

## Appendix B

### National Type Evaluation Technical Committee (NTETC) Grain Analyzer Sector Meeting Summary

August 24 - 25, 2011  
Kansas City, Missouri

#### INTRODUCTION

The charge of the NTETC Grain Analyzer Sector (herein after referred to as “Sector”) is important in providing appropriate type evaluation criteria based on specifications, tolerances and technical requirements of NIST Handbook 44, *Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices*, Sections 1.10. General Code, 5.56.(a) and 5.56.(b) Grain Moisture Meters, and 5.57. Near-Infrared Grain Analyzers. The Sector’s recommendations are presented to the National Type Evaluation Program (NTEP) Committee each January for approval and inclusion in NCWM Publication 14, *Technical Policy, Checklists, and Test Procedures* for national type evaluation.

The Sector is also called upon occasionally for technical expertise in addressing difficult NIST Handbook 44 issues on the agenda of National Conference on Weights and Measures (NCWM) Specifications and Tolerances (S&T) Committee. Sector membership includes industry, NTEP laboratory representatives, technical advisors, and the NTEP Administrator. Meetings are held annually, or as needed and are open to all NCWM members and other registered parties.

Suggested revisions are shown in **bold face print** by ~~striking out~~ information to be deleted and underlining information to be added. Requirements that are proposed to be nonretroactive are printed in ***bold faced italics***.

**Note:** It is policy to use metric units of measurement in publications; however, recommendations received by NCWM technical committees and regional weights and measures associations have been printed in this publication as submitted. Therefore, the report may contain references to inch-pound units.

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**Table B**  
**Glossary of Acronyms and Terms**

<b>Acronym</b>	<b>Term</b>	<b>Acronym</b>	<b>Term</b>
AOCS	American Oil Chemists Society	NTEP	National Type Evaluation Program
ASP	Analytical Standards Program	NTETC	National Type Evaluation Technical Committee
CC	Certificate of Conformance	OCP	Ongoing Calibration Program
CWMA	Central Weights and Measures Association	OIML	International Organization of Legal Metrology
GAC		OWM	Office of Weights and Measures
GIPSA	Grain Inspection, Packers and Stockyards Administration	S&T	Specifications and Tolerances Committee
GMM	Grain Moisture Meter	SMA	Scale Manufacturers Association
HRW	Hard Red Winter	SQT	Soybean Quality Traits
ISU	Iowa State University	TW	Test Weight
NCWM	National Conference on Weights and Measures	UGMA	Unified Grain Moisture Algorithm
NIR	Near Infrared	USB	United Soybean Board
NIST	National Institute of Standards and Technology	USDA	United States Department of Agriculture

**Details of All Items**  
*(In order by Reference Key)*

**1. Report on the 2011 NCWM Interim and Annual Meetings**

The 96<sup>th</sup> Annual Meeting of NCWM was held July 17 - 21, 2011 in Missoula, Montana.

No Grain Moisture Meter (GMM) or Near Infrared (NIR) Grain Analyzer items appeared in the S&T Committee Interim Report for consideration by NCWM at the 2011 Annual Meeting.

Mr. Truex, NTEP Administrator, reported that 31 states were in attendance, down slightly from last year, but sufficient for a quorum. Although there were no items specifically directed to GMMs and NIR Grain Analyzers, there were three items of interest to the Sector:

1. S&T Item 310-1 – Provision for Sealing Electronic Adjustable Components: No changes were made to NIST Handbook 44, but the S&T Committee recommended language to be added to NCWM Publication 14. This item was placed on the S&T Consent Calendar and was subsequently adopted by voice vote. See Agenda Item 5.
2. S&T Item 310-2 Software – The NTETC Software Sector agreed to change the status of this item from Information to Developing because the item lacks enough information for full consideration and a full proposal has yet to be developed. See Agenda Item 6.
3. NTEP Committee Item 500-7 NCWM Publication 14, *Administrative Policy* – The Committee amended several sections of NCWM Publication 14, *Administrative Policy* to make it clear that the manufacturers/Certificate of Conformance (CC) holders are obligated to meet current NIST Handbook 44 requirements, regardless of when the devices covered by the NTEP certificate(s) were evaluated and the certificate was issued. Refer to the NTEP Committee Item 500-7 in the *Reports of the 96<sup>th</sup> National Conference on Weights and Measures* (2011).

## **2. Report on NTEP and Ongoing Calibration Program (OCP) (Phase II) Testing**

Ms. Brenner, Grain Inspection, Packers and Stockyards Administration (GIPSA), briefed the Sector on NTEP Grain Analyzer (Phase I) activity. One meter is currently in the laboratory for grain moisture and test weight per bushel evaluation. Type evaluation is nearing completion and she estimated that there should be activity on a CC within the next few weeks. If there are seven meters in Phase II for 2012, the cost to each manufacturer would go from the present \$8750 per type (with six meters) to \$10,175 per type (with seven meters). With eight meters in the program the cost per type climbs to \$12,185. The costs for 2011 have already been set at \$8750 per type.

Ms. Brenner also reported that annual GMM calibration reviews were completed on schedule and updated CCs were issued for six device types. Seven device types are presently enrolled in the OCP (Phase II) for the 2011 harvest.

## **3. Review of OCP (Phase II) Performance Data**

At the NTETC Grain Analyzer Sector's August 2005 Meeting it was 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, Ms. Brenner, GIPSA, presented data showing the performance of NTEP meters compared to the air oven. This data are based on the last three crop years (2008–2010) using calibrations updated for use during the 2011 harvest season.

There are still two meters that have not been in the program for the required three years, so data is shown for only four of the six meters. Next year's data should include data from one more meter. Only the GAC2100 has been identified on the comparisons. It is identified as "Official Meter". The remaining three instruments were randomly assigned numbers 1, 2 and 3, or, in the case of sunflowers, where only three meters have a sunflower calibration, A and B.

**Note:** The 2008-2010 GMM Phase II comparison graphs were distributed with the August 2011 NTETC Grain Analyzer Sector Agenda. Until completion of NCWM Interim Meeting, held in January 2012, they can be downloaded from NCWM web site at: [ncwm.net/content/grain-analyzer-docs](http://ncwm.net/content/grain-analyzer-docs).

After that time, all NTETC Grain Analyzer Sector Meeting documents will be moved to NCWM web site Meetings Archive Folder.

#### 4. Proposed Changes to NCWM Publication 14 to Address Issues Associated with the Expanded Grain Temperature Ranges of New Technology

##### Background/Discussion:

The recent introduction of GMMs utilizing a 149 MHz measurement frequency has made it possible to make accurate grain moisture measurements over a wider range of temperatures than were previously possible with the lower measurement frequencies used in older instruments. This has led to manufacturers requesting certification of wider grain temperature ranges and greater differences between instrument (room) and grain temperature. The type evaluation tests in the present GMM Section of NCWM Publication 14 do not adequately assess performance over these wider temperature ranges. Although the 149 MHz measurement frequency makes it possible to measure grain moisture at temperatures significantly below the freezing point of water, the acceptable accuracy of grain measurements below 0 °C has an upper moisture limit that will have to be specified.

Dr. Pierce, United States Department of Agriculture (USDA), GIPSA Technical Services Division, expressed concern that the Sector had not considered the ramifications of what might happen with an ambient temperature of 38 °C (100.4 °F). With a permissible difference of grain below ambient of 42 °C, the grain could be as low as - 4 °C. The meter would still be able to test frozen grain without an out of limits error.

Others pointed out that this applied only to grain types that have been listed on the CC with 42 °C room to grain temperature, provided the moisture is at or below 20 %. It was generally believed that meters that had passed a test with grain 42 °C below a room temperature of 22 °C would also pass a test with grain 42 °C below a room temperature of 38 °C.

Dr. Pierce recommended that the intermediate cold temperature should be near the freezing point. It was pointed out that before meters were submitted for testing frozen grain, manufacturers specified a  $\Delta T_C$  that resulted in cold test temperatures of either 0 °C or 2 °C and that these temperatures had been accepted as “intermediate” temperatures when the testing was extended to frozen grain. In the ensuing discussion it was generally agreed that a single intermediate cold temperature should not be forced on manufacturers.

The original recommendation was amended as shown below to incorporate these suggestions:

If room temperature minus  $\Delta T_C$  -Extreme is less than ~~-10~~ 0 °C an additional test will be conducted with an intermediate cold grain temperature ~~equal to room temperature minus one-half  $\Delta T_C$  -Extreme~~ specified by the manufacturer.

This modification required corresponding modifications to the original recommendations in 4(a), 4(b), and 4(c) that were shown in the Agenda. With these modifications the Sector agreed by consensus that the changes described in 4(a), 4(b), 4(c), and 4(d) below be included in the next edition of NCWM Publication 14.

A draft version of this meeting summary was circulated to the Sector Chair, NTEP Administrator, the National Institute of Standards and Technology (NIST) Technical Advisor, and representatives of the NTEP Participating Laboratory. Ms. Brenner, GIPSA, replied with a recommendation to add the sentence, “The intermediate cold grain temperature specified by the manufacturer should be the temperature used for grains that will not be tested when frozen” to the wording shown above to reflect the intent to limit the intermediate cold temperatures to those cold temperatures used before meters were tested for frozen grain. Mr. Truex, NTEP Administrator, ruled that this addition to the Background/Discussion portion of Item 4, and the corresponding additions to Items 4(a) and 4(c) could be considered editorial in nature and would not require a committee ballot. The final recommendation is shown below:

If room temperature minus  $\Delta T_C$  -Extreme is less than ~~-10~~ 0 °C an additional test will be conducted with an intermediate cold grain temperature ~~equal to room temperature minus one-half  $\Delta T_C$  -Extreme~~ specified by the manufacturer. The intermediate cold grain temperature specified by the manufacturer should be the temperature used for grains that will not be tested when frozen.

**Conclusion:**

Make the following changes and additions to the GMM chapter of the 2011 edition of NCWM Publication 14 to address the expanded grain temperature ranges of new technology:

**4.a. Proposed Changes to Test Procedures and Tolerances:**

**II. Sample Temperature Sensitivity**

Testing is required to verify that accurate results are provided when the sample and instrument are at different temperatures. This will be referred to as the sample temperature sensitivity test. The sample temperature sensitivity test will be conducted using corn, Hard Red Winter (HRW) wheat, and soybean samples. Tests will be conducted with the instrument at room temperature and the sample temperature varying from room temperature plus  $\Delta T_H$  to room temperature minus  $\Delta T_{C-Extreme}$  where  $\Delta T_H$  is the magnitude of the manufacturer specified maximum difference for grain above room temperature and  $\Delta T_{C-Extreme}$  is the magnitude of the manufacturer specified maximum difference for grain below room temperature. **If room temperature minus  $\Delta T_{C-Extreme}$  is less than 0 °C an additional test will be conducted with an intermediate grain temperature specified by the manufacturer. The intermediate cold grain temperature specified by the manufacturer should be the temperature used for grains that will not be tested when frozen.**

In no case will room temperature plus  $\Delta T_H$  be allowed to exceed 45 °C **but,  $\Delta T_H$  need not equal  $\Delta T_C$  and in no case will room temperature minus  $\Delta T_{C-Extreme}$  be allowed to be less than - 20 °C.** For purposes of these tests, room temperature will be defined as 22 °C  $\pm$  2 °C.

