

NISTIR 7082

**Proficiency Test Policy and Plan
for State Weights & Measures
Laboratories
(2023 Ed)**

Georgia L. Harris
Laboratory Metrology Program
Office of Weights and Measures

Add OWM Staff
responsible for updates

This publication is available free of charge from:
Link to be provided for approved publication

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

NISTIR 7082

**Proficiency Test Policy and Plan
for State Weights & Measures
Laboratories
(2023 Ed)**

Georgia L. Harris
Applicable OWM
staff

This publication is available free of charge from:
Link to be provided for approved publication

Est: November 2023



U.S. Department of Commerce
Gina M. Raimondo, Secretary

National Institute of Standards and Technology
Dr. Laurie E. Locascio, NIST Director and Under Secretary of Commerce for Standards and Technology

Table of Contents

Table of Contents	i
Abstract	iv
Keywords	iv
Acknowledgments.....	iv
1. Introduction.....	1
1.1 Definitions.....	3
1.2 Abbreviations and Acronyms.....	5
Table 1. Abbreviations and Acronyms Used in this Publication.	5
1.3 Applicable References	5
2. Program Scope.....	6
2.1 Purpose and Description	6
2.2 Measurement Parameters	6
Table 2. PT Parameters, Schedules, and OWM PT Program Scope.....	7
3. Requirements	8
4. Policies.....	8
4.1 Compliance with International Standards	8
4.2 Policy for PT Program Operations.....	9
4.3 Participation Policy	10
4.4 Recognition Requirements.....	11
4.5 Laboratory and Individual Staff Competence Status	11
5. PT Participation Plan	12
Table 3. Example PT Participation Plan according to CMC.....	14
6. Appendices (duplicated from NISTIR 7214).....	16
Form 1: OWM PT Feedback and Inquiry and Complaint Form.....	16
Form 2: OWM PT Participation Request – Training/Qualification Form	16
Form 3: RMAP Associate Membership Application.....	16
Form 7: Examples of Proficiency Test 4-Year Plan and History/Log	16

This publication is available free of charge from: [Link to be provided for approved publication](#)

This publication is available free of charge from: [Link to be provided for approved publication](#)

Abstract

This publication provides the policies and plans for the Proficiency Testing (PT) Program of the NIST Office of Weights and Measures (OWM). This OWM Proficiency Testing (PT) policy and plan has been updated to ensure compliance with the latest applicable documentary standards and policies of the International Laboratory Accreditation Cooperation (ILAC).

The PT program has been in place since the early 1980s as a core part of the support to State weights and measures laboratories through regional measurement assurance programs. Original activities were conducted as “round robin method in support of ongoing measurement assurance activities related to support for State laws with requirements for metrological traceability to national and international standards.

The 2023 edition was updated based on feedback from users and included review and associated updates based on the latest applicable policies of the International Laboratory Accreditation Cooperation (ILAC), NIST Handbook 143, Recognition Program, NIST Handbook 150, National Voluntary Laboratory Accreditation Program (NVLAP) Procedures and General Requirements, and the latest available documentary standards for proficiency testing, including ISO/IEC DIS 17043:2022, Conformity Assessment — General requirements for the competence of proficiency testing providers, and ISO 13528:2022, Third Edition, 2022-08, Statistical methods for use in proficiency testing by interlaboratory comparison.

Kelleen Larson, L. F. Eason, and Ken Fraley in collaboration with NIST OWM personnel at the 2012 PT Workshop, Boulder, Colorado, proposed significant updates to this publication, which formed the foundation for the 2018 update. Reviews by the participants listed below significantly contributed to the development of this policy and plan. The initial 2004 edition was developed under contract with Jeff C. Gust.

Keywords

Accreditation, calibration, interlaboratory comparison, proficiency testing, recognition.

Acknowledgments

The following individuals participated in the 2022 review:

-
-
-
-

The following individuals participated in the 2018 review:

- Val Miller, NIST / OWM
- Tim Osmer, NIST / OWM

- Elizabeth Gentry, NIST / OWM
- Titilayo Shodiya, NIST / National Voluntary Laboratory Accreditation Program (NVLAP)

The following individuals contributed to the review resulting from the 2012 PT Workshop Review:

- Georgia Harris, NIST / OWM
- Kelleen Larson, Consultant
- L. F. Eason, rEason Metrology Consulting, LLC
- Ken Fraley, Consultant
- Val Miller, NIST / OWM
- Elizabeth Gentry, NIST / OWM
- Aaron Aydelotte, Oregon Metrology Laboratory
- Barbara Belzer, NIST / National Voluntary Laboratory Accreditation Program (NVLAP)

