Appendix B

National Type Evaluation Technical Committee
Measuring Sector

October 21 - 22, 2005 – Nashville, Tennesee
Meeting Summary

National Type Evaluation Technical Committee

1. Recommendations to Update to NCWM Publication 14 to Reflect Changes to NIST Handbook 44

Source: NIST/WMD

Background: At its Annual Meeting in July 2005, the National Conference on Weights and Measures (NCWM) adopted the following new or modified requirements that will be reflected in the 2006 Edition of NIST Handbook 44 and NCWM Publication 14. These items are part of the agenda to inform the Measuring Sector of the NCWM actions and to 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 and Test Procedures for Retail Motor-Fuel Dispensers
Code Reference: S.1.6.1. Indication of Delivery: Electronic Devices

Code Reference: S.1.6.1. Indication of Delivery		
7.25.	Retail devices shall automatically show their initial zero condition and amount delivered up to the nominal capacity of the device. **For electronic devices manufactured on or after January 1, 2006, the measurement, indication of delivered quantity, and the indication of total sales price shall be inhibited until the fueling position reaches conditions necessary to ensure the delivery starts at zero.**	**Yes □ No □ N/A □**
7.26.	~~The initial indication on digital indicators may be "suppressed" or not indicated up to a maximum of 0.03 liter or 0.009 gallon.~~ **For electronic devices manufactured prior to January 1, 2006, the first 0.03 L (or 0.009 gal) of a delivery and its associated total sales price need not be indicated.**	**Yes □ No □ N/A □**

Discussion/Conclusion: The Sector reviewed the proposal and agreed that the change was consistent with the requirements in NIST Handbook 44; however, a manufacturer stated that a test method was needed to provide uniform evaluations by various NTEP laboratories of the ability of a device to meet the requirement. That manufacturer and an NTEP Laboratory official agreed to develop a test method for review by the Sector on the second day of the meeting. The Sector reviewed the proposed method and agreed to add the following test method immediately following Section 7.26 currently on page LMD 26 of NCWM Publication 14 and to forward the amended proposal to the NTEP Committee as written for consideration.

Test Method:

Step	Description		
1	Set unit price on dispenser.		
2	Pressurize system.		
3	Turn the dispenser off		
4	Create void in dispenser hydraulics by opening the fuel nozzle to provide a zero internal pressure. Then close the fuel nozzle.		
5	Activate the dispenser and let the system reset to 8's, blanks then 0's.		
6	With the nozzle closed, watch the main sales display for advancement of total sales and total volume for at least 5 seconds and no more than 10 seconds.		
7	No advancement constitutes a passing test.		
8	Advancement constitutes a failed test.		
9	Replace the fuel nozzle and turn off the dispenser.		
10	Repeat this test 2 more times. Note: The evaluator must be aware that a time delay for this feature may be incorporated		
11	Device passes test	Yes □	No □

B. Checklist and Test Procedures for Specific Criteria for Vehicle Tank Meters
Code Reference S.1.4.1. Display of Unit Price

Code Reference: S.1.4.1. Display of Unit Price		
25.1.	Means must be provided to display the unit price at which the device is set to compute in proximity to the total computed price display. **(In a device of the computing type, means shall be provided for displaying, in a manner clear to the operator and an observer, the unit price at which the device is set to compute. The unit price is not required to be displayed continuously.)**	**Yes □ No □ N/A □**
25.2.	The unit price shall be expressed in dollars and decimals of dollars using a dollar sign. A common fraction shall not appear in the unit price (e.g., $1.299 not $1.29 9/10).	**Yes □ No □ N/A □**

Discussion/Conclusion: No comments were received on Agenda Item B; therefore, the proposal will be forwarded to the NTEP Committee as written for consideration.

C. Checklist and Test Procedures for Specific Criteria for Vehicle-Tank Meters
Code Reference S.2.4. Zero Set-Back Interlock, Vehicle-Tank Meters, Electronic

Code Reference: S.2.4. Zero Set-Back Interlock, Vehicle-Tank Meters, Electronic		
26.4.	**Except for vehicle-mounted metering systems used solely for the delivery of aviation fuel, a device shall be so constructed that after individual or multiple deliveries at one location have been completed, an automatic interlock system shall engage to prevent a subsequent delivery until the indicating and, if equipped, recording elements have been returned to their zero position. For individual deliveries, if there is no product flow for 3 minutes, the transaction must be completed before additional product flow is allowed. The 3-minute timeout shall be a sealable feature on an indicator.**	**Yes □ No □ N/A □**

Discussion/Conclusion: No comments were received on Agenda Item C; therefore, the proposal will be forwarded to the NTEP Committee as written for consideration.

D. Field Evaluation and Permanence Test for Vehicle Tank Meters
Code Reference: N.4.2. Special Tests (except Milk-Measuring Systems), N.4.5. Product Depletion Test, and T.4. Product Depletion Test

Product Depletion Test

Before vehicle-mounted applications are listed on an NTEP Certificate of Conformance, the meter must pass a product depletion test. This policy applies to all meter technologies (e.g., Coriolis mass flow meters, turbine meters, and positive displacement meters) even if the meter will never be installed on trucks with more than a single compartment. The permanence test still applies ~~to~~ includeing the throughput and ~~with~~ a duration of a least 20 days. Ideally, this test should be performed with a multiple-compartment vehicle; however, a single-compartment vehicle may be used to simulate the product depletion test by running the tank empty~~, if a multiple-compartment vehicle is unavailable, a single-compartment vehicle may be used~~ to simulate the product depletion ~~test by running the tank empty~~.

Purpose: A product depletion test verifies the proper operation of air elimination means when the storage tank for the product being measured is pumped dry. This test is necessary for meters that may drain a tank completely, such as a vehicle-tank meter.

Test Procedure:

For a multi-compartment tank:

Begin the test from a compartment (ideally the largest compartment) containing an amount of fuel equal to or less than one-half the nominal capacity of the prover being used. Operate the meter at the normal full flow rate until the compartment is empty. There are several methods for determining that the compartment is empty. There may be a significant change in the sound of the pump. ~~Someone may visually watch for~~ There may be visual evidence that the compartment ~~to~~ has run dry. The meter may stop entirely or may begin to move in jumps (pause, resume running, then pause, then run again.)

Continue the test until the meter indication stops entirely for at least 10 seconds. If the meter stops for 10 seconds or more, proceed to step 3. If the meter indication fails to stop entirely for a period of 10 seconds, continue to operate the system for 3 minutes.

Close the valve from the empty compartment, and, if top filling, close the nozzle or valve at the end of the delivery hose. Open the valve from another compartment containing the same product. Carefully open the valve at the end of the

delivery hose. Pockets of vapor or air may cause product to splash out of the prover. The test results may not be valid if product is splashed out of the prover. Appropriate eye protection is required, but caution is still necessary.

Continue delivering product at the normal full flow rate until the liquid level in the prover reaches the nominal capacity of the prover.

Close the delivery nozzle or valve, stop the meter, allow any foam to settle, then read the prover sight gauge as quickly as practical.

Compare the meter indication with the actual delivered volume in the prover.

Calculate the meter error, apply ~~special~~ **Product Depletion** test tolerance, and determine whether or not the meter error is acceptable.

Test Procedure:

For a single-compartment tank:

The test of a single-compartment tank is easier to accomplish if there is a quick-connect hose coupling between the compartment valve and the pump that supplies product to the meter. If the system does not have a quick-connect coupling between the compartment and the meter, an additional source of sufficient product at the test site is required.

Without a quick-connect coupling:

1. Begin the test with the compartment containing an amount of fuel equal to or less than one-half the nominal capacity of the prover being used. Operate the meter at the normal full flow rate until the supply tank is empty. There are several methods for determining that the tank is empty. There may be a significant change in the sound of the pump. Someone may visually watch for the tank to run dry. The meter may stop entirely or may begin to move in jumps (pause, resume running, then pause, then run again).

Continue the test until the meter indication stops entirely for at least 10 seconds. If the meter stops for at least 10 seconds, proceed to step 3. If the meter indication fails to stop entirely for at least 10 seconds, continue to operate the system for 3 minutes.

Close the compartment valve and the delivery nozzle or valve if top filling. Stop the pump and load sufficient product from the alternate source into the supply compartment for the meter being tested. Allow the product to stand in the compartment for a brief time to allow entrained vapor or air to escape.

Open the compartment valve and restart the pump without resetting the meter to zero. Carefully open the nozzle or valve at the end of the delivery hose. Pockets of vapor or air may cause product to splash out of the prover. The test results may not be valid if product is splashed out of the prover. Appropriate eye protection is required, but caution is still necessary.

Continue delivering product at the normal full flow rate until the liquid level in the prover reaches the nominal capacity of the prover.

Close the delivery nozzle or valve, stop the meter, allow any foam to settle, then read the prover sight gauge as quickly as practical.

Compare the meter indication with the actual delivered volume in the prover.

Calculate the meter error, apply ~~special~~ **Product Depletion** test tolerance, and determine whether or not the meter error is acceptable.