Two (2) samples will be selected from each of three 2 % moisture intervals for each of the three grains - corn, HRW wheat, and soybeans. Three analyses will be made for each grain sample at each of the ~~three~~ test temperatures. The overall bias for the 18 observations (2 samples  $\times$  3 moisture intervals  $\times$  3 replicates) run at the **Extreme Cold, Cold (if required), and Hot** temperatures must agree with the room temperature results within the following tolerances:

Corn	0.45
Wheat	0.35
Soybeans	0.35

*Note: When changes are made in corn, soybeans, or hard red winter wheat calibrations, the Sample Temperature Sensitivity Test will have to be repeated unless spectral or other such "raw" data are available from an earlier Sample Temperature Sensitivity Test performed by the NTEP Laboratory on the same device type. When such "raw" data are available, the manufacturer will be required to predict performance at each temperature using the new calibration. If no "raw" data are available and the manufacturer can show that the temperature compensation factor (or factors) are unchanged and are independent of other calibration parameters, the Sample Temperature Sensitivity Test will not have to be repeated. For performance limits, test instructions, and testing requirements applicable to the "other 12" NTEP grains (e.g., grains other than corn, soybeans, and hard red winter wheat), see Appendix D.*

**4.b. Proposed Changes to Appendix A – Laboratory Performance and Test Procedures:**

**TEST: Sample Temperature Sensitivity**

Equipment Needed: Thermometers and Environmental Cabinet

Temperature: Instrument = 22 °C  $\pm$  2 °C  
Sample = 22 °C  $\pm$  2 °C ( $\pm$  manufacturer specified temperature difference (T))  
Sample(s) Required: HRW-2 Each  
Moisture: 10 % to 12 %  
          12 % to 14 %  
          14 % to 16 %

Sample(s) Required: Soybeans-2 Each

Moisture: 10 % to 12 %  
 12 % to 14 %  
 14 % to 16 %  
 Sample(s) Required: Corn-2 Each  
 Moisture: 12 % to 14 %  
 14 % to 16 %  
 16 % to 18 %

Separate Sample Required for Each **Model**: Yes  
 Separate Sample Required for Each **Instrument**: No

**General Information:**

**In the following Test Procedure, the temperature equal to room temperature minus  $\Delta T_{C-Extreme}$  will be referred to as “Extreme Cold,” and the intermediate cold temperature specified by the manufacturer will be referred to as “Cold.” Room Temperature plus  $\Delta T_H$  will be referred to as “Hot.” For purposes of these tests, room temperature will be defined as  $22\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ .**

**Test Sequence:**

1. Power on instruments.
2. Analyze the HRW 10 % to 12 % room temperature sample 3 times on each instrument, *see example*.

Analyses	Replicate	Instrument
1	1	1
2	1	2
3	2	1
4	2	2
5	3	1

3. Repeat step 2 for the second sample.
4. Repeat steps 2 to 3 for the 12 % to 14 % samples.
5. Repeat steps 2 to 3 for the 14 % to 16 % samples.
6. Place the **HRW** samples in the Environmental cabinet set at  **$22\text{ }^{\circ}\text{C}$ —AT Extreme Cold**.
7. Repeat steps 2 to 5 for the room temperature Soybean samples, **and place them in the Environmental Cabinet.**
8. Repeat steps 2 to 5 for the room temperature Corn samples, **and place them in the Environmental Cabinet.**
9. After all of the samples have equilibrated to  **$22\text{ }^{\circ}\text{C}$ —AT Extreme Cold** for at least 4 hours, remove the first HRW sample from the cabinet. After checking the sample temperature, make the first analysis of HRW 1 on instrument 1. Samples must be within  $\pm 1/2\text{ }^{\circ}\text{C}$  of the target temperature.
10. Return HRW 1 to the cabinet. Run HRW 2 on instrument 2.

*Note: The sample cell on each instrument is given a minimum of 10 minutes to equilibrate to room conditions before the next sample is analyzed. **Each sample is to be checked for temperature before it is analyzed. Samples must be within 0.5 °C of the desired test temperature at time of analysis, and samples are to be reconditioned to the test temperature after each analysis.***

11. In order to efficiently analyze the samples, run all of the odd numbered samples on instrument 1 and all of the even numbered samples on instrument 2 starting with HRW then soybeans and ending with corn. By the time the last corn sample has been analyzed, the HRW samples should be reconditioned to the target temperature. Run the odd numbered samples on instrument 2 and the even numbered samples on instrument 1 to complete the replicate 1 analysis. Repeat until all samples have been analyzed 3 times on each instrument. *See Preferred Test Sequence.*

*Note: Approximately 1½ to 2 hours will be required to complete the first test cycle. Depending upon sample size, it may be necessary to wait until samples are within  $\pm 1/2^{\circ}\text{C}$  of the target temperature before completing the second test cycle for Replicate 1.*

12. After all the **Extreme eCold** analyses are performed, allow the samples to equilibrate to room temperature for at least 4 hours.
13. Repeat steps 2 to 5 (Room 2) for the room temperature HRW samples.
14. Place the **HRW** samples in the Environmental eCabinet set at **22 °C + AT Cold**.
15. Repeat steps 13 to 14 for the room temperature Soybean samples, **and place them in the Environmental Cabinet.**
16. Repeat steps 13 to 14 for the room temperature Corn samples, **and place them in the Environmental Cabinet.**
17. After all of the samples have equilibrated to **22 °C + AT Cold** for at least 4 hours, run the **hot Cold** samples using the same test sequence used for the **Extreme eCold** samples.
18. After all the **hot Cold** analyses are performed, allow the samples to equilibrate to room temperature for at least 4 hours.
19. Repeat steps 2 to 5 (Room 3) for the room temperature HRW samples.  
**20. Place the HRW samples in the Environmental Cabinet set to Hot.**
- ~~20~~1. Repeat step 19 for the room temperature Soybean samples, **and place them in the Environmental Cabinet.**
- ~~21~~2. Repeat step 19 for the room temperature Corn samples, **and place them in the Environmental Cabinet.**
- 23. After all the Hot analyses are performed, allow the samples to equilibrate to room temperature for at least 4 hours.**
- 24. Repeat steps 2 to 5 (Room 4) for the room temperature HRW samples.**
- 25. Repeat step 24 for the room temperature Soybean samples.**
- 26. Repeat step 24 for the room temperature Corn samples.**

Preferred Test Sequence		
Cycle	Instrument 1	Instrument 2
1	HRW 1	HRW 2
	HRW 3	HRW 4
	HRW 5	HRW 6
	SOY 1	SOY 2
	SOY 3	SOY 4
	SOY 5	SOY 6
	CORN 1	CORN 2
	CORN 3	CORN 4
	CORN 5	CORN 6
Cycle	Instrument 1	Instrument 2
2	HRW 2	HRW 1
	HRW 4	HRW 3
	HRW 6	HRW 5
	SOY 2	SOY 1
	SOY 4	SOY 3
	SOY 6	SOY 5
	CORN 2	CORN 1
	CORN 4	CORN 3
	CORN 6	CORN 5

The two cycles need to be repeated twice to complete the three replicates of all samples on both instruments.

***Note: If the intermediate Cold temperature is not required, eliminate steps 13 through 19 above and use the results of steps 19 to 22 (Room 3) for (Room 2).***

#### 4.c. Proposed Changes to Appendix E - Sample Temperature Sensitivity

(for grains/oil seeds other than corn, soybeans and hard red winter wheat)

This Appendix specifies the procedure for conducting the sample temperature sensitivity test on NTEP grains/oilseeds other than corn, soybeans, and hard red winter wheat. Tests will be conducted with the instrument at room temperature and sample temperature varying from room temperature plus  $\Delta T_H$  to room temperature minus  $\Delta T_{C-Extreme}$  (where  $\Delta T_H$  is the manufacturer specified difference above room temperature for the grains in Section II, and  $\Delta T_{C-Extreme}$  is the manufacturer specified difference for below room temperature for those grains.) **If room temperature minus  $\Delta T_{C-Extreme}$  is less than 0 °C an additional test will be conducted with an intermediate grain temperature specified by the manufacturer. The intermediate cold grain temperature specified by the manufacturer should be the temperature used for grains that will not be tested when frozen.**

**In the following Test Procedure, the temperature equal to room temperature minus  $\Delta T_{C-Extreme}$  will be referred to as “Extreme Cold,” and the intermediate cold temperature specified by the manufacturer will be referred to as “Cold.” Room Temperature plus  $\Delta T_H$  will be referred to as “Hot.” For purposes of these tests, room temperature will be defined as 22 °C ± 2 °C.**

A device submitted for this test must be capable of transmitting, via its communications interface, "raw" data as well as date, grain type, predicted moisture result, and calibration version identification and recording in Standard Data Format on 3.5 inch diskette all the information listed in Appendix C. If the device itself does not include the necessary keyboard or disk drive, the manufacturer must supply a personal computer and the necessary software to build a file as described in Appendix C.

*Note:* Two (2) samples are to be selected from each of three 2 % moisture intervals for each grain type for which the test is to be performed. Two analyses will be made for each grain sample at each of the ~~three~~ test temperatures. The overall bias for the 12 observations (2 samples × 3 moisture intervals × 2 replicates) run at the Extreme Cold, Cold (if required), and Hot temperatures ~~extremes~~ must agree with the room temperature results within the tolerances listed in the accompanying table.

**Test Procedure:**

1. Analyze the room temperature samples on the test instrument (Room 1).
2. Condition samples to the ~~cold~~ Extreme Cold temperature and run them on the instrument under test ~~cold~~ Extreme Cold.

*Note:* Each sample is to be checked for temperature before it is analyzed. Samples must be within 0.5 °C of the desired test temperature at time of analysis, and samples are to be reconditioned to the test temperature after each analysis. The sample cell on the instrument under test is to be given a minimum of 10 minutes to equilibrate to room conditions between sample analyses.

3. Bring the samples to room temperature, and run the samples on the instrument under test (Room 2).
4. Condition the samples to the ~~hot~~ Cold temperature and run them on the instrument under test ~~hot~~ Cold, observing the precautions in the note following step 2.
5. Repeat step 3 to obtain another set of room temperature results (Room 3).
6. Condition the samples to the Hot temperature and run them on the instrument under test Hot, observing the precautions in the note following step 2.
7. Repeat step 3 to obtain another set of room temperature results (Room 4).