This publication is available free of charge from: [Link to be provided for approved publication](#)

Proficiency Test Policy and Plan for State Weights and Measures Laboratories

1. Introduction

This Office of Weights and Measures (OWM) proficiency testing (PT) policy and plan is designed to assist the National Institute of Standards and Technology (NIST), the State weights and measures laboratories, and Regional Measurement Assurance Program (RMAP) groups in identifying the minimum level of proficiency testing needed on an ongoing basis to comply with international expectations as described in the PT Requirements section of this document. This publication is an integral component of the OWM PT Program Quality Management System. Referenced procedures and forms are integrated in the NISTIR 7214, Office of Weights and Measures, Quality Manual for Proficiency Testing and Interlaboratory Comparisons. For user convenience, Forms 1 through 3, and 7 are duplicated in this publication.

In addition to State weights and measures laboratory participation, the OWM PT program includes participation (when applicable) by the U.S. Department of Agriculture Grain Inspection and Packers and Stockyards master track scale, Los Angeles County Weights and Measures, the District of Columbia, and the U.S. territories of Puerto Rico and the U.S. Virgin Islands. In realizing compliance to this policy, some of the proficiency tests will be conducted through the RMAP regional groups and others will be coordinated on a national basis.

The terms Interlaboratory Comparison (ILC) and Proficiency Test (PT) are often used interchangeably. However, proficiency tests are a subset of ILCs that may be used for other purposes. Hereafter in this document, the term PT will be used to refer to all proficiency tests and ILCs to refer to interlaboratory comparison for simplicity, recognizing that some ILCs are not designed to be proficiency tests. This policy and plan address these different coordination needs. The OWM PT program serves purposes beyond demonstrating proficiency for recognition and accreditation activities. Proficiency testing involves the use of interlaboratory comparisons for the determination of laboratory performance for:

- a) Evaluating laboratory performance of specific measurement scope capabilities and monitoring continuing performance/Calibration Program;
- b) Identifying risks or problems and initiating corrective action. Example causes may include inadequate measurement procedures, ineffectiveness of staff training and supervision, or needed standards and equipment recalibration;
- c) Establishing the effectiveness and comparability of measurement methods/Documented Validated Procedures (e.g., method validation);
- d) Evaluating method performance characteristics/Ensuring Validity (e.g., method validation).
- e) Providing additional confidence to laboratory customers;
- f) Identifying of differences among laboratories/Unbroken Chain of Calibrations;
- g) Educating participating laboratories based on comparison outcomes/Technical Competence. For example, Laboratory Auditing Program (LAP) problems are assigned to the state weights and measures staff after OWM training and prior to OWM

- recognition as approved signatories for measurements);
- h) Validating uncertainty claims/Documented Measurement Uncertainties
- i) Evaluating a reference value; and
- j) Providing additional confidence on conformance statements

While OWM does not operate a formal accreditation program, OWM is responsible for implementing a weights and measures laboratory recognition program according to NIST Handbook 143, Program Handbook. OWM issues *Certificates of Metrological Traceability* that detail defined measurement scopes to support legal metrology measurements that underpin U.S. trade and commerce. This policy and plan are consistent with international policies set forth by the International Laboratory Accreditation Cooperation (ILAC) as of 2023. It also supplements the PT requirements in NIST Handbook 143, Section 3.5.2.2, and ISO/IEC 17025:2017.

As part of the State Laboratory Recognition Program (NIST Handbook 143), OWM is responsible for training and conducting PTs through the RMAPs. Metrologists from State legal metrology laboratories within six regions are required to attend annual training and participate in selecting, planning, and implementing a PT in planned measurement areas aligned with their OWM recognition measurement scope. At the RMAP, each participant laboratory has its own PT plan based on their laboratory's scope to prove proficiency in each area of testing performed. Most PT plans are organized and planned to cover proficiency in every area of calibration based on the lab's scope within a 4-year period. State metrology laboratories may also seek accreditation from accreditation bodies that are signatories to the ILAC Mutual Recognition Arrangement (MRA). RMAP PT 4-year plan and results may be used to meet both recognition and accreditation requirements.