With a quick-connect coupling:

2. During a normal full flow test run, close the compartment valve at approximately one-half of the nominal prover capacity. Then slowly and carefully disconnect the quick-connect coupling allowing the pump to drain the supply line.
3. Continue the test until the meter indication stops entirely for at least 10 seconds. If the meter fails to stop entirely for at least 10 seconds, continue to operate the system for 3 minutes.

4. If the meter stops for at least 10 seconds or after 3 minutes, close the delivery nozzle or valve at the end of the delivery hose if top filling.
5. Reconnect the quick-connect coupling and open the compartment valve.
6. Carefully open the nozzle or valve at the end of the delivery hose. Pockets of vapor or air may cause product to splash out of the prover. The test results may not be valid if product is splashed out of the prover. Appropriate eye protection is required, but caution is still necessary.
7. Continue delivering product at the normal full flow rate until the liquid level in the prover reaches the prover's nominal capacity.
8. Close the delivery nozzle or valve, stop the meter, allow any foam to settle, then read the prover sight gauge as quickly as practical.
9. Compare the meter indication with the actual delivered volume in the prover.
10. Calculate the meter error, apply ~~special~~ **Product Depletion** test tolerance, and determine whether or not the meter error is acceptable.

Discussion/Conclusion: The Sector reviewed this item and agreed that the term "special test" should be changed to "product depletion test" throughout the Product Depletion Test procedure of Section "C" Field Evaluation and Permanence Test For Vehicle-Tank; Except for LPG, Cryogenic, and CO_2 Meters, on pages LMD 65 through LMD 68 in the 2005 Edition of NCWM Publication 14, to be consistent with NIST Handbook 44 Paragraphs N.4.5. and T.4. A manufacturer of aircraft refueling equipment suggested that the exception in N.4.5. for devices used exclusively for the delivery of aircraft fuel should be added to the checklist. The Sector agreed that the first paragraph of the Product Depletion Test should be modified as follows and the modified proposal be forwarded to the NTEP Committee for consideration:

Except for devices used exclusively for the delivery of aircraft fuel, ~~B~~before vehicle-mounted applications are listed on an NTEP Certificate of Conformance, the meter must pass a product depletion test. This policy applies to all meter technologies (e.g., Coriolis mass flow meters, turbine meters, positive displacement meters) even if the meter will never be installed on trucks with more than a single compartment. The permanence test still applies to include the throughput and with a duration of a least 20 days. Ideally, this test should be performed with a multiple-compartment vehicle; however, a single-compartment vehicle may be used to simulate the product depletion test by running the tank empty if a multiple-compartment vehicle is unavailable.

Carry-over Items

2. Product Family Tables for MAG Meters, Ultrasonic Meters, and Turbine Meters

Source: Turbine Meter Work Group

At the meeting this Agenda Item was combined with Agenda Item 4. (See Agenda Item 4 for the conclusion.)

3. Acceptable Symbols or Wording to Identify Unit Price, Total Price, and Quantity on a Retail Motor-Fuel Dispenser

Source: Maryland NTEP Laboratory

Background: At the June 2002 NTEP Laboratory Meeting, one of the participating laboratories requested guidance on acceptable symbols or wording to identify the unit price, total sale, and quantity delivered on a retail motor-fuel dispenser. The laboratories recommended the question be added to the 2002 Measuring Sector Agenda.

At the 2002 Sector Meeting, a work group was formed to address this issue. No input has been received from the work group assigned to develop this issue following the 2002 Sector Meeting.

At its 2004 Meeting, the Sector agreed the NTEP laboratories should develop a list of acceptable symbols at the next laboratory meeting.

Recommendation: The NTEP laboratories submitted to the Sector the following list of acceptable words and symbols for price and volume declarations on RMFDs for inclusion in Publication 14:

List of Price and Quantity Markings on RMFDs		
Total Sale	**Unit Price**	**Delivered Quantity**
Acceptable	**Acceptable**	**Acceptable**
Total Sale $ 000.00 (Preferred) **Total $ 000.00** **This Sale $ 000.00** **Purchase $ 000.00** **Total Purchase $ 000.00** **Sale $ 000.00**	**Price Per Gallon $ 0.000** **Price/Gallon $ 0.000** **$/Liter $0.000** **Price Per Unit $ 0.000** **Price/Unit $0.000** **Unit Price $0.000 (Preferred)** **$/Gal $0.000** **$/L $0.000**	**Gallons (Preferred)** **Gal** **Liters (Preferred)** **L**
Unacceptable	**Unacceptable**	**Unacceptable**
$ 000.00	**Price Per Vol** **Price/Vol** **$/G $0.000** **$/l $0.000**	**G** **l (lower case L for liter)** **Unit** **Volume** **Vol**

Discussion/Conclusion: The Sector reviewed the proposed table and agreed with the concept; however, some members believed that the letter "l" (lower case L for liter) should be acceptable because it is recognized and allowed in NIST Handbook 44, General Code Table 1. Representation of Units. Another member was concerned that if something was identified in the List of Price and Quantity Marking for RMFDs as preferred, some NTEP laboratories might allow only those markings. The Sector modified the Table containing the List of Price and Quantity Markings for RMFDs as shown below and recommended the modified table be forwarded to the NTEP Committee for consideration.

List of Price and Quantity Markings on RMFDs[1]		
Total Sale	**Unit Price**	**Delivered Quantity**
Acceptable	**Acceptable**	**Acceptable**
Total Sale $ 000.00 **Total $ 000.00** **This Sale $ 000.00** **Purchase $ 000.00** **Total Purchase $ 000.00** **Sale $ 000.00**	**Unit Price $0.000** **Price Per Gallon $ 0.000** **Price/Gallon $ 0.000** **Price Per Liter $ 0.000** **Price/ Liter $ 0.000** **Price Per Unit $ 0.000** **Price/Unit $0.000**	**Gallons** **Gal** **Liters** **L or l**
Unacceptable	**Unacceptable**	**Unacceptable**
$ 000.00	**Price Per Vol** **Price/Vol** **$/G $0.000** **$/Gal $0.000** **$/Liter $0.000** **$/L $0.000** **$/l $0.000**	**G** **Unit** **Volume** **Vol**
[1]Does not apply to receipt format		

New Items

4. Product Families for Positive Displacement (PD) Meters

Source: Murray Equipment, Tuthill and Turbine Meter Work Group

Background/Discussion: During several NTEP evaluations conducted since the last Sector meeting, concerns were expressed by manufacturers that the family products table for positive displacement meters need to be revised and updated to reflect changes in metering designs submitted for evaluation and products currently found in the marketplace. One meter manufacturer questioned the appropriateness of keeping aviation fuel as a separate "Product Subgroup" when the physical characteristics of those products are so similar to other refined products. Another manufacturer wanted to know what testing was required to include "biodiesel" on a CC (Certificate of Conformance). Another question asked whether or not the evaluation must be conducted using biodiesel fuel with the highest specific gravity available or could testing be conducted using a product with very similar characteristics that is available in the manufacturer's test facility?

Recommendation: Agenda Item 2 of the meeting agenda distributed prior to the meeting contained a proposal for a family products table for turbine meters. Agenda Item 4 contained two proposals for changes to the family products table for PD meters. At the Sector meeting Items 2 and 4 were combined for discussion and consideration. The Sector reviewed and discussed two alternative proposals for PD meters and the proposal for turbine meters to determine if any of the proposals contained appropriate recommendations for modifications to Section "C" and the Product Family Table for Positive Displacement Meters in the LMD Technical Policy of Publication 14. Two proposals were received to address some of the issues for PD meters. The first proposal submitted by Paul Glowacki (Murray Equipment, Inc.) is

shown below as proposal alternative number 1. The second proposal submitted by Maurice Forkert (Tuthill Transfer System) is shown below as proposal alternative number 2. The proposed family products table submitted by the turbine meters work group is shown following proposal alternative number 2.

Proposal Alternative Number 1:

Proposal Overview

The driving factor behind this proposal is simplification of the Positive Displacement (PD) Meter Product Family chart to more accurately reflect the reality that PD meters are not sensitive to the differences between typical products, but rather that viscosity and specific gravity are the determining metrological considerations.

Thus, the product families are simplified to group liquids in one large category (Normal Liquids) and several additional categories for specialized liquids where other factors are considered.

There are four components to this proposal. Part I is the revised product family table itself to replace the one currently in Pub 14. Part II contains revised language that covers the requirements for testing meters for new certificates according to the table. Part III provides language for the requirements to convert existing certificates to the new proposed categories. Part IV provides revised language to harmonize certain requirements for vehicle-tank meters and stationary meters.