*Note:* If the intermediate Cold temperature is not required, eliminate step 4 above and use the results of step 3 (Room 2) for step 5 (Room 3).

**EXTREME COLD BIAS = Extreme Cold - ((Room 1 + Room 2) / 2)**

COLD BIAS = Cold - ((Room ~~1~~2 + Room ~~2~~3) / 2)

HOT BIAS = Hot - ((Room ~~2~~3 + Room ~~3~~4) / 2)

*Note:* When changes are made in any of the "other 12" calibrations, the Sample Temperature Sensitivity Test will have to be repeated unless spectral or other such "raw" data are available from an earlier Sample Temperature Sensitivity Test performed on the same device type by the NTEP Laboratory. When such "raw" data are available, the manufacturer will be required to predict performance at each temperature using the new calibration.

**Moisture Ranges and Tolerances for Sample Temperature Sensitivity (for the "Other 12" NTEP grains)**

Grain Type	Moisture Range for Test	Tolerance Limit (Bias at <u>Extreme Cold, Cold, and Hot</u> <u>Temperatures Extremes</u> )
Durum Wheat	10 % – 16 %	0.35
Soft White Wheat	10 % – 16 %	0.35
Hard Red Spring Wheat	10 % – 16 %	0.35
Soft Red Winter Wheat	10 % – 16 %	0.35
Hard White Wheat	8 % – 14 %	0.35
Sunflower Seed (Oil)	6 % – 12 %	0.45
Grain Sorghum	10 % – 16 %	0.45
Two-Rowed Barley	10 % – 16 %	0.35
Six-Rowed Barley	10 % – 16 %	0.45
Oats	8 % – 14 %	0.45
Long Grain Rough Rice	10 % – 16 %	0.45
Medium Grain Rough Rice	10 % – 16 %	0.45

**4.d. Proposed Changes to GMM Checklist**

**1. Indicating Elements, Recording Elements and Recorded Representations**

**Code Reference: S.1.3. Operating Range**

1.10. The operating range shall specify the following:

1.10.3. The ambient temperature range over which the meter may be used is specified and moisture results are neither displayed nor printed outside this range.  Yes  No  N/A

1.10.4. The temperature range for each grain or seed for which the meter is to be used is specified and moisture results are neither displayed nor printed outside this range.  Yes  No  N/A

**1.10.4.1. If a grain or seed has multiple temperature ranges each intended for use over a different moisture range, the moisture ranges are specified for each temperature range, and moisture results are neither displayed nor printed if outside the applicable moisture or temperature ranges.**  Yes  No  N/A

**5. Item 310-1 Provision for Sealing Electronic Adjustable Components**

**Background/Discussion:**

This item originated from the Southern Weights and Measures Association and first appeared on the S&T Committee's 2008 agenda.

NTEP evaluators inspected some devices that could be sealed in an "adjustment" mode which would allow the user to make adjustments without breaking a physical security seal. NTEP started receiving an increasing number of reports that users and service agents were not following the instructions in the user's manuals for these devices, thus rendering the method of sealing ineffective.

The purpose of the original submitter's proposed changes were intended to clarify what is considered an effective method of sealing metrological features, and what information is required to be indicated and recorded when a device is in a metrological adjustment mode.

The 92<sup>nd</sup> through 96<sup>th</sup> NCWM S&T Committees, regional weights and measures associations, NTETC Sectors, and other interested parties have considered several proposals intended to address this issue. Throughout these deliberations, it became apparent that a single interpretation of G-S.8. was needed and should be distributed to the NTEP laboratories so that type evaluation procedures for sealing could be reviewed and, if necessary, amended.

The 2010 S&T Committee agreed with comments that no changes were needed to paragraph G-S.8. Consequently, the Committee developed an amended proposal in its 2010 Committee Report, and recommended that the amended proposal be given Informational status to allow interested parties sufficient time to analyze and comment on the most recent language.

The NTETC Weighing Sector and Scale Manufacturers Association (SMA) both recommended that the item be withdrawn, believing that type evaluation procedures have been amended in applicable sections of NCWM Publication 14 to address the issues of incorrectly applying the requirements in G-S.8.

Although the S&T Committee agreed with the comments to withdraw this item, it was concerned that its interpretation would be overlooked in the future if the item was Withdrawn. The Committee agreed to remove the language originally proposed in its 2011 NCWM Interim Meeting Agenda and proposed revised language for consideration as a Voting Item. The Committee further recommended that NTETC Sectors consider adding the language to the applicable "Philosophy for Sealing" appendices in NCWM Publication 14.

The proposed language was made a Voting Item for the 2011 NCWM Annual Meeting. After discussing the comments from the 2011 NCWM Annual Meeting Open Hearings and the proposed changes from NIST, Office of Weights and Measures (OWM), the Committee modified the Item Under Consideration to read as follows:

**Item Under Consideration:**

**The current language in paragraph G-S.8. states: "A device shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism."**

**Thus, for parameters protected by physical means of security, once a physical security seal is applied to the device, it should not be possible to make a metrological change to those parameters without breaking that seal. Likewise, for parameters protected by electronic means of security, it should not be possible to make a metrological change to those parameters without that change being reflected in the audit trail. Since this philosophy addresses provisions for protecting access to any metrological adjustment, the philosophy should be applied consistently to all electronic device types.**

See the 2008 NCWM Annual, 2009 and 2010 Interim and Annual Reports for additional background information. The "Item Under Consideration" was placed on the S&T Consent Calendar and was adopted by the 96<sup>th</sup> Annual Conference.

This item is a carryover from the 2009 NTETC Grain Analyzer Sector Meeting (Agenda Item 9) and again in 2010 (Agenda Item 5). At the Sector's August 2011 meeting, Mr. Truex, NTEP Administrator, notified the Sector that he will add the modified "Item Under Consideration" as shown above to Appendix B of the GMM Chapter of the 2011 edition of NCWM Publication 14 and to Appendix A of the NIR Grain Analyzer Chapter of the 2011 edition of NCWM Publication 14. Sector action would not be required on items 5(d) and 5(e).

### 5.a. Proposed Changes to NIST Handbook 44, Table S.2.5., Section 5.56.(a)

#### **Background/Discussion:**

Table S.2.5. Categories of Device and Methods of Sealing that appears in §5.56.(a) of NIST Handbook 44 lists acceptable methods of sealing for various categories of GMMs. When the Sector first recommended adding the table to NIST Handbook 44 at their September 1996 meeting, the concept of making a change to a GMM from a remote site involved information "...sent by to the device by modem (or computer)." In 2011, this concept has expanded to include the ability of the measuring device to accept new or revised sealable parameters from a memory chip, external computer, network, or other device plugged into a mating port (e.g., USB port) on the measuring device or connected wirelessly to the measuring device.

All of the GMMs in Categories 3, 3a, and 3c of Table S.2.5. use an electronic method of sealing, and most of them also offer access to the configuration mode thorough a keyboard entered password. In this mode, sealable parameters can also be changed locally through the keyboard. Category 3 of Table S.2.5. currently includes the following requirement:

When accessed remotely for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measuring mode.

The Sector agreed by consensus that the following changes to Table S.2.5. of §5.56.(a) of NIST Handbook 44 should be forwarded to the S&T Committee for consideration:

- Add a note to Table S.2.5. to recognize the expanded scope of "remote capability".
- Delete "remotely" from the second paragraph of Category 3 requirements that begins, "When accessed remotely ..." to make it clear that the requirements of Category 3 apply whether accessed manually using the keyboard or accessed by remote means.
- Add the modified second paragraph of Category 3 requirements to Categories 3a and 3b to make it clear that these requirements apply to all the subcategories of Category 3.

The proposed changes to Table S.2.5. are shown below as Item Under Consideration.

The Sector also agreed that contingent upon acceptance of Item Under Consideration the changes to the GMM Chapter of NCWM Publication 14 shown in Agenda Items 5(b) and 5(c) should be made.

**Item Under Consideration NIST Handbook 44:**

<b>Table S.2.5. Categories of Device and Methods of Sealing</b>	
<b>Categories of Device</b>	<b>Methods of Sealing</b>
<p><b>Category 1:</b> No remote configuration capability.</p>	<p>Seal by physical seal or two event counters: one for calibration parameters (000 to 999) and one for configuration parameters (000 to 999). If equipped with event counters, the device must be capable of displaying, or printing through the device or through another on-site device, the contents of the counters.</p>
<p><b>Category 2:</b> Remote configuration capability, but access is controlled by physical hardware.</p> <p>A device shall clearly indicate that it is in the remote configuration mode and shall not be capable of operating in the measure mode while enabled for remote configuration.</p>	<p>The hardware enabling access for remote communication must be at the device and sealed using a physical seal or two event counters: one for calibration parameters (000 to 999) and one for configuration parameters (000 to 999). If equipped with event counters, the device must be capable of displaying, or printing through the device or through another on-site device, the contents of the counters.</p>
<p><b>Category 3:</b> Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).</p> <p>When accessed <del>remotely</del> for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measuring mode.</p>	<p>An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter (for calibration changes consisting of multiple constants, the calibration version number may be used rather than the calibration constants). A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to twenty-five (25) times the number of sealable parameters in the device, but not more than 1000 records are required. (Note: Does not require 1000 changes to be stored for each parameter.)</p>
<p><b>Category 3a:</b> No remote capability, but operator is able to make changes that affect the metrological integrity of the device (e.g., slope, bias, etc.) in normal operation.</p> <p><u>When accessed for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measuring mode.</u></p>	<p>Same as Category 3</p>
<p><b>Category 3b:</b> No remote capability, but access to metrological parameters is controlled through a software switch (e.g., password).</p> <p><u>When accessed for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measuring mode.</u></p>	<p>Same as Category 3</p>
<p><b>Note:</b> In addition to the definition of remote configuration capability as defined in Appendix D of HB44, as used in this table, “remote configuration capability” also includes the ability of the measuring device to accept new or revised sealable parameters from a memory chip, external computer, network, or other device plugged into a mating port (e.g., USB port) on the measuring device or connected wirelessly to the measuring device.                      (Added 201X)</p>	

[Nonretroactive as of January 1, 1999 and January 1, 20XX]

(Amended 1998 and 20XX)

Note: Zero-setting and test point adjustments are considered to affect metrological characteristics and must be sealed.  
 (Added 1993) (Amended 1995 and 1997)

**5.b. Proposed Changes to NCWM Publication 14, GMM Appendix C, Table S.2.5.**

Changes shown below are contingent upon acceptance of Item Under Consideration.