The six regions are the:

- 1) Northeastern Measurement Assurance Program (NEMAP);
- 2) Southeastern Measurement Assurance Program (SEMAP);
- 3) Southwestern Assurance Program (SWAP);
- 4) Mid-America Measurement Assurance Program (MidMAP);
- 5) Western Regional Assurance Program (WRAP); and
- 6) Caribbean Measurement Assurance Program (CaMAP)

Most proficiency tests are planned, coordinated, and analyzed by an administrative team of PT coordinators who is chosen on a volunteer basis, PT analysts, and includes a NIST technical point of contact. All members of the administrative team are required to be technical experts and members of the regional groups. Any new PT Coordinators or PT Analysts will serve as mentor for new PT coordinators. The ongoing operation of proficiency tests in the RMAPs is managed according to a regional schedule. Some proficiency tests are coordinated by NIST personnel, regional technical experts, or NIST OWM approved PT providers. All OWM proficiency tests are overseen by NIST staff and final reports, and amended or appended final reports are reviewed, produced, and signed by NIST staff.

OWM policies and procedures are aligned with the most recent ILAC documents and ensures that formal PT planning and follow-up continues to be implemented.

In this document, the following verbal forms are used:

- “Shall” indicates a requirement;
- “Should” indicates a recommendation;
- “May” indicates a permission; and
- “Can” indicates a possibility or a capability.

1.1 Definitions

For the purpose of this document, terms, and definitions from the International Vocabulary of Metrology (VIM) and the listed below apply in this document.

Accreditation: A formal process of determining the technical competence of a laboratory to carry out specific types of testing, measurement, and calibration. It provides formal acknowledgement that the laboratory is competent, impartial, and independent. Regular evaluation occurs to ensure continued compliance with requirements and to check that standards of operation are being maintained.

Accuracy Class: A class of measuring instruments or measuring systems that meet stated metrological requirements that are intended to keep measurement errors or instrumental measurement uncertainties within specified limits under specified operating conditions.

Calibration: A set of operations which establish, under specified conditions, in a first step, establishes the relationship between values with measurement uncertainties provide by measurement standards and corresponding indications with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication.

Calibration and Measurement Capability (CMC): A CMC is a calibration and measurement capability available to customers under normal conditions: (a) as published in the BIPM key comparison database (KCDB) of the International Committee for Weights and Measures (CIPM) Mutual Recognition Arrangement (MRA); or (b) as described in the laboratory’s scope of accreditation granted by an accreditation body that is signatory to the International Laboratory Accreditation Cooperation (ILAC), MRA.

Certificate of Metrological Traceability: Document issued by OWM to a participating state legal metrology laboratory that has been granted recognition according to NIST Handbook 143 requirements and is always issued with a Measurement Scope.

Confidentiality: property that information is not made available or disclosed to unauthorized individuals, entities, or processes. OWM PTs are not confidential, but PT data and PT reports have usage restrictions. PT reports are available through the Freedom of Information Act.

Corrective Action: An action taken to eliminate the causes of an existing nonconformity or other undesirable situation to prevent recurrence.

Impartiality: presence of objectivity. Note 1 to entry: Objectivity means that conflicts of interest do not exist or are resolved so as not to adversely influence subsequent activities of the laboratory. Note 2 to entry: Other terms that are useful in conveying the element of impartiality

include “freedom from conflict of interests”, “freedom from bias”, “lack of prejudice”, “neutrality”, “fairness”, “open-mindedness”, “evenhandedness”, “detachment”, “balance”.

Interlaboratory Comparison: The organization, performance and evaluation of measurements or tests on the same or similar items by two or more laboratories or inspection bodies accordance with predetermined conditions.

Intralaboratory Comparison: The organization, performance, and evaluation of measurements or tests on the same or similar items within the same laboratory in accordance with predetermined schedule.

Laboratory: An organization that performs tests, calibrations, and/or sampling associated with subsequent testing or calibration. When a laboratory is part of an organization that carries out activities additional to calibration and testing, the term "laboratory" refers only to those parts of that organization that are involved in the calibration and testing process. A laboratory's activities may be carried out at a permanent location, temporary, or remote location. A laboratory may be further defined as being a physical entity that is a testing or calibration facility that is separate and apart physically from any other laboratory whether sharing common ownership, management, or management systems with any other laboratory.

Measurement Procedure: A detailed description of a measurement according to one or more measurement principles and to a given measurement method, based on a measurement model, and including any calculation to obtain a measurement result.

Measurement Scope: A range of approved measurements issued by OWM to a participating state legal metrology laboratory that has been granted OWM recognition. The measurement scope is found on the Certificate of Metrological Traceability and details calibration services for which the laboratory is recognized. See also: Calibration and Measurement Capability.