Part I
Proposed Product Table Group

PRODUCT GROUP TABLE				
Product Groups	**Typical Products**	**Viscosity (Centipoise [cP])**	**Specific Gravity**	**Minimum Test Requirements to Cover Products in Group***
Normal Liquids	Water; Alcohols; Glycols; Water Mixes thereof; Agricultural Liquid Fertilizers, Liquid Feeds, Crop Chemicals; Chemicals: Petroleum Products; Solvents; Suspensions; Vegetable Oils	0.3 to 2500	to 2.5	* All products in this group within the range of lowest specific gravity/viscosity to the highest specific gravity/viscosity tested are covered
Compressed Liquids	Propane, Butane, Ethane, Freon 11, Freon 12, Freon 22, NH3, etc.	0.1 to 0.5	0.3 to 0.68	Test with one product in the group to cover all products in this group
Compressed Gases	CNG	0.1 to 0.5	0.6 to 0.8	Test with one product in the group to cover all products in this group
Cryogenic Liquids (BP 152 C) and Liquefied Natural Gas	Liquefied Oxygen, Nitrogen, etc.	0.1 to 0.5	0.07 to 1.4	Test with one product in the group to cover all products in this group
Heated Products (above 50 C)	Bunker C, Asphalt, etc.	25 to 2420	0.8 to 1.2	* All products in this group within the range of lowest specific gravity/viscosity to the highest specific gravity/viscosity tested are covered
*If only a single product is selected for test in Normal Liquids or Heated Products groups, the resulting CC will cover only that product.				
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 and product subgroup.				

Part II
Proposed Language For Product Family Requirements

C. Product Families for All Meters

When submitting a meter for evaluation, the applicant must specify the product or product group for which the meter is being submitted. To cover a product group, NTEP tests must be conducted with two liquids within the product group. Upon test completion, a range of specific gravities/viscosities between the specific gravities/viscosities of the two liquids attained within the product group will be covered on the Certificate of Conformance (CC). The specific gravity/viscosity range within the product group can be expanded by conducting an NTEP test with a liquid of higher or lower specific gravity/viscosity than is covered on the existing CC.

The above does not apply to the following product groups: compressed gasses, compressed liquids, and cryogenic liquids. In case of these product groups, only one liquid within each of these groups is required to undergo an NTEP evaluation and, upon completion, the entire product group will be covered on the CC.

Multi-product applications in which the meter is to be used without a change to zero or calibration to dispense different products must include a multi-product test if:

(1) specific gravity varies by more than 0.1 for devices measuring in mass; or
(2) viscosity varies by more than 1 cP (below 25 cP) for devices measuring in volume.

The multi-product initial test will be performed on the meter without a change to zero or calibration using multiple products having a difference in specific gravity of at least 0.2 for devices measuring in mass and 2 centipoise for devices measuring in volume. For mass measuring devices which will be used to dispense products having a specific gravity range greater than 0.2 and for volume measuring devices which will be used for products having a viscosity range greater than 2 cP, the multi-product testing must be performed over the anticipated range before multi-product applications will be included on the CC. For the multi-product testing, throughput testing will be performed on one or more combinations of products; testing for the subsequent test will be conducted on all products used during the initial test without a change to zero or calibration. Multi-product testing requirements do not apply to devices used to dispense a product such as propane in which the product varies in normal operation.

Part III
Proposed Requirements for Conversion of Pre-existing NTEP Certificates of Conformance to New Requirements

NTEP Liquid Measuring Device Certificates of Conformance issued before 2006, will be reclassified according to specific gravity and viscosity ratings matching the Product Groups and corresponding Sub-Groups listed on the existing manufacturer's Certificate of Conformance:

Current Certificate Product Family and Subgroup Listing	2006 Certificate Product Group Table Classification
Fuel, Lubricant, Oil Products, and Edible Oil Products Refined Products Aviation Fuels Vegetable Oils	Normal Liquids: Specific Gravity 0.70 to 2.5 Viscosity 0.3 cP to 2500 cP
Solvents General Solvents Chlorinated Solvents	
Alcohol & Glycols Alcohols, Glycols, Water Mixes	
Water Water	
Agricultural Liquids Clear Liquid Fertilizer, Crop Chemicals, Flowables, Crop Chemicals, Suspension Fertilizer, Liquid Feed	
Chemicals Chemicals	
Liquefied Compressed Gases Fuels and Refrigerants NH3	Compressed Liquids: Specific Gravity 0.3 to 0.68 Viscosity 0.1 cP to 0.5 cP
Liquefied Compressed Gases Fuels and Refrigerants CNG	Compressed Gases Specific Gravity 0.6 to 0.8 Viscosity 0.1 cP to 0.5 cP
Liquefied Compressed Gases Fuels and Refrigerants Liquefied Oxygen, Nitrogen	Cryogenic Liquids and Liquefied Natural Gas Specific Gravity 0.7 to 1.4 Viscosity 0.1 cP to 0.5 cP
Fuel, Lubricant, Oil Products, and Edible Oil Products Refined Products Bunker C, Asphalt	Heated Products: Specific Gravity 0.8 to 1.2 Viscosity 25 cP to 2420 cP

NOTE: In the event pre-2006 NTEP Liquid-Measuring Device testing was performed on a single meter with products having a Specific Gravity and/or Viscosity greater or lower than the Specific Gravity and Viscosity of the reclassification, the product's actual Specific Gravity and Viscosity can be used to meet the requirements for the 2006 manufacturer's Liquid Measuring Device Certificate of Conformance.

NOTE: A table of sample specific gravity and viscosity values for typical products would be included in Pub 14. This is not included in the proposal and would have to be developed at some point for inclusion with the other changes.

EXAMPLES:

1) Current Certificate lists a meter model approved for Solvents. The 2006 classification is: Normal Liquids Specific Gravity 0.70 to 2.5 and Viscosity 0.3 cP to 2500 cP.

2) Current Certificate lists a meter model approved for Solvents and Agricultural Liquids. The 2006 Classification is: Normal Liquids Specific 0.70 to 2.5 Viscosity 0.3 cP to 2500 cP.

3) Current Certificate lists a meter model approved for Solvents, Agricultural Liquids and Asphalt. 2006 Classification is Normal Liquids and Heated Products Specific 0.70 to 2.5 Viscosity 0.3 cP to 2500 cP.

4) Current Certificate lists a meter model approved for Asphalt and Solvents. 2006 Classification is Normal Liquids Specific Gravity 0.70 to 2.5 Viscosity 0.3 cP to 2500 cP and Heated Products Specific Gravity 0.8 to 1.2 Viscosity 25 cP to 2420 cP.

Part IV
Revised Language for Vehicle-Mounted and Stationary Meter Application Requirements

Publication 14 LMD Section R, page 8

Vehicle-Mounted and Stationary Applications of the Meter

If a meter evaluation is conducted in a vehicle-mounted ***or*** stationary application and the meter successfully meets the NTEP accuracy and performance requirements for both vehicle-mounted and stationary applications, then both applications can be included on the NTEP Certificate of Conformance.

Proposal Alternative Number 2:

This proposal is based on several factors:

A) Level playing field. The regulation should not be dependent on the type of liquid-measuring device. All types of liquid-measuring devices should be required to meet the same regulation or not be approved. I am proposing this Family of Liquids for all types of liquid-measuring devices.

B) End use of a liquid is not a metrological issue. It is not an issue of measurement if vegetable oil ends up on the dinner table or in the crankcase. My proposal does not recognize the end use of a liquid. The marketplace regulations take care of that aspect.

C) The effect of a measuring device on a liquid is not a metrological issue. The viscosity/specific gravity can affect the performance of a meter. It is a marketplace issue if the liquid is Newtonian, Thixotropic, Dilatant, Colloidal, or Rheopectic.

D) Liquid-measuring devices that are approved for a range of viscosities/specific gravities may encounter liquids with solids in that range. The marketplace will be quick to eliminate the measuring device if the measuring device is not able to handle the solids.

E) This is a move to bring our regulations closer in alignment with Canada and OIML regulations.

C. Product Families for All Meters

When submitting a meter for evaluation, the applicant must specify the product or product group for which the meter is being submitted. To cover a product group, NTEP tests must be conducted with two liquids within the product group. Upon test completion, a range of specific gravities/viscosities between the specific gravities/viscosities of the two liquids attained within the product group will be covered on the Certificate of Conformance (CC). The specific gravity/viscosity range within the product group can be expanded by conducting an NTEP test with a liquid of higher or lower specific gravity/viscosity than is covered on the existing CC.

The above does not apply to the following product groups: compressed gasses, compressed liquids, and cryogenic liquids. In case of these product groups, only one liquid within each of these groups is required to undergo an NTEP evaluation and, upon completion, the entire product group will be covered on the CC.

Multi-product applications, in which the meter is to be used without a change to zero or calibration to dispense different products, must include a multi-product test if:

a) specific gravity varies by more than 0.1 for devices measuring in mass;
b) viscosity varies by more than 1 cP (below 25 cP) for devices measuring in volume.

The multi-product initial test will be performed on the meter without a change to zero or calibration using multiple products having a difference in specific gravity of at least 0.2 for devices measuring in mass and 2 cP for devices measuring in volume. For mass measuring devices which will be used to dispense products having a specific gravity range greater than 0.2 and for volume measuring devices which will be used for products having a viscosity range greater than 2 cP, the multi-product testing must be performed over the anticipated range before multi-product applications will

be included on the CC. For the multi-product testing, throughput testing will be performed on one or more combinations of products; testing for the subsequent test will be conducted on all products used during the initial test without a change to zero or calibration. Multi-product testing requirements do not apply to devices used to dispense a product such as propane in which the product varies in normal operation.

