment, 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.

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Appendix A – Recommendations for Amendments to Publication 14[1]

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 Test[1]

~~***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.

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1. The manufacturer must provide the following information with a request for evaluation:

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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.

[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	100 000 kg	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. See additional exceptions in DES Sections 31. and 32. for multi-interval and multiple range scales.	Yes ☐ No ☐ N/A ☐

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)
– 4 kg	Tare Weight (WSR1 d = 2 kg)	– 0.06 lb	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:

net = gross – 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:	Displayed and/or Printed		
WR1 = 0 - 4 kg x 2 g		Preferred	Acceptable
WR2 = 4 - 10 kg x 5 g	Gross	13.380 kg	13.380 kg
WR3 = 10 - 20 kg x 10 g	Tare	-3.814 kg	-3.810* kg
	Net	9.566 kg	9.570 kg

* 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 ☐ No ☐ N/A ☐
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 ☐ No ☐ N/A ☐
56.4.	Wheel-load weighing and axle-load scales must weigh accurately when placed out-of-level by 5 percent* ~~(approximately 3 degrees)~~.	Yes ☐ No ☐ N/A ☐

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 ***not listed*** on the CC (enabled/disabled)	. . . Screen Saver/Sleep and/or Power Save mode ***listed*** on the CC (enabled/disabled)
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 . . .*	

11.8.4. Does the scale or indicating element have a: ~~**Yes ☐ No ☐ N/A ☐**~~

- ☐ screen saver/sleep ~~or~~ mode, or
- ☐ power save mode?

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:

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.

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.

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				
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	***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.
		Period of time with a non changing load on the scale	Deliberate operator action (remove load off scale and rezero if necessary)	***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.
Power Save	Off/Blank	Period of time with no activity on the LRE (loaded or unloaded)	**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.)	***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.**
				Accurate weights are ~~displayed~~ indicated or recorded 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.**

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

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	***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.
		Period of time with a non changing load on the scale	Deliberate operator action (remove load off scale and rezero if necessary)	***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.
Power Save	Off/Blank	Period of time with no activity on the LRE (loaded or unloaded)	**Return the scale to a zero-balance indication with the automatic zero tracking or semi-automatic zero-setting mechanisms**, or	***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.**

			other deliberate operator action (e.g., turn on the scale, etc.)	***Accurate weights are~~displayed~~ indicated or recorded*** 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.**

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 a stored weighment.**	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."

10.2~~1~~ ***(Renumber remaining sections)***

Agenda Item 18. Capacity – Markings and Display: ***Part 1 (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.**

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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 underlined 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.

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.

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).

1. 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.

   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.

   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.

   The following is an overview of possible combinations at a combined (un)loading and stabilization time of 40 seconds:

(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 in 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 Multipler based upon a time constant relationship:

Where: $M = 1.65 \in^{-T}$

M = tolerance multipler $\quad T = \dfrac{load\,time}{Table\,5\,time}$

$\in$ = 2.7182818 = 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	1.65
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: $** i = \frac{E}{R} \in^{\frac{-t}{RC}}$

i = current E = voltage C = capacitance R = resistance t = time

RC = time constant $\in$ = 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 nth 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 k lb 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**
[redacted]	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	
[redacted]	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**		
[redacted]	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.	2		
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.				
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. ***Please include your recommended changes with your ballot response.***	2		
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	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 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. 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. - 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	Recommend including the following note to clarify the differences between automatic zero-tracking and automatic zero-setting in the definitions stating: **<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>** - **<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 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. 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. 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.			

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

Carryover Items **D2**
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1.b. NCWM/NTEP Policies – Issuing Certificates of Conformances (CC) for Software D2
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New Items **D19**
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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.

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~~/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 to be 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:

- The CC would have a 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.

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** ☐ **No** ☐ **N/A** ☐
	cannot be modified or uploaded by any means after securing/verification		**Yes** ☐ **No** ☐ **N/A** ☐
	Note: *It is acceptable to break the "seal" and load new software; audit trail is also a sufficient seal.*		
	The software documentation contains:		
		description of the (all) metrologically significant functions (OIML states that there shall be no undocumented functions)	**Yes** ☐ **No** ☐ **N/A** ☐
		description of the securing means (evidence of an intervention)	**Yes** ☐ **No** ☐ **N/A** ☐
		software identification	**Yes** ☐ **No** ☐ **N/A** ☐
		description of how to check the actual software identification	**Yes** ☐ **No** ☐ **N/A** ☐
	The software identification is:		
		clearly assigned to the metrologically significant software and functions	**Yes** ☐ **No** ☐ **N/A** ☐
		provided by the device as documented	**Yes** ☐ **No** ☐ **N/A** ☐
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 *metrologically significant* software is:		
		documented with all relevant (see below for list of documents) information	**Yes** ☐ **No** ☐ **N/A** ☐
		protected against accidental or intentional changes	**Yes** ☐ **No** ☐ **N/A** ☐

	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** ☐ **No** ☐ **N/A** ☐
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** ☐ **No** ☐ **N/A** ☐
	Check whether the manufacturer has submitted a written declaration of the completeness of the set of commands		**Yes** ☐ **No** ☐ **N/A** ☐
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** ☐ **No** ☐ **N/A** ☐
	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** ☐ **No** ☐ **N/A** ☐
Software interface(s)			
	Verify the manufacturer has documented:		
		the program modules of the metrologically significant software are defined and separated	**Yes** ☐ **No** ☐ **N/A** ☐
		the protective software interface itself is part of the metrologically significant software	**Yes** ☐ **No** ☐ **N/A** ☐
		the *functions* of the metrologically significant software that can be accessed via the protective software interface	**Yes** ☐ **No** ☐ **N/A** ☐
		the *parameters* that may be exchanged via the protective software interface are defined	**Yes** ☐ **No** ☐ **N/A** ☐
		the description of the functions and parameters are conclusive and complete	**Yes** ☐ **No** ☐ **N/A** ☐
		there are software interface instructions for the third party (external) application programmer	**Yes** ☐ **No** ☐ **N/A** ☐