**Table S.2.5. Categories of Device and Methods of Sealing**

<b>Categories of Device</b>	<b>Method of Sealing</b>
<p><b>Category 1:</b> No remote configuration capability</p>	<p>Seal by physical seal or two event counters: one for calibration parameters (000 to 999) and one for configuration parameters (000 to 999.) If equipped with event counters, the device must be capable of displaying, or printing through the device or through another on-site device, the contents of the counters.</p>
<p><b>Category 2:</b> Remote configuration capability, but access is controlled by physical hardware.</p> <p>Device shall clearly indicate that it is in the remote configuration mode and shall not be capable of operating in the measure mode while enabled for remote configuration.</p>	<p>The hardware enabling access for remote communication must be at the device and sealed using a physical seal or two event counters; one for calibration parameters (000 to 999) and one for configuration parameters (000 to 999.) If equipped with event counters, the device must be capable of displaying, or printing through the device or through another on-site device, the contents of the counters.</p>
<p><b>Category 3:</b> Remote configuration capability, access may be unlimited or controlled through a software switch (e.g. password.)</p> <p>When accessed <del>remotely</del> for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measure mode.</p>	<p>An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change and the new value of the parameter (for calibration changes consisting of multiple constants, the calibration version number may be used rather than the calibration constants.) A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to twenty-five (25) times the number of sealable parameters in the device, but not more than 1000 records are required. <i>(Note: Does not require 1000 changes to be stored for each parameter.)</i></p>
<p><b>Category 3a:</b> No remote capability, but operator is able to make changes that affect the metrological integrity of the device (e.g. slope, bias, etc.) in normal operation.</p> <p><u>When accessed for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measure mode.</u></p>	<p>Same as Category 3</p>

Categories of Device	Method of Sealing
<p><b>Category 3b:</b> No remote capability, but access to metrological parameters is controlled through a software switch (e.g. password.)</p> <p><u>When accessed for the purpose of modifying sealable parameters, the device shall clearly indicate that it is in the configuration mode and shall not be capable of operating in the measure mode.</u></p>	<p>Same as Category 3</p>

*[Non-retroactive as of January 1, 1999]*

*(Amended 1998 and 20XX)*

**5.c. Proposed Changes to NCWM Publication 14, GMM Checklist**

Changes shown below are contingent upon acceptance of Item Under Consideration.

**2. Design of Measuring Elements**

**For Category 3 Devices:**

- 2.10.5. If a measurement is in process when the device is accessed ~~remotely~~ for the purpose of modifying sealable parameters, the measurement is either:  Yes  No  N/A
- Terminated Before Results can be Displayed or Printed. **OR**
  - Completed Before Entering the Configuration Mode
- 2.10.6. When accessed ~~remotely~~ for the purpose of modifying sealable parameters, the device clearly indicates that it is in the configuration mode and is not capable of operating in the measure mode.  Yes  No  N/A

**5.d. Proposed Changes to NCWM Publication 14, GMM Appendix B**

**Appendix B**

**Philosophy for Sealing**

**Typical Features to be Sealed**

**Principles for Determining Features to be Sealed**

The need to seal some features depends upon:

- The ease with which the feature or the selection of the feature can be used to facilitate fraud. **AND**
- The likelihood that the use of the feature will result in fraud not being detected.
- 

**5.e. Proposed Changes NCWM Publication 14, NIR Appendix A**

**Appendix A**

**Philosophy for Sealing**

**Typical Features to Be Sealed**

**Principles for Determining Features to Be Sealed**

The need to seal some features depends upon:

- The ease with which the feature or the selection of the feature can be used to facilitate fraud. **AND**
- The likelihood that the use of the feature will result in fraud not being detected.

Features or functions which are routinely used by the operator as part of device operation, such as selecting the grain calibration to be used, are not sealable parameters and shall not be sealed.

#### 5.f. Proposed Changes to NCWM Publication 14, NIR Checklist

NIR Grain Analyzers use an electronic method of sealing similar to those of GMMs, and most of them also offer access to the configuration mode through a keyboard entered password. In this mode, sealable parameters can be changed locally through the keyboard. The Sector agreed that contingent upon acceptance of Item Under Consideration the NIR Check List of NCWM Publication 14 should be modified to delete “remotely” from section 4 Design of NIR Analyzers, paragraph 4.9.16 as shown below.

#### 4. Design of NIR Analyzers

##### **For Category 3 Devices:**

- 4.10.7. If a measurement is in process when the device is  Yes  No  N/A accessed ~~remotely~~ for the purpose of modifying sealable parameters, the measurement is either:

#### 6. Item 310-2: G-S.1. Identification. – (Software)

##### **Source:**

2010 Carryover Item 310-3. This item originated from the NTETC Software Sector and first appeared on the S&T Committee’s 2007 agenda as Developing Item Part 1, Item 1.

##### **Background/Discussion:**

This proposal is intended to amend the identification marking requirements for all electronic devices manufactured after a specified date by requiring that metrological software version or revision information be identified. Additionally, the proposal will list methods, other than “permanently marked,” for providing the required information.

After the 2008 NCWM Annual Meeting, the S&T Committee received the NTETC Software Sector’s 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. The proposal listed “acceptable” and “not acceptable” methods for presenting:

- NTEP CC Number
- Make
- Model
- Serial Number
- Software Version / Revision Number

At the 2009 NCWM Interim Meeting, SMA commented that it has consistently opposed having different requirements between embedded and downloadable/programmable software-based devices. The SMA added that it continues to support the intent of the proposal and will continue to participate in the NTETC 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, or dropdown menus). The 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. The SMA 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.

This item remained Informational to allow NCWM members to further study the proposal in order to develop a consensus on the format for Table G S.1. Identification in the NTETC Software Sector's 2009 Meeting Summary.

During the 2011 NCWM Annual Meeting Open Hearings, the S&T Committee heard from NIST, OWM relative to whether or not the status of this item should be changed from Informational to Developing in order to provide the NTETC Software Sector additional time to more fully develop the item.

The S&T Committee discussed the comments offered by NIST, OWM and the SMA. After considering those comments, the Committee agreed to change the status of this item from Informational to Developing because the item lacks enough information for full consideration and a full proposal has yet to be developed.

**Conclusion:**

The NTETC Grain Analyzer Sector had no comments other than those previously submitted. See GS August 2010 Meeting Summary, Agenda Item 6.

**7. Other Software Requirements That May Impact Grain Analyzers**

The items under this heading are mostly excerpts from the NTETC Software Sector's March 2010 Meeting Summary intended to keep NTETC Grain Analyzer Sector Members informed of developmental software requirements that may impact grain analyzers. For additional information, see the complete NTETC Software Sector 2011 Meeting Summary. This meeting summary was not available at the time of the NTETC Grain Analyzer Sector Meeting. No action was taken on this item at the August 2011 Sector meeting.

**7.a. Identification of Certified Software**

*Note: This item is now partially covered by the provisional proposal to make G-S.1.(d) applicable to software-based electronic devices and by adding the following new sub-subparagraph G S.1.(d)(3):*

“The version or revision identifier shall be directly and inseparably linked to the software itself. The version or revision identifier may consist of more than one part, but at least one part shall be dedicated to the metrologically significant software.”

Also, the NTETC Software Sector recommends the following information be added to NCWM Publication 14 as explanation/examples:

- Unique identifier must be displayable/printable on command or during operation, etc.
- At a minimum, a version/revision indication (1.02.09, rev 3.0 a, etc.). Could also consist of/contain checksum, etc. (crc32, for example).

**NTETC Software Sector Conclusions:**

The item needs additional discussion and development by the NTETC Software Sector. Outstanding questions:

- If we allow hard-marking of the software identifier (the Sector has wavered on this in the past), does the above wording then imply that some mechanical means is required (i.e. physical seal) to “inseparably link” the identifier to the software?
- Do we still have to be able to display/print the identifier if it is hard-marked?

## 7.b. Software Protection/Security

### Background/Discussion:

The NTETC Software Sector derived a trial NCWM Publication 14 checklist based on the International Organization of Legal Metrology (OIML) checklist to verify that the software adequately protected against fraudulent modification as well as accidental or unintentional changes. The checklist has been distributed to current NTEP laboratories for use on a trial basis for new type approval applications.

### 1. Devices with Embedded Software TYPE P (aka built-for-purpose)

- 1.1. Declaration of the manufacturer that the software is used in a fixed hardware and software environment. **AND**  Yes  No  N/A
- 1.2. 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.*

- 1.3. The software documentation contains:
- 1.3.1. Description of all functions, designating those that are considered metrologically significant.  Yes  No  N/A
- 1.3.2. Description of the securing means (evidence of an intervention).  Yes  No  N/A
- 1.3.3. Software Identification  Yes  No  N/A
- 1.3.4. Description how to check the actual software identification.  Yes  No  N/A
- 1.4. The software identification is:
- 1.4.1. Clearly assigned to the metrologically significant software and functions.  Yes  No  N/A
- 1.4.2. Provided by the device as documented.  Yes  No  N/A

### 2. 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)

- 2.5. The metrologically significant software is:
- 2.5.1. Documented with all relevant (see below for list of documents) information.  Yes  No  N/A
- 2.5.2. Protected against accidental or intentional changes.  Yes  No  N/A
- 2.6. 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

### 3. Software with Closed Shell (no access to the operating system and/or programs possible for the user)

- 3.7. 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
- 3.8. Check whether the manufacturer has submitted a written declaration of the completeness of the set of commands.  Yes  No  N/A

**4. Operating System and/or Program(s) Accessible for the User**

- 4.1. 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 Weights and Measures jurisdiction and type-specific parameters).  Yes  No  N/A
- 4.2. 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

**5. Software Interface(s)**

- 5.1. Verify the manufacturer has documented:
- 5.1.1. The program modules of the metrologically significant software are defined and separated.  Yes  No  N/A
- 5.1.2. The protective software interface itself is part of the metrologically significant software.
- 5.1.3. The functions of the metrologically significant software that can be accessed via the protective software interface.  Yes  No  N/A
- 5.1.4. The parameters that may be exchanged via the protective software interface are defined.  Yes  No  N/A
- 5.1.5. The description of the functions and parameters are conclusive and complete.  Yes  No  N/A
- 5.1.6. There are software interface instructions for the third party (external) application programmer.  Yes  No  N/A

The laboratories again indicated they had not had a chance to utilize the checklist. The list was reviewed and some minor modifications to the checklist text were incorporated as shown above.

**NTETC Software Sector Conclusion:**

Work is ongoing on this item with the intent that it eventually be incorporated as a checklist in NCWM Publication 14; again the labs are requested to try utilizing this checklist for any evaluations on software-based electronic devices.

**7.c. Software Maintenance and Reconfiguration**

**Background/Discussion:**

The NTETC Software Sector agreed that the two definitions below for Verified Update and Traced Update were acceptable.

