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## Calibration Procedures Updated

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Please be sure to regularly check the Calibration Procedures pages on the NIST website for updates (the short-cut is [www.nist.gov/pml/wmd/labmetrology/index.cfm](http://www.nist.gov/pml/wmd/labmetrology/index.cfm), and then select Calibration Procedures). During the 2014 Combined Regional Measurement Assurance Program (C-RMAP) training session in October 2014, printed copies of NISTIR 5672, Advanced Mass Calibrations and Measurement Assurance Program for State Calibrations Laboratories, NISTIR 6969, Selected Laboratory and Measurement Practices, and Procedures to Support Basic Mass Calibrations, and NISTIR 7383, Selected Procedures for Volumetric Calibrations were provided to participants. Subsequently, a new NISTIR 8028, Selected Laboratory and Measurement Practices and Procedures for Length Calibrations, was approved and circulated to all participants. Please see additional information for updates to each publication with associated history regarding OWM calibration procedures. Also, please be aware that the documents published on the web page are considered the “Official” versions of the documents and print copies are provided only as a convenience during training. Updates to the documents will be posted on the website with updated document control, but hard copies will not necessarily be provided for updates. Laboratory references to the documents, for example, Master List, must be updated to match the Official version of the documents.

### ***Handbook 145 – Will not be updated.***

NBS Handbook 145 (1986), Handbook for the Quality Assurance of Metrological Measurements, by John K. Taylor and Henry V. Oppermann has been out of print for many years. The majority of content has been updated and published in the publications noted below. Handbook 145 was developed as a source of calibration procedures for weights and measures laboratories and covered mass, length, and volume calibrations for field standards used in the commercial marketplace. The original Table of Contents and several Legacy sections are provided on the OWM website as reference only. The Good Laboratory Practices (GLPs), Good Measurement Practices (GMPs), and Standard Operating Procedures (SOPs) that have not been updated are available on the linked pages as scanned PDF copies and are dated 1986. The entire collection of SOPs, GLPs, and GMPs are all presented together for consistency in numbering; however, updates are published through the NISTIR series of publications with “selected procedures” combined by measurement parameters as shown below and described in subsequent sections.

NISTIR 6969, 2014, *Selected Laboratory and Measurement Practices, and Procedures to Support Basic Mass Calibrations*, Georgia L. Harris.

NISTIR 5672, 2014, *Advanced Mass Calibrations and Measurements Assurance Program for the State Calibration Laboratories*, Kenneth L. Fraley, Georgia L. Harris.

NISTIR 7383, 2013, *Selected Procedures for Volumetric Calibrations*, Georgia L. Harris

NISTIR 8028, 2014, *Selected Laboratory and Measurement Practices and Procedures for Length Calibrations*, Jose A. Torres, Georgia L. Harris

Suggested Action Item: Laboratories need to be sure their Quality Management Systems reference the correct publications, correct dates, and do not reference older or out of date publications in their Master List.

Suggested Action Item: Review and update the Master List to ensure that only procedures used by the laboratory are listed. GMPs, GLPs, and SOPs that don't support the laboratory measurement scope should not be listed.

***NISTIR 6969, Selected Laboratory and Measurement Practices, and Procedures to Support Basic Mass Calibrations – Updated September 2014.***

The collection of GLPs, GMPs, and SOPs published in this NISTIR were first published in 2003 in association with SP 1001, Basic Mass Metrology CD-ROM course. If downloading and using the Basic Mass course, be sure to reference the latest procedures rather than those that are integrated in the program files. This publication was also updated in 2012 with training provided at all of the Regional Measurement Assurance Program training sessions in 2012, where input was collected from laboratories regarding deviations from the procedures. Updates in 2014 included modifications that were appropriate based on laboratory applications of these procedures. Additional content from the OIML R111, Weights of classes E<sub>1</sub>, E<sub>2</sub>, F<sub>1</sub>, F<sub>2</sub>, M<sub>1</sub>, M<sub>1-2</sub>, M<sub>2</sub>,

M<sub>2-3</sub> and M<sub>3</sub>, Part 1: Metrological and technical requirements was incorporated in the 2012 version as well, along with the latest internationally accepted calculations for air density. Updates in 2014 included: 1) removal of all example calculations because prior calculated values were rounded to digits appropriate for handheld calculators but not adequate for computerized calculations, and 2) the addition of detailed uncertainty budget tables for each SOP. Updates were also included to ensure consistency with the content presented in the updated two-week Mass Metrology Seminar.