Product Group Table				
Product Groups	**Typical Products**	**Viscosity (Centipoise [cP])**	**Specific Gravity**	**Minimum Test Requirements to Cover Products in Group***
Normal Liquids	Water;Alcohols; Glycols; Water Mixes thereof; Agricultural Liquids, Fertilizers, Seeds, and Herbicides; Chemicals:Petroleum Products; Solvents; Suspensions	0.3 to 2500	0.7 to 2.5	* All products in this group within the range of lowest specific gravity/viscosity to the highest specific gravity/viscosity tested are covered
Compressed Liquids	Propane, Butane, Ethane, Freon 11, Freon 12, Freon 22, NH3, etc.	0.1 to 0.5	0.3 to 0.68	Test with one product in the group to cover all products in this group
Compressed Gases	CNG	0.1 to 0.5	0.6 to 0.8	Test with one product in the group to cover all products in this group
Cryogenic Liquids (BP 152 C) and Liquefied Natural Gas	Liquefied Oxygen, Nitrogen, etc.	0.1 to 0.5	0.07 to 1.4	Test with one product in the group to cover all products in this group
Heated Products (above 50 C)	Bunker C, Asphalt, etc.	25 to 2420	0.8 to 1.2	* All products in this group within the range of lowest specific gravity/viscosity to the highest specific gravity/viscosity tested are covered
*If only a single product is selected for test in Normal Liquids or Heated Products groups, the resulting CC will cover only that product.				
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 and product subgroup.				

The turbine meters work group proposed amending Section "P" of the LMD Technical Policy in Publication 14 to add the following:

P. Product Families for Turbine Meters

To facilitate the certification of turbine meters, product family groups have been created to eliminate the necessity of testing each product individually. Turbine meter product groups are defined by viscosity, density, lubricity, and chemical/physical compatibility.

When submitting a turbine meter for evaluation, the applicant must specify the product or product group(s) for which the meter is being submitted. A meter that is successfully tested on one product will be approved for use with that product only. If the meter is successfully tested on a lower viscosity product and then successfully tested on a higher viscosity

product in the same product group, then all products in that group falling within the range of viscosities can be included on the Certificate.

Bi-directional turbine meters must be tested in "forward" and "reverse" flow directions. Turbine meters must be tested in the mounting orientation(s) required. Horizontal/vertical-mounted turbine meters must be tested in both horizontal and vertical orientation, and in "forward" and "reverse" flow, if they are bi-directional. Vertically-mounted turbine meters that flow in only one direction must be described in the Certificate.

The flow range of turbine meters is affected by line size, viscosity, and specific gravity. Therefore, the criteria for inclusion of meters from 50 % to 200 % min/max flow rate of the meter tested cannot be applied to all line size, viscosity, and specific gravity requirements, with respect to turbine meters.

One method to include smaller line sizes with higher viscosities is to use multiple meter factors to linearize the performance curve.

Another method to include smaller line sizes with higher viscosities is to increase the minimum flow rate.

The following calculation can be used to determine if a smaller line size needs adjustment because of viscosity. The method of adjustment must be described in the Certificate.

Sizing Ratio = Liquid Viscosity (centistokes) / Nominal Line Size (inches)

Sizing Ratio = 1 or less, use the normal 10 % minimum flow rate. (10:1 turndown)
= Above 1 to 1.5 use 20 % minimum flow rate. (5:1 turndown)
= Above 1.5 exceeds the Minimum Discharge Rate of Wholesale Devices and cannot be included.

Multiple meter factors can also be used to achieve extended flow rate and to linearize the performance curve with low and high specific gravity applications. This use must be described in the Certificate.

The product or product group(s), meter orientation, and flow directions covered by the Certificate are to be identified on page 1 of the Certificate of Conformance. More detailed information, including typical products to be covered, number of meter factors required for smaller line size, higher viscosity, low/high specific gravity and extended flow rate are to be included in the application section of the Certificate.

Turbine Meter Product Group Table			
Product Groups	**Typical Products[1]**	**Viscosity (centistokes [cSt])**	**Specific Gravity[2]**
Refined Petroleum Products	diesel[3], gasoline[4], kerosene, jet fuel		
	distillate, fuel oil, stove oil	0.5 to 200	0.64 to 1.1
Alcohols & Glycols	ethanol, methanol, butanol,		
	isopropyl, isobutyl	0.6 to 54	0.6 to 1.6
	ethylene glycol, propylene, glycol		
Compressed Liquefied Gases	LPG, anhydrous-ammonia,		
	propane, butane, freon	0.2 to 0.6	0.3 to 0.68
Cryogenic Liquids (BP 152 C) and Liquefied Natural Gas	Liquefied Argon, Oxygen, Nitrogen	0.1 to 0.4	0.8 to 1.4

[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 Group.
[2]The specific gravity of a liquid is the ratio of its density to that of water at standard conditions, usually 4 °C (or 20 °C) and 1 atmosphere. The density of water at standard conditions is approximately 1 000 kg/m3 (or 998 kg/m3)
[3]Diesel fuel blends (biodiesel) with up to 20 % vegetable or animal fat/oil.
[4]Gasoline includes oxygenated fuel blends with up to 15 % oxygenate.

The source for some of the viscosity value information is in the Industry Canada – Measurement Canada "Classification of Liquids for the Approval of Liquid Meters", Bulletin V-16 (rev. 2), Issue Date: 2005-05-13 Effective Date: 2005-07-01

Discussion: On the first day of the meeting, because of the common issue presented in the proposals, the Sector agreed to combine Agenda Items 2 and 4 for discussion. One manufacturer of RMFDs stated that the proposals in Item 4 to include alcohols in the product group of "normal liquids" that also included water, petroleum products, chemicals, and vegetable oils was not appropriate. Another manufacturer stated that if a company could make a single device that can pass type evaluation for both alcohols and petroleum products, that company should not be penalized because another company must submit different models to measure each product. After considerable discussion it was apparent that while each of the proposals had merit, no individual proposal satisfied all of the concerns of the members. It was suggested that the parties responsible for each of the proposals and other interested parties meet after the conclusion of the first day of the Sector Meeting to work on a compromise document that would satisfy all participants.

Conclusion: On the second day of the meeting the volunteer group presented a proposal for consideration by the entire Sector membership present at the meeting. After a few minor editorial changes, the Sector agreed to forward proposed revisions to NCWM Publication 14 Section "C" Product Families for Positive Displacement (PD) Meters, Section "D" Product Families for Mass Flow Meters (MFM), and a new Product Families Table designed to include product family testing requirements for PD meters, MFM, and Turbine Meters in a single table, as shown below, to the NTEP Committee for consideration.

C. Product Families for ~~Positive Displacement~~ Meters

When submitting a ~~positive displacement~~ meter for evaluation, the manufacturer must specify the product family and ~~subgroup(s)~~ critical parameters for which the meter is being submitted. ~~From the list of liquids constituting a product family and subgroup, at least two liquids representing of the high and low key characteristics of that subgroup are to be selected for use in the test. If the meter successfully completes all accuracy and permanence tests with these products, the resulting Certificate of Conformance will cover the entire subgroup of the product family.~~

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 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.
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.

Mass Meter Product Family & Test Requirements (Test B unless otherwise noted)	PD Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Product Family & Test Requirements (Test A unless otherwise noted)	Typical Products[1]	Viscosity[5] (Centipoise [cP]) (Centistokes [cSt])	Specific Gravity[2]
Normal Liquids	Fuels, Lubricants, Industrial and Food Grade Liquid Oils	Fuels, Lubricants, Industrial and Food Grade Liquid Oils (Test E permitted)	Diesel Fuel[3], Distillate, Gasoline[4], Fuel Oil, Kerosene, Light Oil, Spindle Oil, Lubricating Oils, SAE Grades, Bunker Oil, 6 Oil, Crude Oil, Asphalt, Vegetable Oil, Biodiesel above B20, AVgas, Jet A, Jet A-1, Jet B, JP4, JP5, JP7, JP8, Cooking Oils, Sunflower Oil, Soy Oil, Peanut Oil, Olive Oil, etc.	0.3 to 2500 0.44 to 2270	0.68 to 1.1
	Solvents General	Solvents General (Test E permitted)	Acetates, Acetone, Esters, Ethylacetate, Hexane, MEK, Naphtha, Toluene, Xylene, etc.	0.3 to 7 0.5 to 4.38	0.6 to 1.6
	Solvents Chlorinated	Solvents Chlorinated	Carbon Tetra-Chloride, Methylene-Chloride, Perchloro-Ethylene, Trichloro-Ethylene, etc.	0.3 to 7 0.5 to 4.38	0.6 to 1.6
	Alcohols, Glycols, & Water Mixes Thereof	Alcohols, Glycols, & Water Mixes Thereof (Test E permitted)	Ethanol, Methanol, Butanol, Isopropyl, Isobutyl, Ethylene glycol, Propylene glycol, etc.	0.3 to 7 0.5 to 4.38	0.6 to 1.6