Metrological Traceability: The property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty.

Proficiency testing administrative team (PT administrative team): the collection of OWM Laboratory Metrology Program staff, and PT volunteers such as PT regional coordinators, PT coordinators, PT analysts, and any other NIST technical staff engaged in the planning and/or evaluation of a PT in the OWM PT program.

Proficiency testing analyst (PT analyst): Assigned person who is responsible for handling data related activities for the proficiency test, including initial review, data entry in analysis tools, initial assessments and selection of reference values, and recommendations to OWM regarding final evaluation and assessment.

Proficiency testing coordinator (PT coordinator): Assigned person who is responsible for implementation of the PT, including preparation and submission of the PT plan for participant review and OWM approvals, managing the flow and oversight of the schedule, shipping, intervening on problems that arise to notify OWM and ensure completion of the PT round in a timely manner.

PT Participant: Laboratory, organization or individual metrologist that receives proficiency test artifacts, follows all planned instructions, tasks, and timelines, and submits the measurement results for review by the proficiency testing provider.

Proficiency Test: The determination of the calibration or testing performance of a laboratory or the testing performance of an inspection body against pre-established criteria by means of interlaboratory comparison. (Historically, the term “round robin” but is inconsistent with current international documentary standards and should not be used.)

State Laboratory Program (officially known as the OWM Laboratory Metrology Program): A NIST OWM Program that provides guidance, technical support, and assistance to state legal metrology laboratories to ensure accurate and traceable measurements are made within each participating jurisdiction.

1.2 Abbreviations and Acronyms

Table 1. Abbreviations and Acronyms Used in this Publication.

Abbreviation or Acronym	Description
AB	Accreditation Body
IACET	International Association for Continuing Education and Training
IEC	International Electrotechnical Commission
ILAC	International Laboratory Accreditation Cooperation
ILC	Interlaboratory Comparison
ISO	International Organization for Standardization
MRA	Mutual Recognition Arrangement
NIST	National Institute of Standards and Technology
NISTIR	NIST Interagency or Internal Report
NVLAP	National Voluntary Laboratory Accreditation Program
OWM	Office of Weights and Measures
PT	Proficiency Test
RMAP	Regional Measurement Assurance Program

1.3 Applicable References

The following documents or contents therein are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced documents (including any amendments) applies.

- ISO/IEC Guide 98-1:2009, Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement (GUM), (also known as JCGM 100:2008).
- ISO/IEC Guide 99:2007, International Vocabulary of Metrology – Basic and General Concepts and Associated Terms (VIM), 3rd edition, 2008 version with minor corrections (Confirmed 2015), (also known as JCGM 200:2012).

- ISO/IEC 17011:2017, Conformity Assessment – Requirements for Accreditation Bodies Accrediting Conformity Assessment Bodies.
- ISO/IEC 17025:2017, General Requirements for the Competence of Testing and Calibration Laboratories.
- ISO/IEC DIS 17043:2022, Conformity Assessment – General Requirements for Proficiency Testing.
- ISO 13528, Third edition, 2022-08, Statistical Methods for use in Proficiency Testing by Interlaboratory Comparison.
- ILAC P9: 2014, ILAC Policy for Participation in Proficiency Testing Activities.
- ILAC P10: 2020, ILAC Policy on Metrological Traceability of Measurement Results.
- ILAC-P14: 2020, ILAC Policy for Uncertainty in Calibration.
- NIST Handbook 143:2023, State Weights and Measures Laboratories, Program Handbook, 7th Edition.
- NIST Handbook 150:2020, NVLAP Procedures and General Requirements.
- NIST Handbook 150-2:2023, NVLAP Calibration Laboratories.
- NISTIR 7214, Office of Weights and Measures, Quality Manual for Proficiency Testing and Interlaboratory Comparisons.

2. Program Scope

2.1 Purpose and Description

The OWM PT program is administered to support State metrological traceability legal requirements and operated through a national infrastructure of regions, the Regional Measurement Assurance Program. Participation in all OWM proficiency tests is limited to State Weights and Measures laboratories, where personnel have demonstrated adequate on-the-job training and success completion of applicable OWM training seminars. OWM PT program activities are limited to the U.S. states and territories. State metrology staff are automatically eligible to participate in planned OWM PT program activities if suitable training has been completed or if participation is approved by OWM.