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** ☐ **No** ☐ **N/A** ☐
	The software identification:		
		covers all program modules of the metrologically significant software and the type-specific parameters at runtime of the instrument	**Yes** ☐ **No** ☐ **N/A** ☐
		is easily provided by the instrument	**Yes** ☐ **No** ☐ **N/A** ☐
		can be compared with the reference identification fixed at type approval	**Yes** ☐ **No** ☐ **N/A** ☐
	Spot check whether the ~~checksums (signatures) are generated and~~ means of identifying the software works as documented		**Yes** ☐ **No** ☐ **N/A** ☐

	~~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~~ ~~An entry is generated for each software update.~~ ~~The software log/audit trail shall contain the following information:~~ ~~• notification of the update procedure,~~ ~~• software identification of the installed version,~~ ~~• time stamp of the event,~~ ~~• identification of the downloading party.~~ 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.	**Yes □ No □ N/A □**

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 stricken 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 a 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 ☐ No ☐~~			
		~~DSD realised with programmable/loadable software (examine software acc. to G.1)~~ ~~Yes ☐ No ☐~~			
		~~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.

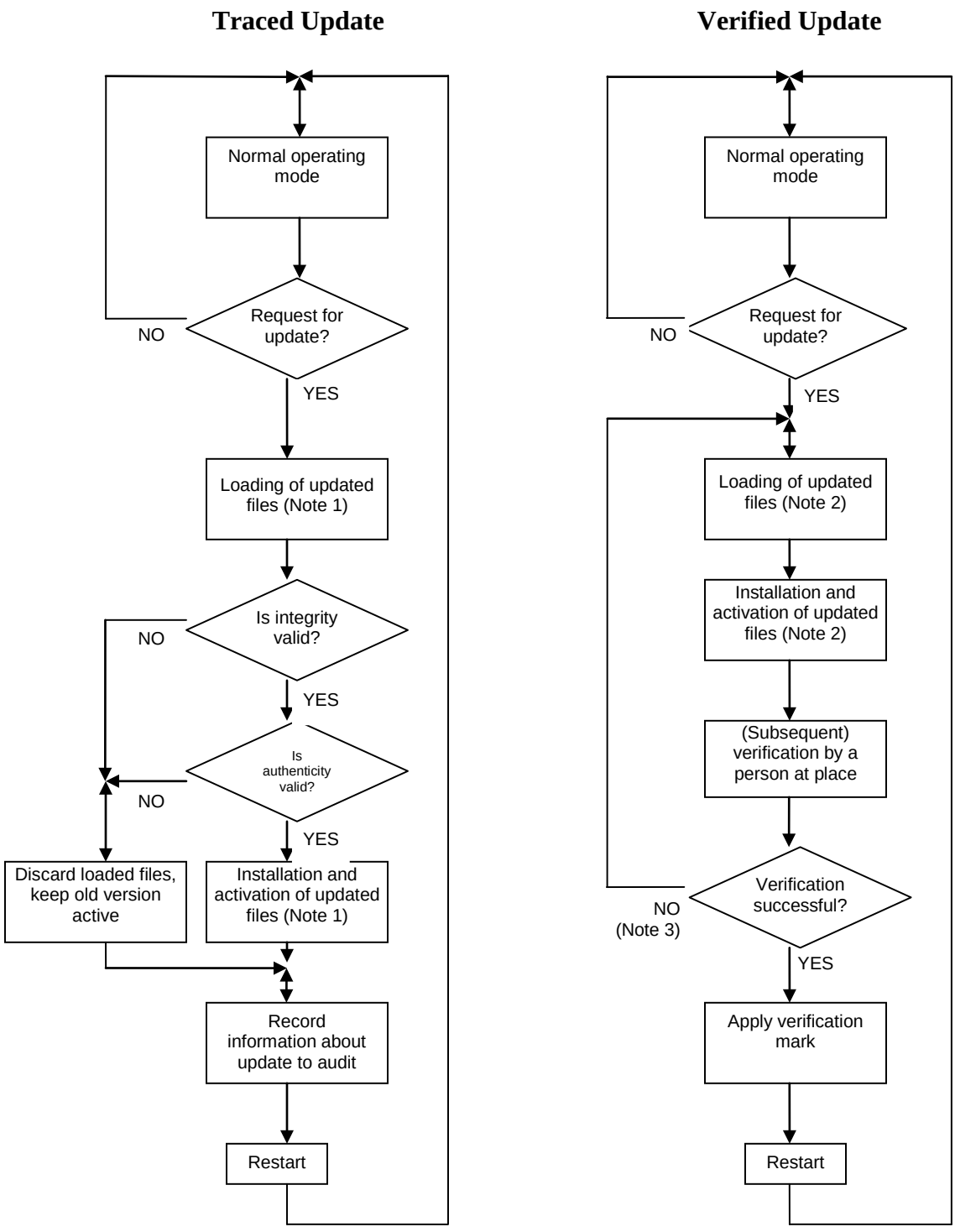


Figure 5-1: Software update procedures

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 is 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.

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, RFI/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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Report of the Nominating Committee

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 REGION: 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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July 12-16, 2009 / San Antonio, Texas

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