Mass Meter Product Family & Test Requirements (Test B unless otherwise noted)	PD Product Family & Test Requirements (Test C unless otherwise noted)	Turbine Product Family & Test Requirements (Test A unless otherwise noted)	Typical Products[1]	Viscosity[5] (Centipoise [cP]) (Centistokes [cSt])	Specific Gravity[2]
	Water (Test D permitted)	Water (Test D permitted)	Tap Water, Deionized, Demineralized, Potable, Nonpotable	1.0 1.0	1.0
	Clear Liquid Fertilizers	Clear Liquid Fertilizers	Nitrogen Solution; 28 %, 30 % or 32 %; 20 % Aqua-Ammonia; Urea; Ammonia Nitrate; N-P-K solutions; 10-34-0; 4-10-10; 9-18-9; etc.	10 to 400 10 to 275	1.0 to 1.45
	Crop Chemicals	Crop Chemicals	Herbicides: Round-up, Touchdown, Banvel, Treflan, Paraquat, Prowl, etc	4 to 400 5.7 to 333	0.7 to 1.2
	Crop Chemicals	Crop Chemicals	Fungicides, Insecticides, Adjuvants, Fumigants	0.7 to 100 1 to 83	0.7 to 1.2
	Flowables	Flowables	Dual, Bicep, Marksman, Broadstrike, Doubleplay, Topnotch, Guardsman, Harness, etc.	20 to 900 20 to 750	1 t o 1.2
	Crop Chemicals	Crop Chemicals	Fungicides		
	Crop Chemicals	Crop Chemicals	Micronutrients		
	Suspensions Fertilizers	Suspensions Fertilizers	3-10-30; 4-4-27, etc.	20 to 900 20 to 560	1.0 to 1.6
	Liquid Feeds	Liquid Feeds	Liquid Molasses; Molasses plus Phos Acid and/or Urea; etc.	10 to 50 000 8 to 33 000	1.2 to 1.5
	Chemicals	Chemicals	Sulfuric Acid, Hydrochloric Acid, Phosphoric Acid, etc	1.0 to 296 0.9 to 160	1.1 to 1.85
Heated Products (above 50 °C)	Heated Products (above 50 °C)	Heated Products (above 50 °C)	Bunker C, Asphalt, etc.		0.8 to 1.2

Mass Meter Product Family & Test Requirements (Test B unless otherwise noted)	**PD Product Family & Test Requirements (Test C unless otherwise noted)**	**Turbine Product Family & Test Requirements (Test A unless otherwise noted)**	**Typical Products[1]**	**Viscosity[5] (Centipoise [cP]) (Centistokes [cSt])**	**Specific Gravity[2]**
Compressed Liquids – (Test D)	**Fuels and Refrigerants**	**Fuels and Refrigerants – (Test E)**	**LPG, Propane, Butane, Ethane, Freon 11, Freon 12, Freon 22, etc.**	**0.1 to 0.5 0.3 to 0.77**	**0.3 to 0.65**
	NH[3]	**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**	**0.1 0.2**	**0.56 to 0.68**
Compressed Gases – (Test D)	**Note: CNG is only included in Section 3.37 Mass Flow Meters of Handbook 44**		**CNG**		**0.6 to 0.8**
Cryogenic Liquids and Liquefied Natural Gas – (Test D)	**Cryogenic Liquids and Liquefied Natural Gas – (Test A)**	**Cryogenic Liquids and Liquefied Natural Gas – (Test D)**	**Liquefied Oxygen, Nitrogen, etc.**		**0.07 to 1.4**

[1]*NOTE: The Typical Products listed in this table are not limiting or all-inclusive; there may be other products and product trade names, which fall into a product family. Water and a product such as stoddard solvent or mineral spirits may be used as test products in the fuels, lubricants, industrial, and food- grade liquid oils product family.*

[2]The specific gravity of a liquid is the ratio of its density to that of water at standard conditions, usually 4 °C (or 40 °F) and 1 atm. The density of water at standard conditions is approximately 1000 kg/m3 (or 998 kg/m3)

[3]Diesel fuel blends (biodiesel) with up to 20 % vegetable or animal fat/oil.

[4]Gasoline includes oxygenated fuel blends with up to 15 % oxygenate.

[5] Kinematic viscosity is measured in centistokes. $$Centistokes = \frac{Centipoise}{Specific\,Gravity}$$

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."

D. Additional Criteria for Product Families for Mass Flow Meters

~~**When submitting a direct mass flow meter for evaluation, the manufacturer must specify the product or product group for which the meter is being submitted. To cover a product group, NTEP tests must be conducted with two liquids within the product group.**~~ When two liquids of different densities are tested, the Certificate of Conformance (CC) for the mass flow meter will cover approved liquids with a specific gravity range from 0.1 above the highest specific gravity tested to 0.1 below the lowest specific gravity tested. The specific gravity range within the product

group can be expanded by conducting an NTEP test with a liquid of higher or lower specific gravity than is covered on the existing CC.

~~**The above does not apply to the following product groups: compressed gases, compressed liquids, and cryogenic liquids. In the case of these product groups, only one liquid within each group is required to undergo an NTEP evaluation and, upon completion, the entire product group will be covered on the existing CC.**~~

Multi-product applications (that is, applications in which the meter will be used without a change to zero or calibration to dispense different products which vary in specific gravity by more than 0.1) must include a multi-product test. The multi-product initial test will be performed on the meter without a change to zero or calibration using multiple products having a difference in specific gravity of at least 0.2. For devices which will be used to dispense multiple products having a specific gravity range greater than 0.2, the multi-product testing must be performed over the anticipated range before multi-product applications will be included on the CC. For the multi-product testing, throughput testing will be performed on one or a combination of the products; testing for the subsequent test will be conducted on both products without a change to zero or calibration. The CC for a mass flow meter will cover multi-product applications where the specific gravity of a single product, or multiple products, varies by the amount tested throughout the entire approved specific gravity range of the meter. Example: Where a meter has been tested and a certificate issued for multi-product with one liquid having a specific gravity of 0.7 and another liquid having a specific gravity of 1.0 and the meter is subsequently tested to expand the range with a liquid having a specific gravity of 1.6, the allowed variation of gravities covered by the CC will be from 0.7 through 1.6. Multi-product testing requirements do not apply to meters used to dispense a product such as propane in which the density varies in normal operation.

5. Permanence Test for "Wholesale Meters" in Publication 14

Source: NTEP Laboratories

Background/Discussion: At the 2005 meeting of the NTEP laboratories it was noted that Publication 14 does not contain permanence test criteria for wholesale positive displacement meters. The NTEP labs developed the following proposal for submission to the Sector for review.

Recommendation: The Sector reviewed the following proposal for possible forwarding to the NTEP Committee for approval and addition to the 2006 Edition of Publication 14.

Proposal: Modify Section D of the Publication 14 LMD Checklist as follows:

D. Initial Evaluation and Permanence Tests for Wholesale Positive Displacement (PD) Meters

The following tests are considered to be appropriate for metering systems on Wholesale PD Meters:

1. **Four test drafts at each of five flow rates.**

2. **Only one meter is required for the initial test, after which the meter will be reevaluated for permanence. The minimum throughput criterion for these meters is the maximum rated flow in units per minute x 2000**

3. **Following the period of use, the tests listed above are to be repeated. All results must be within acceptance tolerances.**

Tests of Automatic Temperature Compensating Systems on Wholesale Meters (Code Reference T.2.3.4.)

The difference between the meter error for results determined with and without the automatic temperature compensating system activated shall not exceed:

1. 0.2 % of the test draft for mechanical automatic temperature compensating systems; and

2. 0.1 % of the test draft for electronic automatic temperature compensating systems.

The results of each test shall be within the applicable "acceptance" or maintenance tolerance.

Repeatability on Wholesale Meters (Code Reference T.2.3.3.)

When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance, and the results of each test shall be within the applicable tolerance. This tolerance does not apply to the test of the automatic temperature compensating system.

Tests for repeatability shall include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature, pressure, and flow rate, are reduced to the extent that they will not affect the results obtained.

Discussion/Conclusion: A mass flow meter manufacturer suggested that the throughput requirement should be replaced with a time requirement of 60 days between the initial evaluation and the permanence test. The NTEP laboratories were opposed to that change because it did not include any criteria for an amount of use between tests. After some discussion the proposal for a 60-day time frame was withdrawn. Another member suggested that the reference to the Canadian throughput requirement should be removed because at this time there is no mutual recognition program between the United States and Canada for meters. The Sector agreed that the reference to Canadian throughput requirements should be editorially removed from all permanence test section in NCWM Publication 14. The Sector agreed to forward the proposal for test requirements for wholesale meters to the NTEP Committee for consideration.