Non-weights and measures laboratory participants who are members of the RMAPs are eligible to participate in the OWM PT program only when personnel have successfully completed training requirements, according to HB 143 Table 2 (at suitable and NIST-OWM-approved levels), participate in annual RMAP training on an ongoing basis, and/or are approved for participation by OWM.

OWM personnel are responsible for evaluating PT program participants, including the approval or denial of participation before a PT commences. The OWM PT program is not available to support unsolicited requests or contracts for services outside of the members of the RMAP groups.

2.2 Measurement Parameters

NIST HB 143 defines recognition scopes (calibration and measurement capabilities (CMC))

includes measurement parameter, range of measurements, uncertainties, and methods). At minimum laboratories are required to have objective evidence of ‘favorable/successful’ proficiency testing results for each discipline in their scope of accreditation within a four-year cycle. Successful PT completion in one measurement area, range, or parameter does not necessarily indicate that a laboratory will be successful in other areas. PT requirements shall be met for all measurement parameters where a laboratory personnel serves as an approved signatory because each scope area is based on a unique system of resources, including facilities, standards, and equipment.

Table 2. PT Parameters, Schedules, and OWM PT Program Scope.

Measurement Parameter	Typical Calibration Standard	Typical Recognition Scope Range	Typical PT Range	Recommended Participation per Parameter (Alternating Ranges and Measurement Systems per PT Round)	Example Frequency
Mass Echelon I ^{a, b}	Mass Standard	30 kg to 1 mg 50 lb to 0.001 lb 8 oz to 0.03125 oz	20 kg to 1 kg	2 year	4 year
			50 lb, 20 kg, 10 kg		
			1 kg to 1 mg		
Mass Echelon II ^a	Mass Standard	1200 kg to 1 mg 2500 lb to 0.001 lb 8 oz to 0.0125625	50 lb, 20 kg, 10 kg, 5 kg	2 year	4 year
			1 kg to 1 mg		
			100 g to 1 mg		
Mass Echelon III ^a	Mass Standard	2500 kg to 1 mg 2500 lb to 0.001 lb 8 oz to 0.0125625	50 lb, 25 kg, 25 lb, 10 kg	2 year	5 year
			5 kg to 100 mg 1 kg to 1 mg 10 lb to 0.001 lb		4 year
			500 lb		6 year
Volume Echelon I (Gravimetric) ^{a, b}	Prover	500 L to 100 mL 100 gal to 1 gi	100 gal	2 year	4 year
	Slicker		5 gal		4 year
	Glassware		1 L to 100 mL 1 gal to 1 gi		4 year
Volume Echelon II (Volume Transfer) ^a	Test Measure or Prover	5000 L to 100 mL 2000 gal to 1 gal	5 gal	2 year	4 year
	Prover		100 gal	3 year	6 year
			10 to 25 gal		
Length ^a	Tape	Up to 30 m Up to 200 ft	100 ft	2 year	4 year
	Rule	Up to 1 m Up to 24 in	18 in		4 year

Measurement Parameter	Typical Calibration Standard	Typical Recognition Scope Range	Typical PT Range	Recommended Participation per Parameter (Alternating Ranges and Measurement Systems per PT Round)	Example Frequency
Temperature Accuracy Class I, Class II, Class III, and Class IV	Liquid-In-Glass Thermometers, RTD's, SPRT's, Thermistors, and Thermocouples	230 °C to -30 °C 450 °F to -25 °F	100 °C to 0 °C	4 year	4 year
Frequency ^{a,b}	Tuning Fork	10 kHz to 1 kHz		4 year	4 year
Time ^{a,b}	Stopwatch	≤ 24 h	3 h	4 year	4 year
Hydrometer ^{a,b}	Hydrometer			5 year	5 year
^a Typically coordinated by RMAP, ^b coordinated by NIST.					
NOTE: Mass Echelon I, II, and III correspond to details published in NIST Handbook 143, Program Handbook and are directly related to OIML R111 (2004) classes of weights. Echelon I: E ₁ and E ₂ . Echelon II: F ₁ and F ₂ . Echelon III: M ₁ , M ₂ , M ₃ (etc.). The ASTM E617-18 classes correspond to those of OIML R111. NIST Handbook 105-1 (1990), Class F weights corresponds to Echelon III. Volume Echelon I is related to gravimetric volume calibration measurement procedures. Echelon II is related to volume transfer test methods. Temperature Accuracy classes are related to guidance published in NVLAP 150-2 Annexes. Six year exceptions are provided for large trailer mounted provers and mass standards due to cost and logistics.					