**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.

The NTETC Software Sector also worked towards language proposed for defining the requirements for a Traced Update (currently considered as relevant for NCWM Publication 14):

**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.**

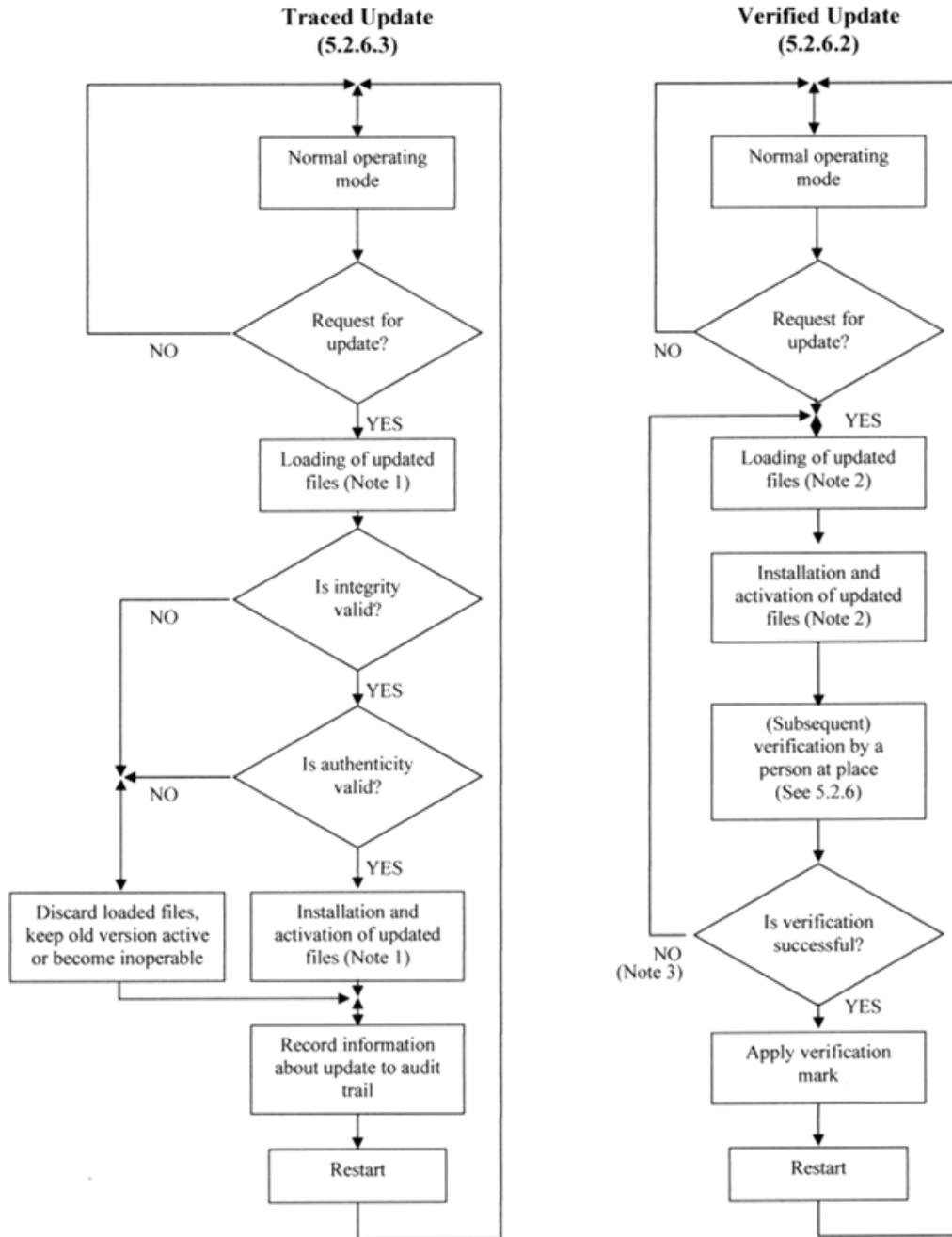
**Use of a Category 3 audit trail is required for the Traced Update. If software update is the only loggable event, then the Category 3 audit trail can be limited to only 10 entries. A log entry representing a software update shall include the software identification of the newly installed version.**

**NTEC Software Sector Conclusions:**

The general consensus of the Sector after considering feedback from external interested parties is that a new G-S.9. with explicit requirements [for Metrologically Significant Software] is not necessary (nor likely to be adopted by NCWM) and that this requirement belongs in NCWM Publication 14 lists of sealable parameters rather than in NIST Handbook 44; that is:

**The updating of metrologically significant software shall be considered a sealable event.**

Additional work is to be done to further develop the proposed text toward inclusion in NCWM Publication 14. At its August 2009 NTETC Grain Analyzer Sector Meeting the Sector questioned the need for a definition of “Traced Update”. The Traced Update was initially intended to cover cases in Europe where the National Body controls a network of devices and wants to update all the devices simultaneously from a central location. Denmark and France do this with NIR Grain Analyzers. Even though individual states may still require that a device updated via a “Traced Update” must be “returned to service” by a registered serviceperson before it can be used, the Sector may want to consider adopting “Traced Update” requirements for all Category 3 Grain Analyzers. The device is still subject to later inspection by state weights and measures personnel. By designing to the requirements for “Traced Update”, states might be encouraged to allow devices updated to those requirements to be returned to service without requiring a visit by a registered serviceperson.



**Software Update Procedure – from OIML D 31:2008 (E)**

Notes:

1. In the case of a Traced Update updating is separated into two 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 and revert to the old version, if the checks fail.
2. In the case of a 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 failure of the verification due to the software update is considered. Failure due to other reasons does not require re-loading and re-installing of the software, symbolized by the NO-branch.

## 8. Test Weight per Bushel Acceptance and Maintenance Tolerances

**Source:**

Mr. Adkisson, Grain and Feed Association of Illinois

**Background/Discussion:**

The Sector first considered this issue at its March 1996 meeting. At the 1997 NTETC Grain Analyzer Sector Meeting, the Sector agreed that priority should be given to drafting changes to the Grain Moisture Code to specify field test methods and reasonable tolerances. A draft of proposed changes to the Code was reviewed by the Sector at its March 1998 meeting. Action to forward the draft to the S&T Committee on was deferred pending receipt of feedback from the grain trade on the acceptability of the proposed tolerances and feedback from weights and measures members on a sampling of field test results applying those tolerances. Committee Ballot 84-03 to add the proposed changes to NIST Handbook 44, Section 5.56.(a), was issued on August 18, 1998, with ballots due for return by September 10, 1998. The TW tolerances proposed at that time are shown below:

<u>Test Weight per Bushel</u>	
<u>Type of Grain or Seed</u>	<u>Acceptance and Maintenance Tolerance</u>
<u>Corn</u>	<u>1.1 lb per bushel</u>
<u>Sorghum, soybeans, and all wheat classes</u>	<u>0.6 lb per bushel</u>
<u>Barley, oats, rice, sunflower, and all other small cereal grains and oil seeds</u>	<u>0.9 lb per bushel</u>

Most of the sector members agreed with the need for criteria but were not in agreement with the tolerances. In a written comment accompanying his ballot, Professor Hurburgh, Iowa State University (ISU), suggested that the proposed tolerances had not been calculated correctly and were not discriminating enough. Professor Hurburgh submitted an analysis of variances in test weight per bushel measurements based on data collected by the Grain Quality Laboratory at ISU. For corn, he proposed a tolerance of 0.80 pounds per bushel, setting it at plus or minus two standard deviations relative to the reference. His calculations assumed:

- A root mean square difference (RMSD) of 0.55 lb/bu (each sample tested once in standard quart cup and once in meter)
- A standard error (precision) of 0.3 for corn (and 0.15 for other grains) for both cup and meter

The corn columns in the following table illustrate the method used by Professor Hurburgh in his calculations. The rest of the table has been filled in to show suggested tolerances for the remaining grains at both 95.4 % and 99.7 % confidence levels. *Editor’s note: The grain groupings shown in the table represent the original groupings suggested prior to the Sector’s 1999 meeting. The groupings in the present code are the groupings adopted at the Sector’s September 1999 meeting.*

	Single Test on drop in cup and one in meter			Calculated for Replicated Tests 10 drops in cup and 3 in meter		
	Corn	Sorghum, Soybeans, Wheat (all classes)	Barley, Oats, Rice, Sunflower, and all other small cereal grains and oil seeds	Corn	Sorghum, Soybeans, Wheat (all classes)	Barley, Oats, Rice, Sunflower, and all other small cereal grains and oil seeds
Cup Standard Deviation (precision/repeatability)	0.3000	0.1500	0.1500			
Meter Standard Deviation (precision/repeatability)	0.3000	0.1500	0.1500			
Variance due to Cup precision/repeatability (SD <sup>2</sup> for Cup precision)	0.0900	0.0225	0.0225	0.0090	0.0023	0.0023
Variance due to Meter precision/repeatability (SD <sup>2</sup> for Meter precision)	0.0900	0.0225	0.0225	0.0300	0.0075	0.0075
Other Variances (calculated so sum of variances equals the total below)	0.1225	0.0450	0.1150	0.1225	0.0450	0.1150
Total variance (RMSD <sup>2</sup> )	0.3025	0.0900	0.1600	0.1615	0.0548	0.1248
RMSD (for Single Test conditions this is obtained from test data)	0.55	0.30	0.40	0.40	0.23	0.35
Tolerance 1 (lb/bu) (2x RMSD)	1.10	0.60	0.80	0.80	0.46	0.70
Tolerance 2 (lb/bu) (3xRMSD)	1.65	0.90	1.20	1.20	0.69	1.05
Originally Proposed Tolerance (lb/bu)				1.10	0.60	0.90

At the Sector's September 1999 meeting, maintenance tolerances of ±0.8 pounds per bushel for corn and oats; ± 0.5 pounds per bushel for all classes of wheat; and ± 0.7 for soybeans, barley, rice, sunflower, and sorghum were proposed for further study. Although several members opposed adopting the proposed tolerances and groupings for the following reasons: 1) difficult to meet the proposed tolerance for wheat; 2) difficult to obtain samples for field test; and 3) not discriminating enough for corn, they agreed to consider them for further study.

States agreeing to participate in a field evaluation of the proposed tolerances and test methods included:

- Arkansas
- Illinois
- Nebraska
- North Carolina
- Maryland
- Missouri

In late September 2000, the USDA/GIPSA sent one portion of a HRW standardizing sample to each of the participating state laboratories. Participating laboratories verified that the quart kettle used in their standard Test Weight (TW) per bushel apparatus met the requirements in GIPSA's volume test procedures. They also verified that the apparatus was set up according to GIPSA standards before testing the HRW standardizing samples. With the

exception of one state, the test weight apparatuses were within GIPSA’s tolerance. GIPSA has since worked with the state to correct the test weight apparatus that was out of tolerance.

To obtain base-line performance data on the standard quart kettle test method for corn and soybeans, GIPSA sent corn and soybeans samples to the participating laboratories prior to the 2002 NTETC Grain Analyzer Sector Meeting. Tests were run on each state’s standard quart kettle TW apparatus and on any NTEP model Grain Moisture Meter with TW capability that the state had in its laboratory.