6. NTEP Tolerances for Meters with Different Flow Rates when Using Different Sized Provers

Source: Maryland NTEP Laboratory

Background: During an evaluation of a high-gallonage RMFD with marked flow rates of 60 gpm maximum and 12 gpm minimum, the Maryland NTEP laboratory found that the actual flow rate on the lowest setting of the automatic nozzle was 6 GPM. Several questions need to be addressed regarding this situation.

N.4.2.2 (b) in the LMD Code states “Devices with a marked minimum flow rate shall have a "special" test performed at or near the marked minimum flow rate.”

If a 10-gal test measure is used, what is the appropriate tolerance applicable? Table T.2. in the LMD Code stipulates that the special test tolerance is 0.5 %, which is 11.55 cu in on a ten-gal test draft; however, there is a footnote that states that the applicable acceptance tolerance for a special test when using a 10-gal test draft is 5.5 cu in. Which tolerance should be applied during an NTEP evaluation? If a prover with a capacity greater than 10 gallons is used, does it provide a tolerance advantage over tests conducted with a 10-gal test measure?

G-T.1. (e) states that acceptance tolerances apply to all equipment undergoing type evaluation. Does that mean that special test tolerances are not applicable during NTEP testing?

At its 2005 meeting the Sector agreed to forward a proposal to modify G-T.1. as shown below to the NCWM and Southern Weights and Measures Association S&T Committees for consideration.

Proposal: Modify H44 Sec. 1.10 Paragraphs G-T.1. Acceptance Tolerances (e) and N.4.2.2. Retail Motor-Fuel 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 major reconditioning or overhaul; and

(e) equipment undergoing type evaluation (special test tolerances are not applicable).

At the 2005 NCWM Annual Meeting, the Meter Manufacturers Association (MMA) indicated that they had not understood that the proposal submitted to the Committee from the Measuring Sector would only apply to all types of liquid-measuring devices submitted for NTEP evaluation. The MMA stated that without special test tolerances most meters, especially those installed in vehicle-mounted applications, would not meet tolerances for low flow tests during both field and NTEP evaluations. The Committee agreed to make the proposal an information item to allow the MMA and the Measuring Sector time to further develop the proposal and resubmit it to the Committee for consideration.

Prior to the addition of Table T.2. to the Handbook 44 LMD Code in 2002, the applicale tolerances in T.2.1. for "retail devices" including RMFDs were the same for normal and special tests. Special test tolerances were only applicable to "wholesale devices" measuring liquids other than agri-chemicals and asphalt. The Sector was asked to consider a recommendation that limits the application of special test tolerances in the LMD code to only those devices where it was appliclble prior to 2002.

Recommendation: The Sector reviewed the following proposal for posible forwarding to the NCWM S&T Committee for consideration along with a recommendation that the NCWM S&T Committee General Code item to amend G-T.1. be withdrawn.

Proposal: Modifty Table T.2. Accuracy Classes for Liquid-Measuring Devices Covered in NIST Handbook 44 Section 3.30. as follows:

Table T.2. Accuracy Classes for Liquid Measuring Devices Covered in NIST Handbook 44 Section 3.30.				
Accuracy Class	**Application**	**Acceptance Tolerance**	**Maintenance Tolerance**	**Special Test Tolerance[1]**
0.3	Petroleum products delivered from large capacity (flow rates over 115 L/min (30 gal/min))** devices including motor fuel devices, heated products at or greater than 50 °C asphalt at or below temperatures 50 °C, all other liquids not shown where the typical delivery is over 200 L (50 gal)	0.2 %	0.3 %	0.5 %
0.3A	Asphalt at temperatures greater than 50° C	0.3 %	0.3 %	0.5 %
0.5*	Petroleum products delivered from small capacity (at 4 L/min (1 gal/min) through 115 L/min (30 gal/min))** motor-fuel devices, agri-chemical liquids, and all other applications not shown where the typical delivery is # 200 L (50 gal)	0.3 %	0.5 %	0.5%
1.1	Petroleum products and other normal liquids from devices with flow rates** less than 1 gal/min and devices designed to deliver less than 1 gal	0.75 %	1.0 %	1.25%
*For 5 gal and 10 gal test drafts, the tolerances specified for Accuracy Class 0.5 in the table above do not apply. For these test drafts, the maintenance tolerances on normal and special tests for 5 gal and 10 gal test drafts are 6 cu in and 11 cu in, respectively. Acceptance tolerances on normal and special tests are 3 cu in and 5.5 cu in. ** Flow rate refers to designed or marked maximum flow rate. **[1] Special Test Tolerances are not applicable to Retail Motor-fuel Dispensers or to devices used for the measurement of agri-chemical liquids and asphalt.**				

(Added 2002)

Discussion/Conclusion: The Sector reviewed the proposal that would remove the special test tolerance for retail motor-fuel dispensers and wholesale meters measuring agri-chemicals and asphalt. The Sector agreed that some devices measuring agri-chemicals and asphalt should have a special test tolerance. The current definition of "retail" in Handbook 44 now applies to devices that, prior to 2004 when the definition of "retail" was changed, would have met the definition for a wholesale device because of their rated flow. When the wholesale devices measuring agri-chemicals and asphalt were classified as "wholesale," they were permitted to have a special test tolerance. Those same devices may now meet the criteria to be classified as "retail"; however they should still be allowed to have a special test tolerance. The Sector agreed to limit the proposal to only RMFDs and to forward the modified proposal shown below to the NCWM S&T Committee for consideration.

Table T.2. Accuracy Classes for Liquid-Measuring Devices Covered in NIST Handbook 44 Section 3.30.				
Accuracy Class	**Application**	**Acceptance Tolerance**	**Maintenance Tolerance**	**Special Test Tolerance[1]**
0.3	Petroleum products delivered from large capacity (flow rates over 115 L/min (30 gal/min))** devices including motor fuel devices, heated products at or greater than 50 °C asphalt at or below temperatures 50 °C, all other liquids not shown where the typical delivery is over 200 L (50 gal)	0.2 %	0.3 %	0.5 %
0.3A	Asphalt at temperatures greater than 50 °C	0.3 %	0.3 %	0.5 %
0.5*	Petroleum products delivered from small capacity (at 4 L/min (1 gal/min) through 115 L/min (30 gal/min))** motor-fuel devices, agri-chemical liquids, and all other applications not shown where the typical delivery is # 200 L (50 gal)	0.3 %	0.5 %	0.5%
1.1	Petroleum products and other normal liquids from devices with flow rates** less than 1 gal/min and devices designed to deliver less than 1 gal	0.75 %	1.0 %	1.25%

*For 5 gal and 10 gal test drafts, the tolerances specified for Accuracy Class 0.5 in the table above do not apply. For these test drafts, the maintenance tolerances on normal and special tests **(except for retail motor-fuel dispensers)** for 5 gal and 10 gal test drafts are 6 cu in and 11 cu in, respectively. Acceptance tolerances on normal and special tests **(except for retail motor-fuel dispensers)** are 3 cu in and 5.5 cu in. **[1] Special Test Tolerances are not applicable to retail motor-fuel dispensers.**

** Flow rate refers to designed or marked maximum flow rate.

(Added 2002)**(Amended 200X)**

7. Marking Requirements for 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices

Source: NTEP Laboratories

Background/Discussion: At the 2005 meeting of the NTEP laboratories it was recommended that the location of markings requirement from the LMD code be added to Sections 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices and 3.37. Mass Flow Meters

Recommendation: The Sector was asked to review the following proposal and, if it agreed, to forward it to the NCWM S&T Committee for consideration.

Proposal: Add a new paragraph S.4.3. Location of Marking Information; Retail Motor-Fuel Dispensers to Handbook 44 Section 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices and renumber subsequent paragraphs as follows:

S.4. Marking Requirements.

S.4.1. Limitation of Use. - If a device is intended to measure accurately only products having particular properties, or to measure accurately only under specific installation or operating conditions, or to measure accurately only when used in conjunction with specific accessory equipment, these limitations shall be clearly and permanently stated on the device.

S.4.2. Discharge Rates. - A device shall be marked to show its designed maximum and minimum discharge rates. The marked minimum discharge rate shall not exceed:

(a) 20 L (5 gal) per minute for stationary retail devices, or

(b) 20 % of the marked maximum discharge rate for other retail devices and for wholesale devices. (Amended 1987)

Note: See example in Section 3.30. Liquid-Measuring Devices Code, Paragraph S.4.4.1. (Added 2003)

S.4.3. Location of Marking Information; Retail Motor-Fuel Dispensers. - The required marking information in the General Code, Paragraph G-S.1. Identification shall appear as follows:

(a) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;

(b) either internally and/or externally provided the information is permanent and easily read; and

(c) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).

Note: ***The use of a dispenser key or tool to access internal marking information is permitted for Retail Liquid-Measuring Devices.***
[*Nonretroactive as of January 1, 200X]

S.4.~~3~~4. Temperature Compensation. - If a device is equipped with an automatic temperature compensator, the primary indicating elements, recording elements, and recorded representation shall be clearly and conspicuously marked to show that the volume delivered has been adjusted to the volume at 15 °C (60 °F).