Key procedures in this publication that were new to the GLP, GMP, and SOP series and not part of the original Handbook 145 include the following:

GMP 11, Assignment and Adjustment of Calibration Intervals for Laboratory Standards

GMP 12, Standard Operating Procedure Selections

GMP 13, Ensuring Traceability

SOP 29, Assignment of Uncertainty

SOP 30, Process Measurement Assurance Program

SOP 33, Calibration of Weights Carts (first published in 2012)

SOP 34, Selection and Use of Sensitivity Weights and Tare Weights in Weighing Procedures (originally published as GMP 14, converted to SOP in 2014)

***NISTIR 5672, Advanced Mass Calibrations and Measurements Assurance Program for the State Calibration Laboratories – Updated September 2014.***

This publication includes SOPs 5 and 28 that are applicable for advanced dissemination and weighing designs. These procedures reference those in NISTIR 6969 with similar changes in the 2014 versions (examples were removed and uncertainty budget tables were added). Content from this publication is also used in the two-week Mass Metrology Seminar, but the 2014 updates also included the changes to support the Advanced Mass Metrology Seminar that will be presented in June 2015. SOP 5 was originally part of NIST Handbook 145, but SOP 28 was new to address advanced mass calibration methods.

***NISTIR 7383, 2013, Selected Procedures for Volumetric Calibrations – April 2013.***

This publication and the associated procedures were first published in 2006, again in 2012, and then in 2013 for the updated Volume Metrology Seminar. Updates in 2014 included: 1) removal of all example calculations because prior calculated values were rounded to digits appropriate for handheld calculators but not adequate for computerized calculations, and 2) the addition of detailed uncertainty budget tables for each SOP, just like the procedures for mass calibrations.

A key Standard Operating Procedure that is included in the publication was new to the SOP series in 2006 and underwent significant updates for the 2012 and 2013 versions: SOP 26, Gravimetric Calibration of Dynamic Volumetric Systems used as Standards. SOP 13 and 15 were combined in SOP 14 to maintain one calibration procedure for gravimetric volume calibrations, which was also updated to ensure greater consistency with the uncertainty components used in other international calibration guides. SOP 13 was based on single-pan mechanical balances and SOP 15 was based on equal-arm balances; however, most gravimetric calibrations in the past 20 years have been performed on electronic balances and mass comparators. GLP 10 on the purity of water needed for volume calibrations was updated in 2012 and in 2013 to adopt the latest versions of the internationally accepted water density calculations.

***NISTIR 8028, Selected Laboratory and Measurement Practices and Procedures for Length Calibrations – Updated October 2014.***

Draft versions of length procedures were presented in 1996, but based on the number of laboratories continuing to perform length calibrations, and limited use of the procedures, limited effort was put into finalizing and publishing the SOPs associated with length. These have now been updated and published. SOP 23 was not part of the original Handbook 145 and covers the calibration of Pi Tapes.

***Miscellaneous SOPs and OWM Input***

A number of individual publications are in use in the laboratories, and have been through review among the laboratories and by NIST, but have never been officially published. Those procedures include the

calibration of tuning forks, timing devices, and thermometers. Additional working groups and efforts will be established to review, update, and publish these as a miscellaneous collection of SOPs. If you have suggestions for new SOPs or drafts of procedures that you would like considered for national publication, please submit them to Georgia Harris for review. Questions or comments regarding current calibration procedures may be directed to Georgia Harris at [gharris@nist.gov](mailto:gharris@nist.gov) or to Val Miller at [val.miller@nist.gov](mailto:val.miller@nist.gov).