<b>Quart Kettle Method Test Weight per Bushel Test Results for Participating State Grain Moisture Labs with GIPSA Measurements as Reference</b>				
	<b>Corn</b>		<b>Soybeans</b>	
	Bias (pounds per bushel) (avg. of 3 replicates)	Individual Lab Precision (pounds per bushel) (3 replicates)	Bias (pounds per bushel) (avg. of 3 replicates)	Individual Lab Precision (pounds per bushel) (3 replicates)
State 1	0.23	0.06	0.13	0.06
State 2	- 0.60	0.00	- 0.50	0.00
State 3	0.07	0.06	0.00	0.00
State 4	0.27	0.06	0.27	0.06
State 5	- 0.07	0.06	- 0.13	0.06
State 6	0.30	0.00	0.07	0.06
Avg Bias*	0.16	---	- 0.07	---
SDD of Overall Bias*	0.16	---	0.15	---

\* the data from State 2 was not included in Avg Bias and SDD of Overall Bias

With the exception of State 2 that reported results significantly lower than the reference for both corn and soybeans, the results indicate that in a laboratory setting the quart kettle method can achieve accuracies (based on the average of three readings) that are approximately one-half to one-third the proposed maintenance tolerances of  $\pm 0.8$  pounds per bushel for corn and  $\pm 0.7$  pounds per bushel for soybeans.

The same set of samples used for the Quart Kettle Method tests were used to test NTEP grain moisture meters located in state moisture labs and in the ongoing calibration maintenance program at GIPSA. (Note: Some of the meters located in state moisture labs may have been used as Field Standards). For both NTEP and State Laboratory meters, the bias on NTEP meters using TW calibrations that had been standardized met the proposed tolerance requirements for corn and soybeans with one exception. The exception, with an error at least seven times greater than meters of the same type, was judged to be an isolated case, most likely indicating the need for service, as results for nine other meters of like type were well within the proposed tolerance limits. Consistent biases on the majority of meter models with TW calibrations that had not been standardized suggest that with proper standardization, these models would also meet the proposed tolerance requirements. The laboratory TW results (from both NTEP and state laboratories) for GMM’s are summarized below.

<b>Test Weight per Bushel Test Results for Grain Moisture Meters in Participating State Grain Moisture Labs and at the NTEP Laboratory with GIPSA Quart Kettle Measurements as Reference</b>					
Model	Number of Meters Tested	Corn		Soybeans	
		Average Bias (pounds per bushel)	SDD (pounds per bushel) Based on 3 Replicates per Meter	Average Bias (pounds per bushel)	SDD (pounds per bushel) Based on 3 Replicates per Meter
Model 1	2	- 0.35	0.21	0.08	0.12
Model 2	9*	- 0.29	0.17	- 0.04	0.16
Model 3	3	- 1.14	0.21	- 0.66	0.07
Model 4	2	- 1.12	0.40	- 0.37	0.38
Model 5	2	- 1.48	0.35	- 1.35	0.07
* net of 1 outlier					

Dr. Pierce, GIPSA, remarked that the repeatability of the meters was impressive, especially in light of the fact that the SD between two inspectors at GIPSA is typically 0.25 pounds per bushel for official inspections. This translates to 0.5 pounds per bushel at a 95 % confidence level.

One sector member noted that the samples used for the initial tests were fairly dry (corn: approximately 13.3 % and soybeans: approximately 10 %). The use of low moisture samples, plus the fact that the samples were also clean and free of foreign material and broken kernels may have contributed to the excellent results obtained in the initial lab tests. Official TW determinations by GIPSA, for most large grains, are obtained prior to removal of dockage and foreign material.

It was also pointed out that TW measurements on high moisture samples are not reliable. In normal years, TW will increase as a grain samples loses moisture. The grain kernel tends to shrink somewhat as it dries. In fact, the volume reduction is normally greater, percentage wise, than the reduction in mass due to drying. As a result, TW (weight per unit volume) increases. The surface condition of high moisture corn may also contribute to additional variance in the packing density as the sample is loaded into the test kettle or test cell of a GMM.

A field test was also conducted on a sampling of TW capable NTEP grain moisture meters. Participating laboratories obtained their own samples for this test. Each participating laboratory was to make an initial determination of the test weight per bushel of each sample portion with the standard quart kettle apparatus before sending it to the field. Tests were to be run on TW capable NTEP grain moisture meters and on the kettle test weight apparatus used at each commercial location selected for field-testing. Kettle tests at each location were to be made by the operator who normally made test weight per bushel determinations for commercial transactions. No instruction was to be given to the operator on how to perform the test. The participating laboratory was to make a final determination of test weight per bushel when the sample was returned to the laboratory. Data was to be collected on no more than twenty instruments per grain sample.

In August 2002, field data were received from Illinois, Missouri, Nebraska and Arkansas. The results are summarized below. The Sector noted that TW errors were essentially the same for both GMM's with TW capability and for the various kinds of stand-alone TW apparatus currently in use in the field. The results for corn and soybeans were especially encouraging considering that most of the field GMM's had not been adjusted for optimum performance on TW.

Biases reported by Arkansas were significantly greater (and all negative with respect to their reference) than those reported for wheat and soybeans by other states on both GMM devices and on kettle test weight apparatus. The

Arkansas weights and measures representative said that he would review the data to see if a cause for this difference could be determined.

<b>Field Evaluation – Bushel Test Weight Hard Red Winter Wheat and Soft Red Winter Wheat State Quart Kettle Apparatus as Reference</b>				
<b>State</b>	<b>Grain Moisture Meters</b>		<b>TW Apparatus</b>	
	SDD (pounds per bushel) Based on 3 replicates per meter	Average Bias (pounds per bushel) with respect to reference sample	SDD (pounds per bushel) Based on 3 replicates per device	Average Bias (pounds per bushel) with respect to reference sample
All Participating States	0.47	– 0.47	0.31	– 0.23
Illinois	0.43	– 0.52	0.50	0.02
Missouri	0.26	– 0.55	0.32	– 0.31
Nebraska	0.29	– 0.02	0.23	– 0.19
Arkansas (net of 1 outlier)	0.45	– 0.92	0.23	– 0.36

<b>Field Evaluation – Bushel Test Weight Soybeans State Quart Kettle Apparatus as Reference</b>				
<b>State</b>	<b>Grain Moisture Meters</b>		<b>TW Apparatus</b>	
	SDD (pounds per bushel) Based on 3 replicates per meter	Average Bias (pounds per bushel) with respect to reference sample	SDD (pounds per bushel) Based on 3 replicates per device	Average Bias (pounds per bushel) with respect to reference sample
All Participating States	0.85	– 0.10	0.64	0.06
Illinois	0.40	– 0.09	0.41	0.25
Missouri	0.32	0.66	0.20	0.36
Nebraska	0.52	– 1.19	0.56	– 1.04
Arkansas (net of 1 outlier)	0.85	– 0.10	0.64	0.06

<b>Field Evaluation – Bushel Test Weight Corn State Quart Kettle Apparatus as Reference</b>				
<b>State</b>	<b>Grain Moisture Meters</b>		<b>TW Apparatus</b>	
	SDD (pounds per bushel) Based on 3 replicates per meter	Average Bias (pounds per bushel) with respect to reference sample	SDD (pounds per bushel) Based on 3 replicates per device	Average Bias (pounds per bushel) with respect to reference sample
All Participating States	0.55	0.05	0.61	– 0.27
Illinois	0.60	0.33	0.46	0.37
Nebraska	0.38	– 0.18	0.37	– 0.59

In early 2007, an outreach study was conducted to determine which jurisdictions were inspecting GMMs for accuracy in test weight per bushel TW determination. Of the six states responding four had been inspecting GMMs for TW for several years. None of the four reported any problems with procedures or tolerances. South Carolina, then in its fourth year of inspecting for TW, reported a decline in meters rejected for TW indications. Initial rejection rate for TW was 47.57 %. The 2006 inspection year yielded a rejection rate of 12.27 %, while tests thus far in 2007 showed a rejection rate of 2.83 %.

The submitter believes that test weight tolerances are too tight for field operation of GMMs at country grain elevators in Illinois. Some manufacturers have also expressed concern over the large number of GMM Field Test failures due to exceeding NIST Handbook 44 TW Acceptance and Maintenance Tolerances.

The submitter has recommended that NIST Handbook 44 TW tolerances be increased by 50 %.

<b>Table T.3.</b>	
<b>Acceptance and Maintenance Tolerances Test Weight per Bushel</b>	
Type of Grain or Seed	Tolerance (pounds per bushel)
Corn, oats	<b>0.8</b> <u>1.20</u>
All wheat classes	<b>0.5</b> <u>0.75</u>
Soybeans, all barley classes, all rice classes, sunflower, sorghum	<b>0.7</b> <u>1.05</u>

As an alternative solution, the submitter has suggested allowing GMMs to print (and display) “approximate test weight.” See Agenda Item 12.

**Conclusion:**

Mr. Adkisson, Grain and Feed Association of Illinois, cited problems his industry is having regarding TW. GMMs that have failed TW during field inspection are sent to the manufacturer for repair. When the meters are returned, the reports indicate that no problems have been found. There are also situations where a meter has failed TW.

When the state inspector subsequently tested the elevator’s quart kettle it matched the meter, but it didn’t match the state inspector’s sample. This is particularly frustrating for the country elevators in Illinois that are using the GMM TW only as a screening tool.

Mr. Cunningham, Illinois Department of Agriculture, outlined the care being used to select and measure TW samples used in field inspection. Field inspectors carry two portions of each TW sample. The second portion can be compared to the first portion if any results are suspect. He was of the opinion that this was more a problem of meters in the field not being consistent within any one brand.

Ms. Eigenmann, DICKEY-john Corporation, referred the Sector to a USDA study that listed critical factors in the use of the standard quart kettle and the resultant errors if not used properly. Improperly used, the “standard method” isn’t so standard.

The NTEP laboratory collects TW data on two meters of each of the models in the NTEP Laboratory. That data is provided to the manufacturers (or CC holders). The question was raised as how that data translates to a host of field instruments. The two manufacturers represented at the Sector meeting outlined their instrument standardization procedures. Mr. Kaeding, Perten Instruments, Inc. reported that the strike-off device is the biggest source of TW variation between individual instruments. He suggested that even for a single grain type on a single instrument TW results may be sample dependent.

Professor Hurburgh, Iowa State University, described the procedure he has used with two groups of elevators to align their GMMs for TW on corn. Five to ten samples with some range of TW are passed around to all the instruments in their system. Typically, the results from the initial tests are within plus or minus one pound per bushel of the overall average TW of that population of instruments. Bias and skew adjustments are then made on

each of the instruments so they all read to the mean TW. At that point the problem is solved. He stressed that GMMs don't read the same on TW when they first are placed in the field whatever the cause may be.