Conclusion: There was no discussion on agenda Item 7 to add a new paragraph S.4.3. and renumber subsequent paragraphs. The Sector agreed to forward the proposal to the NCWM S&T Committee for consideration.

8. Marking Requirements for 3.37. Mass Flow Meters

Source: NTEP Laboratories

Background/Discussion: At the 2005 meeting of the NTEP laboratories it was recommended that the location of markings requirement from the LMD Code be added to Sections 3.32. LPG and Anhydrous Ammonia and 3.37. Mass Flow Meters

Recommendation: The Sector was asked to review the following proposal and, if it agreed, to forward the proposal to the S&T Committee for consideration.

Proposal: Add a new paragraph S.5.1. Location of Marking Information; Retail Motor-Fuel Dispensers to Handbook 44 Section 3.37. Mass Flow Meters and renumber subsequent paragraphs as follows:

S.5. Markings. - A measuring system shall be legibly and indelibly marked with the following information:

(a) pattern approval mark (i.e., type approval number);

(b) name and address of the manufacturer or his trademark and, if required by the weights and measures authority, the manufacturer's identification mark in addition to the trademark;

(c) model designation or product name selected by the manufacturer;

(d) nonrepetitive serial number;

(e) *the accuracy class of the meter as specified by the manufacturer consistent with Table T.2.;** (Added 1994)

(f) maximum and minimum flow rates in pounds per unit of time;

(g) maximum working pressure;

(h) applicable range of temperature if other than –10 °C to +50 °C;

(i) minimum measured quantity; and

(j) product limitations, if applicable.

*[*Nonretroactive as of January 1, 1995]*

S.5.1. Location of Marking Information; Retail Motor-Fuel Dispensers. - The required marking information in the General Code, Paragraph G-S.1. Identification shall appear as follows:

(d) within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;

(e) either internally and/or externally provided the information is permanent and easily read; and

(f) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).

Note: ***The use of a dispenser key or tool to access internal marking information is permitted for Retail Liquid-Measuring Devices.***
[*Nonretroactive as of January 1, 200X]

S.5.~~1~~2. Marking of Gasoline Volume Equivalent Conversion Factor. - A device dispensing compressed natural gas shall have either the statement "One Gasoline Liter Equivalent (GLE) is Equal to 0.678 kg of Natural Gas" or "One Gasoline Gallon Equivalent (GGE) is Equal to 5.660 lb of Natural Gas" permanently and conspicuously marked on the face of the dispenser according to the method of sale used.
(Added 1994)

Conclusion: There was no discussion on agenda Item 8 to add a new paragraph S.5.1. and renumber subsequent paragraphs. The Sector agreed to forward the proposal to the NCWM S&T Committee for consideration.

9. Value of the Smallest Unit for LMD Code

Source: WMD

Background/Discussion: In 2004 the definition of a "retail device" in Handbook 44 was modified to include all devices used to measure product for the purpose of sale to the end user. At that time the S&T Committee believed all affected parties were aware of the proposal and there was no opposition to the change. However, after the 2005 Edition of Handbook 44 was published and distributed, WMD received a comment from a weights and measures jurisdiction that routinely tests large meters used to deliver fuel to fishing fleets and other large ocean-going boats. The jurisdiction stated that the average delivery is approximately 300 000 gal and may be as much as 1 000 000 gal. At the present time value of the smallest unit of the indicated delivery for these devices is 1 gal. Because the fuel is being delivered to the end user, the jurisdiction believes this is a retail delivery and that Handbook 44 now requires a smallest unit of delivery of not more than 0.5 L (1 pt) for these devices. WMD recommends a change to Handbook 44 is appropriate to recognize a larger minimum unit of delivery for large fuel deliveries.

Recommendation: The Sector was asked to review the following proposal and if it agreed, to forward it to the S&T Committee for consideration. It was also suggested that as an alternative, the Sector could decide it was more appropriate to form a work group to develop suitability criteria for all meters, including such things as minimum and maximum flow rate, minimum resolution, minimum measured quantity, etc., for an application and forward the concept to the S&T Committee as a developing issue.

Proposal: Modify Handbook 44, Section 3.30., S.1.2.3. Value of Smallest Unit as follows:

> **S.1.2.3. 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) 0.5 L (~~1 pt~~ 0.1 gal) on ~~retail~~ devices making a delivery of less than 1 000 gal;
>
> (b) 5 L (1 gal) on ~~wholesale~~ devices making a delivery of 1 000 gal or more.
>
> This requirement does not apply to manually operated devices equipped with stops or stroke-limiting means. (Amended 1983 and 1986)

Discussion/Conclusion: The Sector supported the concept of the proposal; however, during the discussion of the item, a recommendation was made to base the smallest unit requirement on meter size (marked flow rate) rather than the size of the delivery. The Sector agreed and modified the proposal as shown below. The Sector agreed to forward the modified proposal to the NCWM S&T Committee for consideration.

Proposal: Modify Handbook 44, paragraph S.1.2.3. as follows:

> **S.1.2.3. 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) 0.5 L **(~~1 pt~~ 0.1 gal)** on **~~retail~~** devices **with a maximum rated flow rate of 750 L/min (200 gal/min) or less.**
>
> (b) 5 L (1 gal) on **~~wholesale~~** devices **with a maximum rated flow of more than 750 L/min (200 gal/min).**
>
> This requirement does not apply to manually operated devices equipped with stops or stroke-limiting means. **(Amended 1983, ~~and~~ 1986, and 200X)**

10. Value of the Smallest Unit for Vehicle-Tank Meters (VTM) Code

Source: Maryland NTEP Laboratory

Background/Discussion: Paragraph S.1.1.3. in the VTM Code requires the smallest unit of indicated delivery to be not greater than 0.5 L (0.1 gal) for deliveries on meters with a rated maximum flow rate of 500 L/min (100 gal/min) or less used for retail deliveries of liquid fuel and 5 L (1 gal) for all other meters (except milk-metering systems). VTMs with rated maximum flow rates greater than 100 gal/min are being introduced into the marketplace; however, the amount of the increase in flow rate and the amount of product being delivered do not warrant a tenfold increase in the required value of the smallest unit of measurement.

Recommendation: The Sector was asked to review the following proposal and consider forwarding it to the NCWM S&T Committee for consideration.

Proposal: Modify Handbook 44, Section 3.31., Paragraph S.1.1.3. Value of the Smallest Unit. as follows:

> **S.1.1.3. Value of Smallest Unit.** - The value of the smallest unit of indicated delivery, and recorded delivery if the meter is equipped to record, shall not exceed the equivalent of:
>
> (a) 0.5 L (0.1 gal) or 0.5 kg (1 lb) on milk-metering systems
>
> (b) 0.5 L (0.1 gal) on meters with a rated maximum flow rate of ~~500~~ **750** L/min (~~100~~ **200** gal/min) or less used for retail deliveries of liquid fuel, or
>
> (c) 5 L (1 gal) on other meters.

Discussion/Conclusion: The Sector reviewed a proposal to increase the rated maximum flow rate criteria in S.1.1.3. from 100 gal/min to 200 gal/min. Some manufacturers of aviation refueling systems suggested that these systems need a separate criterion due to the unique nature of their application. The Sector agreed with the aviation refueler manufacturers and agreed to forward the modified proposal shown below to the NCWM S&T Committee for consideration.

Proposal: Modify Paragraph S.1.1.3. as follows:

> **S.1.1.3. Value of Smallest Unit.** - The value of the smallest unit of indicated delivery, and recorded delivery if the meter is equipped to record, shall not exceed the equivalent of:
>
> (a) 0.5 L (0.1 gal) or 0.5 kg (1 lb) on milk-metering systems**,**
>
> (b) 0.5 L (0.1 gal) on meters with a rated maximum flow rate of ~~**500**~~ **750** L/min **(**~~**100**~~ **200** gal/min) or less used for ~~**retail**~~ deliveries of liquid fuel, or
> (**Amended 200X)**
>
> **(c) 5 L (1 gal) on meters with a rated maximum flow of 575 L/min (150 gal/min) or more used for aviation refueling systems,**
> **(Added 200X)**
>
> **(**~~**c**~~**d)** 5 L (1 gal) on other meters.

11. Add Fluid Ounce to NIST Handbook 44, Section 3.30. Liquid-Measuring Devices, Paragraph S.1.2. Units

Source: NTEP Laboratories

Background: NTEP issued a CC for a liquid-measuring device that displays its deliveries in fluid ounces. The device currently in use always makes a delivery of 4 fl oz. A weights and measures jurisdiction would not approve the use of the device stating that it did not comply with S.1.2. in the LMD Code. Paragraph S.1.2. allows binary submultiples of the liter or gallon; therefore an indication of 1/32 gallon would be acceptable. The laboratories agreed that consumers would understand 4 fl oz better than 1/32 of a gallon and suggested the Measuring Sector review the following proposal and consider recommending it to the NCWM S&T Committee for adoption into Handbook 44.

Recommendation: Modify Handbook 44, Section 3.30, S.1.2. Units, as follows:

> **S.1.2. Units. -** A liquid-measuring device shall indicate, and record if the device is equipped to record, its deliveries in liters, gallons, quarts, pints, **fluid ounces** or binary-submultiples or decimal subdivisions of the liter or gallon. (Amended 1987, 1994)

Conclusion: The Sector supported the proposal to modify S.1.2. and agreed to forward the proposal a recommended to the NCWM S&T Committee for consideration.

12. Reorganize Publication 14 to Clarify Tests of ECRs for RMFDs

Source: NTEP Laboratories

Background: At the 2005 NTEP Laboratory Meeting, one of the Measuring labs stated that the LMD section of Publication 14 was not well organized. During an NTEP evaluation the evaluator must continuously flip from one section of the publication to another to find all the requirements applicable to the device under test. The lab also stated that the evaluation of an ECR interfaced with a RMFD required the use of both the ECR Checklist and the LMD Checklist in order to find all the applicable requirements. The California laboratory volunteered to provide a draft reorganization of LMD Checklist and a draft of a revised ECR checklist with the applicable requirements added from the LMD checklist. Drafts of the reorganized LMD checklist and the revised ECR checklist are available from NIST WMD upon request.

Recommendation: The Sector was asked to review the drafts submitted and, if agreeable, to forward them to the NTEP Committee for approval as revisions to the 2006 version of Publication 14.

Conclusion: The Sector supported the concept provided all NTEP laboratories and other interested parties conduct a thorough review of the proposed changes before they are incorporated in NCWM Publication 14. The NTEP Director, Steve Patoray, agreed to post the draft changes as shown in Appendices A and B on the NCWM website.

13. Next Meeting

The Sector discussed the time and location for its next meeting. The Sector supported having its next meeting immediately prior to the annual meeting of the Southern Weights and Measures Association which will be held in Annapolis, Maryland. Maryland Weights and Measures offered to host a tour of the Maryland NTEP facility in the morning of the first day of the meeting.

14. Multi-point Calibration (linearization) for Meters

Source: NTEP Laboratories

Background/Discussion: At the 2005 NTEP Laboratory Meeting, one of the labs noted a concern that some meter manufacturers are using multi-point calibration (linearization) to expand the range of flow rates for a meter submitted for type evaluation. Neither Handbook 44 nor Publication 14 prohibit or provide requirements for the use of multi-point calibration for meters. The laboratories agreed that, if multi-point calibrations are used during an evaluation, it must be noted on the CC for the device and that installations must include that feature. The laboratories also agreed that multi-point calibration should only be used to extend the range of flow rates beyond a turn-down ratio of 5 to 1. Any meter submitted for evaluation utilizing multi-point calibration must be able to meet test requirements over a turn-down ratio of 5 to 1 without multi-point calibration and then would be tested using multi-point calibration to expand the range of flow rates beyond a ratio of 5 to 1.

At the time of distribution of this agenda a specific proposal for addition to Handbook 44 or Publication 14 had not been submitted by any of the NTEP laboratories. This item is included on the agenda to alert the members of a concern and to solicit input on the subject that may appear as an agenda item at the next Sector Meeting.

Conclusion: The Sector discussed the concerns of the NTEP laboratories and agreed that the use of multi-point calibration should be restricted to only extending the turn-down range to a ratio of greater than 5 to 1. During the meeting the Sector developed a modification to Section "G" of the technical policy on page LMD – 6 of the 2005 edition of NCWM Publication 14 as shown below and agreed to forward the recommended change to the NTEP Committee for consideration.

Modify Publication 14 Technical Policy Section G. Range of Data Points as follows:

G. Range of Data Points

The number and types of tests to be run on devices covered under this checklist are specified in the Checklist and Test Procedures section and the Field Evaluation and Permanence Tests for Metering Systems section of this checklist. However, if the NTEP laboratory feels that there is a performance or other Handbook 44 related problem and provides reasons to support this belief, the laboratory is given the latitude to require additional testing.

Multi-point calibration shall be blind and integral (programmed during manufacture and not accessible in the field) to the measuring element or it shall not be used to establish the minimum flow range required (5:1 or 10:1, etc., as required). Programmable multi-point calibration can be used to extend the range of a system beyond the minimum range required for the measuring element. The use of multi-point calibration to extend the range will be noted on the CC.

15. Audit Trail Remote Configuration

Source: NTEP Laboratories

Background/Discussion: At the 2005 NTEP Laboratory Meeting, one of the labs noted a concern that some retail motor-fuel dispensers do not meet the sealing requirements for Category 1 devices because of the definition of remote configuration capability in Handbook 44. Remote configuration capability is defined as "the ability to adjust a weighing or measuring device or change its sealable parameters from or through some other device that is not itself necessary to the operation of the weighing or measuring device or is not a permanent part of that device." The mechanism for changing blend ratios on some dispensers, while not required for normal operation of the device, is not a "permanent" part of the device.

At the time of distribution of the agenda a specific proposal for addition to Handbook 44 or Publication 14 had not been submitted by any of the NTEP laboratories. This item was included on the agenda to alert the members of a concern and to solicit input on the subject that may appear as an agenda item at the next Sector Meeting.

The Sector discussed NIST Handbook 44 codes for liquid-measuring devices that do not have specific provisions for electronic sealing (i.e., audit trails) in the code, such as the Vehicle-Tank Meters Code or the LPG and Anhydrous Ammonia Metering-Devices Code. At the meeting, manufacturers of these devices stated that they have designed metering systems with electronic sealing capability with remote configuration capability. They are currently seeking an NTEP Certificate of Conformance (CC) for these systems. Currently the specific NIST Handbook 44 code for these devices does not address electronic sealing, but it is recognized in the General Code and under the provisions of G-A.3. Special and Unclassified Equipment. Accordingly, NTEP has made an *ad hoc* decision to apply the criteria in the LMD Code to these devices; however, the manufacturers would prefer specific language similar to that in the Liquid-Measuring Devices (LMD) Code. During the discussion, the Sector concluded that some of these new applications and other applications currently in use would have been classified as the former device Category 2 device.

Conclusion: The Sector agreed that the decision to remove Category 2 from the LMD Code and the Mass Flow Meters Code should be reversed and that provisions for electronic sealing should be added to liquid-measuring devices codes 3.30. Liquid-Measuring Devices, 3.31. Vehicle-Tank Meters, 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices, 3.34. Hydrocarbon Gas Vapor-Measuring Devices, 3.35. Milk Meters, and 3.38. Carbon Dioxide Liquid-Measuring Devices and agreed to forward that proposal to the Committee for consideration. The technical advisor, Dick Suiter, NIST, will develop the specific proposal for the recommended change to each of the codes listed above.

16. New Product Application for Meters and Formula for the Proper Calculation of Relative Error

(Note: This item was added to the agenda during the Sector meeting.)

Source: FMC Smith Meter

Recommendation: Amend Section "F" of the LMD Technical Policy in Publication 14 as shown in the proposal below:

Proposal: If a manufacturer wants to add a new product to an existing family of meters, the following criteria will be applied:

1. If the accuracy class in NIST Handbook 44 for the new product falls within the same NIST Handbook 44 accuracy class or a more strict accuracy class than the most strict accuracy class covered on the Certificate of Conformance, the entire range of meters sizes will be covered for product tested.

2. If the accuracy class in NIST Handbook 44 for the new product falls within a less strict NIST Handbook 44 accuracy class than the most strict accuracy class covered by the Certificate, the new product will only be covered for meters meeting the requirements of paragraph E, Meters Sizes to be included on a Certificate of Conformance.

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.

Make the following editorial change to NCWM Publication 14 LMD Checklists to add the formula for the proper calculation of relative error

Percent Error = [(Indicated – Actual) / Actual] x 100

Where "Actual" = the amount delivered corrected for appropriate influence factors.

Discussion/Conclusion: At the Sector meeting, FMC Smith Meter requested that Section "F" be modified, as shown above, to allow the addition of a new product to a CC that already includes product(s) from the same product family as the product to be added. FMC Smith Meter also suggested that the formula for proper calculation of relative error should be added to all of the LMD checklists to provide uniformity between the NTEP laboratories when calculating errors during NTEP evaluations. The Sector reviewed the proposed change to Section "F" and agreed to forward the proposal to the NTEP Committee for consideration. The Sector also agreed that the formula for proper calculation of relative error should be added to all of the LMD checklists to provide uniformity between the NTEP laboratories when calculating errors during NTEP evaluations.

Appendix A 2005 Measuring Sector Meeting Attendees				
Name	**Company/Agency**	**Address**	**Telephone #**	**E-Mail Address**
Katalinic, Allen	North Carolina Dept of Agriculture	1050 Mail Service Center Raleigh, NC 27699-1050	(919) 733-3313	None available
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Buxton, Joe	Daniel Measurement Control	19267 Hwy 301 N Statesboro, GA 30461	(912) 489-0253	Joe.buxton@emersonprocess.com
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Keilty, Mike	Endress & Hauser Flowtech AG	2350 Endress Place Greenwood, IN 46143	(317) 535-2745	michael.keilty@us.endress.com
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Appendix A 2005 Measuring Sector Meeting Attendees				
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