In response to a question, "If not used in trade, how is TW used?" One sector member pointed out that TW is a major factor in trading wheat (there are 5 TW dependent U.S. grades for wheat). Professor Hurburgh, Iowa State University, said that the general practice, at least for corn, (nobody knows how soybean TW is used) is if the TW (by meter) gets low enough to engender discounts, then the discount itself will be assessed by a quart kettle reading...perhaps even on a composite sample. The meter's TW reading goes into the inventory record that is used in several internal operations: calculation of stored grain volume and a calculation to estimate storageability (time). Note: There are also 5 TW dependent U.S. grades for corn, but in normal years corn TW is typically several lbs/bu higher than the 56 lb/bu minimum for U.S. No. 1 Corn.

Professor Hurburgh, Iowa State University, also explained that the grain dealer has a greater interest having the correct TW reading than the farmer has, because the TW reading is used to establish volume in storage on measure-up inspections. At \$7.00 per bushel corn TW is the biggest factor of error on the inventory balance.

Professor Hurburgh, Iowa State University, objected to increasing TW tolerances as this would only cover up the problems. What was needed was an investigation of the whole system of calibrating meters, then translating that calibration into the field, and then keeping it that way. The whole system has some issues that can be fixed.

He suggested that the Sector re-form a task force on TW and ultimately lay out a procedure that would improve TW both for the user and for the inspection function. Until then, suspend inspecting meters for TW until there's a better way to translate the standard into practice. Pending resolution of the issues involved, continue to use the meters, but mandate use of the standard Quart Kettle if a discount is involved.

Professor Hurburgh, Iowa State University, agreed to head a task force to study the whole TW system (including the economic impact) and to recommend solutions to the issues that need fixing. Other task force members:

- Mr. Jeff Adkisson – Grain and Feed Association of Illinois
- Ms. G. Diane Lee – NIST, OWM
- Ms. Cassie Eigenmann – DICKEY-john Corporation
- Mr. Ivan Hankins – Iowa Department of Agriculture/Weights and Measures
- Mr. Tim Kaeding – Perten Instruments, Inc.
- Mr. Karl Cunningham – Illinois Department of Agriculture

The Sector decided to postpone action on the issue of tolerances until the TW task force has studied the issue and has recommended action.

## **9. Report on OIML TC 17/SC 1 R 59 Moisture Meters for Cereal Grains and Oilseeds**

### **Background/Discussion:**

This item was included on the NTETC Grain Analyzer Sector's agenda to provide a summary of the activities of OIML TC 17/SC 1. In October 2008, the Secretariat of TC 17/SC 1 was jointly allocated to China and the United States. The Co-Secretariats (China and the United States) are working closely with an International Work Group to revise OIML R59 *Moisture Meters for Cereal Grains and Oilseeds*. The 5 CD of OIML R 59, revised to comply with OIML's Guide Format for OIML Recommendations and to incorporate tests for the recommended disturbances of OIML D 11 General Requirements for Electronic Measuring Instruments, was distributed to the subcommittee in February 2009. Comments to R 59 5 CD were received from 10 countries including the United States. A

preliminary R 59 6 CD addressing those comments was discussed at the September 28 - 29, 2010, TC 17/SC 1 meeting in Orlando, Florida.

Ms. Lee, NIST, OWM, briefed the Sector on the September 2010 meeting. The meeting was attended by representatives from Australia, International Bureau of Legal Metrology (BIML), Canada, China, Germany, Japan, and the United States. Attending for the United States:

- Ms. Cathy Brenner, USDA, GIPSA
- Ms. Cassie Eigenmann, DICKEY-john Corporation
- Ms. G. Diane Lee, NIST, OWM
- Dr. Richard Pierce, USDA, GIPSA
- Mr. Richard Cantrill

Twelve items were included in the review of the preliminary 6 CD that included all the United States comments to R 59 5 CD:

1. Efforts to Establish Recognized Traceability Under the CIPMA MRA for “Moisture in Grain” Measurements
2. Printed Results
3. Description of Instruments
4. Reference Conditions for Performance Tests
5. Verification
6. Level Indicating Means
7. Minimum Sample Size
8. Definition for Error Shift
9. Software
10. Harmonizing the OIML Moisture and Protein Recommendation
11. Revisions to Test Report Forms for Consistency with Laboratory Calibration Worksheets
12. Detailed Review of Comments to R 59 CD 5

Decisions made on the three items of most interest to the United States include:

- Printed Results – The existing language for recording elements in 5 CD will remain unchanged. The working group agreed that since a number of countries have varying requirements for printers that the existing language in OIML R 59 CD 5 which states that “the meter may be equipped with a communication interface that permits interfacing with a recording device” allows the instrument to connect to a printer if this is required by the national responsible body.
- Software – Germany reviewed the current draft to determine if additional changes are required to comply with OIML D 31 and provided a list of items to be considered for inclusion in the draft OIML R 59.

- **Minimum Sample Size** – The requirements for Minimum Sample Size in 5 CD will remain the same. The purpose of the minimum sample size 100 g or 400 kernels or seeds is to ensure that accurate results can be obtained when testing non-homogeneous samples. A statement is also included that the national authorities may determine otherwise.

Ms. Lee, NIST, OWM, reported that there is a proposal on the international front to do a study of moisture measurement methods with the apparent purpose of establishing a universal standard method “internationally accepted by competent authorities in the field of moisture measurements in grains and cereal.” During the TC 17/SC 1 meeting Mr. Magana, BIML, gave an overview of a discussion paper titled, *Efforts to Establish Recognized Traceability Under the CIPMA MRA for ‘Moisture-in-Grain’ Measurements*. The Sector recalled that previous attempts to establish a universal standard method for measuring moisture in grain had failed. One member speculated as to whether or not the debates on selecting a single international reference method might be made to devalue the United States grain crops. The U.S. reference method for grain moisture determination is lower than the ICC method. Attempts to change the reference method were made years ago but received much opposition from industry.

USDA and NIST, OWM are preparing a formal response to address the necessity to maintain the U.S. standard air-oven method for determining grain/oilseed moisture. The U.S. grain standards, domestic grain trade, and control/evaluation of grain inventory are all based on this air-oven method.

## **10. Report on OIML TC 17/SC 8 Protein Measuring Instruments for Cereal Grain and Oil Seeds**

### **Background/Discussion:**

This item was included on the Sector’s agenda to provide a summary of the activities of OIML TC 17/SC 8. Subcommittee SC 8 was formed to study the issues and write a working draft document *Measuring Instruments for Protein Determination in Grains*. Australia is the Secretariat for this subcommittee. A TC 17/SC 8 meeting was hosted by NIST, OWM in September 2007 to discuss the 2 CD. Discussions on 2 CD dealt mostly with maximum permissible errors and harmonization of the TC 17/SC 8 Recommendation for protein with the TC 17/SC 1 Recommendation for moisture. The Secretariat distributed a 2 CD of the document in February 2010. A meeting of TC 17/SC 8 was held September 2010 in Orlando, Florida. At the September meeting comments to the Recommendation on Protein Measuring Instruments for Cereal Grain and Oil Seeds 2 CD were reviewed. It was agreed at this meeting that two instruments will be submitted for OIML type approval. This agreed change and other changes from the September 2010 meeting will be included in 3 CD.

Other changes agreed to at the September 2010 Meeting:

- Reference method instruments (e.g. Dumas or Kjeldahl instruments) will be removed from scope of the document.
- TC 17/SC 8 and TC 17/SC 1 will not attempt to merge type evaluation tests for the protein measuring instrument and the moisture meter due to potential differences in sample set requirements.
- Mutual acceptance of test results is possible for the influence and disturbance tests that are less dependent on the grain-specific calibrations. Member states are expected to facilitate mutual acceptance by harmonizing with the model tests.
- Due to regional and seasonal variation in the grain samples used for calibration and testing, countries are unlikely to accept the accuracy, repeatability and reproducibility tests conducted by another country (i.e., where foreign produce is developed as test samples).
- The full protein measuring range specified by the country will be tested for accuracy, repeatability and reproducibility.

- Detailed design of the tests including the number of test samples and how the test results are pooled to obtain the mean absolute error, SD, SDD and SDDI will be left to the national authorities.
- Some guidance on the minimum number of samples to be used across the full protein measuring range will be provided, e.g., min 45 samples distributed randomly over the full range.

Ms. Lee, NIST, OWM, reported that since the United States has an established system for protein measuring devices, the United States is trying to incorporate what has been done in the NTEP program for protein. Progress toward that goal should be noticeable in 3 CD when it is released.

## 11. Proficiency Testing

### Source:

Ms. Johnson, American Oil Chemists Society (AOCS)

### Background/Discussion:

At the 2009 NTETC Grain Analyzer Sector Meeting, Professor Hurburgh, Iowa State University, urged the representatives from the AOCS to prepare a proposal so that the collaborative (air-oven) study could be conducted on an on-going basis rather than on an ad hoc basis. He cautioned that the proposal would have to include corn and wheat as well as soybeans.

Several years ago the AOCS in conjunction with the United Soybean Board (USB) established the AOCS-USB Soybean Quality Traits (SQT) Analytical Standards Program (ASP), a system of verification of analytical measurements. This program provided the infrastructure for the generation of reliable analytical results at all levels of the soybean industry by establishing industry-wide acceptance of analytical methods and protocols and their implementation under internationally accepted quality management standards. The AOCS has proposed the addition of an air-oven/grain moisture meter proficiency testing series to their ASP. Proficiency testing is a continuous program, samples are sent out in regular intervals (e.g., two to four times per year). Participants are able to join on a continuous basis.

Ms. Johnson, AOCS, proposed an air-oven/GMM proficiency testing series designed specifically to address the needs of GMM manufacturers and states maintaining a grain moisture laboratory. AOCS would administer the program, oversee distribution of samples, compile results, perform statistical analysis of results, and distribute a report to participants. AOCS does not collect the samples. This is subcontracted to suitable providers. AOCS does not have laboratories. Since GIPSA is a certified laboratory already participating in the SQT program, GIPSA air-oven results could be reported for comparison if desired.

At a previous meeting, the Sector decided that a program that included distribution of two samples each of corn, wheat (preferably of one type), and soybeans per year would be adequate. A final report by mid-July is desirable, so sample distribution would have to take place in early spring (March – April).

### Conclusion:

Ms. Johnson, AOCS, presented details of the proposed Air-Oven and Moisture Meter Proficiency Testing Program designed specifically for the NTETC Grain Analyzer Sector for review by the Sector. The proposal included provisions for collecting moisture meter results in addition to air-oven results on the program samples. Several sector members objected to including moisture meter results stressing that this was not intended to be “backdoor Phase II program”. Testing moisture meter calibrations is an activity requiring a large number of samples. Two samples per grain are not adequate to assess meter performance. The Sector decided that the program should focus solely on the standard GIPSA air-oven method.

### Program Details:

- Samples – Soybeans 2, Corn 2, Hard Red Winter Wheat 2
- Cost to Participants - \$100.00/year

**Schedule:**

- Samples (6) ship on the 15<sup>th</sup> of February
- Samples must be tested within five business days with results due by 15 March
- Reports will be posted on [www.SoybeanQualityTraits.org](http://www.SoybeanQualityTraits.org) by 1 May
- Detailed Participant Instructions will be provided to each participant

The Sector endorsed the proposal with the exclusion of instrument results.

## 12. Printed Ticket User Requirements

**Source:**

Mr. Adkisson, Grain and Feed Association of Illinois

**Purpose:**

The submitter believes that NIST Handbook 44 User Requirements for Printed Tickets, as specified in section 5.56.(a), paragraph UR.3.4.(b) are not realistic for country elevators. Traffic patterns at country elevators do not lend themselves to providing a printed ticket to all customers. Many customers, in fact, do not want them. In addition, since meters in Illinois are inspected and are required to be using the correct calibration, there is no need for the calibration version identification to be printed on the ticket.

**Item Under Consideration:**

Mr. Adkisson, Grain and Feed Association of Illinois, has proposed that GMMs be allowed to print [and display] “approximate test weight,” and that NIST Handbook 44, section 5.56.(a), paragraph UR.3.4.(b) be modified as shown:

### UR.3.4. Printed Tickets.

- (b) **If requested** the customer shall be given a printed ticket showing the date, grain type, grain moisture results, **and actual or approximate** test weight per bushel, ~~and calibration version identification.~~ The ticket shall be generated by the grain moisture meter system.

(Amended 1993, 1995, ~~and~~ 2003, **and 20XX**)

**Background/Discussion:**

The Sector heard objections to including “actual or approximate” test weight in light of the Sector’s decision to form a task force to study the whole TW system and to recommend solutions to the issues that need fixing (see Agenda Item 8). Mr. Truex, NTEP Administrator, agreed that “actual or approximate” would be difficult words to get approved. He pointed out that this issue was really not something that the Sector has to decide, because it wasn’t an NTEP issue. He suggested that it be submitted through the Central Weights and Measures Association (CWMA) that would be meeting in September. Mr. Hankins, Iowa Department of Agriculture/Weights and Measures, agreed to submit the issue to the CWMA.

Mr. Pierce, USDA, GIPSA, pointed out that an unsuccessful attempt had been made in 1994 to delete the portion of paragraph UR.3.4. stipulating that the customer receive a ticket. At the 1994 NCWM Annual Meeting, the S&T Committee maintained the position that the system should print the information; the information should not be handwritten or printed with a device separate from the grain moisture measuring system. The Committee had not received sufficient justification to warrant reversing the decision made by NCWM in 1993. They decided that this item should remain informational to allow an opportunity for additional information to be submitted; however, they warned that the item would be withdrawn from the Committee’s 1995 agenda unless additional information was provided to support making changes to this paragraph. See *Report of the 79<sup>th</sup> NCWM, 1994*, Report of the S&T

Committee, Item 356-6, UR.3.4. Printed Tickets. Note: Item 356-6 did not appear in the *Report of the 80<sup>th</sup> NCWM*, 1995.

The Sector generally agreed that modification of UR.3.4.(b) to make a printed ticket available upon request was more likely to be accepted by the S&T Committee citing “Pay at the Pump” credit/debit card transactions where the customer is given the choice of whether or not to have a receipt printed. The Sector was not in favor of eliminating “calibration version identification” believing that this is important information in the event that the ticket is ever questioned.

The Sector developed the following language for the submission to CWMA:

#### **UR.3.4. Printed Tickets.**

- (b) ~~The customer shall be given a printed ticket showing.~~ A printed ticket shall be made available to the customer upon request at the time of transaction. The printed ticket shall show the date, grain type, grain moisture results, test weight per bushel, and calibration version identification. The ticket information shall be generated by the grain moisture meter system.

(Amended 1993, 1995, ~~and~~ 2003, and 20XX)

### **13. Next Sector Meeting**

The next NTETC Grain Analyzer Sector Meeting is tentatively planned for Wednesday, August 22 and Thursday, August 23, 2012, at the Chase Suites by Woodfin at KCI in Kansas City, Missouri. Sector members are asked to hold these days open pending confirmation of availability of facility, determination of agenda items, exact meeting times, and meeting duration. Final meeting details will be announced by early June 2012.

If you would like to submit an agenda item for the 2012 meeting, please contact any of the following persons by June 1, 2012:

- Mr. Jim Truex, NTEP Administrator, at [jim.truex@ncwm.net](mailto:jim.truex@ncwm.net)
- Ms. G. Diane Lee, Co-Technical Advisor, at [diane.lee@nist.gov](mailto:diane.lee@nist.gov)
- Mr. Jack Barber, Co-Technical Advisor, at [barber.jw@comcast.net](mailto:barber.jw@comcast.net)

### **14. Unified Grain Moisture Algorithm – Update**

At the 2010 NTETC Grain Analyzer Sector Meeting, Dr. Funk, USDA FGIS QARD QCT Branch, made a presentation entitled, *Future Direction of Moisture Measurement Technology*. In that presentation he offered a proposed timeline for choosing and implementing a new moisture technology that offers improved accuracy, better stability over time and crop conditions, easier calibration development, reduced support cost, and that provides competition (it can be duplicated by any manufacturer). At the 2011 NTETC Grain Analyzer Sector Meeting he brought the Sector up-to-date on the progress made since the Sector’s 2010 meeting.

#### **Significant Milestones Since the Sector’s Last Meeting:**

- August 2010 – The GIPSA Executive Management Team decided to pursue adoption of new Official moisture measurement technology.
- June 2011 – The Grain Inspection Advisory Committee recommended that GIPSA continue to go forward with the evaluation and adoption of the 149 MHz technology as the new official standard for grain moisture measurement.

**Projected Timeline for Implementing the New Technology:**

- July 2011 - January 2012
- Collect calibration data for new technology.
- Conduct additional “green” grain tests to quantify effects.
- Develop detailed criteria and test processes for determining? (UGMA)-compatibility.
- Verify consistency among UGMA-based moisture meters.
- February 2012
- Finalize technology decision.
- May 2012
- Develop and validate calibrations for officially-inspected grain types.
- May 2013
- Implement new technology for initial grains.
- September 2013 and later
- Implement new technology for other grains.

**Implications for NTETC Grain Analyzer Sector**

- Calibration review and modifications for official moisture system may be significantly reduced upon adoption of UGMA as Official moisture technology.
- Phase II testing may be reduced or eliminated after current 5-year agreement expires.
- Official approval of UGMA-compatible instruments may be based on confirmation of UGMA-compatibility rather than extensive moisture tests.
- NTEP certification of UGMA-compatible instruments might be similarly simplified.

Following Dr. Funk’s presentation to the NTETC Grain Analyzer Sector, he conducted a question and answer session. Some of the questions and his responses are shown below:

**Question:**

This is very significant work. I hope USDA is getting a royalty on this.

**Answer:**

No, all this is in the public domain. GIPSA decided to make it freely available to anybody wanting to use it.

**Question:**

How did the? (GAC) get chosen to replace the Motomco?

**Answer:**

After the 1990 Farm Bill, GIPSA set up a process by which we could choose a new official meter. The first “gate” we set up was that the new official meter must be NTEP certified. Once we had a reasonable pool of NTEP-certified meters, we developed a set of performance criteria and a bid selection process that became the basis of procurement. The GAC 2100 was the successful bidder.

**Question:**

In the future will there be an opportunity for another company to become the standard of choice?

**Answer:**

It’s not limiting to say we have two manufacturers here. In the future I expect to see more. The idea is that for official inspection consistency is the name of the game. If you’re using fundamentally different technologies they are all measuring different things. The error (difference between instrument types) on a sample-by-sample basis may be 1.4 times as great as the error of any one of the instruments relative to the air-oven. So having multiple types of instruments in the system is not tenable because of the inconsistencies it generates from market point to market point. What we have done in this instance from the very beginning is to provide the means for multiple manufacturers to provide equivalent instrumentation. We are limiting competition in one sense (by restricting it to 149 MHz UGMA technology), but we are saying that instruments from different manufacturers are going to have to give equivalent results and use the same calibrations.

**Question:**

How is this technology able to measure frozen grain, and is it able to measure as accurately within normal moistures?

**Answer:**

At the higher frequency of the new technology, if you plot the dielectric constant of wet sand as a function of temperature, you will find that the dielectric constant decreases slowly with decreasing temperature (from hot to cold) linearly until it reaches the freezing point—at which time it plunges abruptly downward and remains constant. A plot of the dielectric constant of moderately moist grain decreases as the temperature decreases, but when it reaches the freezing point it continues to decrease. The question is, under what conditions the grain continues to decrease linearly instead of dropping sharply. The answer is, as long as the grain is at a moisture level below the level where it contains freezable water it will exhibit linear behavior. That moisture level is around 20 % for cereal grains, a little below 20 % for soybeans, and for other oil seeds such as canola or sunflower it is down to below 15 % or even to 10 %. The fact is, there is a linear function there that is not destroyed by freezing if you limit the conditions. You can’t test 30% moisture cereal grain at – 10 °C and get reasonable results. What you see if you do that is 20 % moisture. Anything, whether it is 21 %, 25 %, or 40 %, what you will see is 20 %, because that water which is above that 20 % threshold just freezes out and is invisible. As long as the moisture is below that threshold level, you can trust the results (if the temperature measurement is accurate and the temperature correction function is appropriate).

**Question:**

In the past, what we have done in the code has always been non-retroactive? That means, if we continue with that policy, that existing meters will stay in the field, and more than likely they will be in the field for 30 years. If government Phase II support goes away, who supports the existing meters?

**Answer:**

I’m not saying it will go away, only that it could go away. GIPSA is heavily supporting Phase II both with an annual contribution of \$30,000 plus full support of the sample gathering and testing that is required to maintain the calibrations for the official meter. (In addition, NIST, OWM contributes \$30,000 per year.) With budgets going the way they are, activities (such as Phase II testing) that are not clearly required to support the official system may not survive, unless manufacturers or other sources are willing to fully support them.

After Dr. Funk concluded his presentation and question and answer session, the Sector heard additional questions and concerns related to the possible discontinuance of Phase II for GMMs. These included:

- How will manufacturers of existing non-UGMA GMMs and NIR instruments keep their NTEP CCs active?

- How will NIR instruments that aren't yet designed be certified?
- Why are NIR protein, oil, and etc. calibrations not checked the same as moisture calibrations?
- What are the additional implications of abandoning Phase II?
- What are the additional implications to the GMM Chapter of NCWM Publication 14?
- What are the additional implications to the NIR Grain Analyzer Chapter of NCWM Publication 14?

These issues will have to be a carryover to the 2012 NTETC Grain Analyzer Sector Meeting.

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