3. Requirements

The NIST OWM is not a formal accreditation body and does not enter into national or international agreements for acceptance and reciprocity. NIST OWM implements a Recognition Program (NIST HB 143, Program Handbook) for State Weights and Measures laboratories to ensure metrological traceability and ensure the implementation of uniform international measurement practices. NIST Handbook 143 is based on ISO/IEC 17025 and requires participation in a measurement assurance program and ongoing proficiency. This policy and plan are designed to ensure State laboratories demonstrate competence and proficiency and comply with ISO/IEC 17025 and ILAC P9.

4. Policies

4.1 Compliance with International Standards

It is NIST OWM policy to comply with ILAC policies and ISO/IEC 17043 when operating the PT program to the extent possible. OWM does not claim compliance to ISO/IEC 17011 and is not an accreditation body. Accreditation bodies that have signed the ILAC Mutual Recognition

Arrangement (ILAC MRA) have been peer evaluated to ensure demonstrated compliance with ISO/IEC 17011 and ILAC P9.

4.2 Policy for PT Program Operations

The NIST OWM offers IACET accredited training seminars in Fundamentals of Metrology, Mass, Volume, and Advanced Mass to State weights and measures laboratories and non-weights and measures participants. Courses participants are required to demonstrate successful achievement of learning objectives that are specifically related to competency. OWM also uses the results of proficiency tests to evaluate the application of training concepts in participant State laboratories as Laboratory Auditing Program (LAP) problems. The LAP problems integrate proficiency tests and serve as special internal technical audits and participant technical competency.

All recognized (NIST Handbook 143) laboratories shall demonstrate satisfactory participation in suitable PT activities that align with their measurement scope, where available. Staff must be identified in the PT Plan during the planning stages for each PT. All or current laboratory staff shall demonstrate proficiency in each four year cycle in the measurement areas identified on the laboratory Scope for which they have documented responsibility and Approved Signatory status. Failure to participate in an available PT shall negatively impact Approved Signatory status, recognition status, and OWM-approved laboratory recognition. Failure to participate may result in removal of measurement parameters from the laboratory scope until applicable proficiency tests are completed. Proficiency tests and interlaboratory comparisons objectively validate laboratory measurement capability. NIST Handbook 143 requires the use of proficiency testing and interlaboratory comparisons as a mechanism to ensure measurement result quality and validate calibration methods consistent with requirements in 17025:2017, section 7.7.

Laboratories shall report actual measurement uncertainties on calibration certificates for all proficiency tests consistent with ISO/IEC Guide 98-1 (GUM) and ILAC P14.

Laboratories shall maintain records of PT participation, conduct follow-up evaluations, and demonstrate corrective action effectiveness when PT failures occur. Pass/fail criteria are determined and documented during the planning phase of each PT and communicated to participants as a part of the PT 4-year Plan.

Feedback, inquiries, or complaints regarding any aspect of the OWM PT program may be submitted by completing Form 1. Appeals regarding OWM decisions (outside of performance evaluations) must be submitted in writing on the laboratory's official organizational letterhead. General feedback may be submitted to OWM at any time and is solicited as a part of each PT Report. OWM acknowledges receipt of input and manages communications following the OWM PT program SAP 2, Standard Administrative Procedure for Handling Action Items.

4.3 Participation Policy

Any laboratory organization that would like their metrology personnel to participate in a PT activity within the scope of the OWM PT program must be a member of a Regional Measurement Assurance Program (RMAP) and agree to operate in accordance with these policies and conditions for participation.

- The participating organization shall annually attend RMAP meetings and participate in PT/ILC planning discussions.
- Metrologists and their participating organizations shall be technically qualified for the measurement parameter of interest based on recognition or accreditation to ISO/IEC 17025 (or compliance as approved by OWM). State weights and measures staff shall comply with NIST Handbook 143 training requirements, summarized in Table 2, or receive exceptions from OWM during their planning phase. Non-weights and measures laboratory staff must complete available OWM seminars where applicable and document additional training for staff members by using Form 2, Training Qualification Form.
- Each participating organization and metrologist shall follow all PT plan details and instructions, including the use of designated procedures where specified or a laboratory procedures must be submitted and approved by OWM during the planning phase.
- All OWM proficiency tests are considered OPEN. As a condition of participating in OWM proficiency tests, participants must waive confidentiality. Anonymity is not implied or guaranteed, however there are restrictions on appropriate sharing and use of PT reports.
- PT participants shall not use any PT report for any purpose other than internal measurement assurance, staff technical competency (LAP problems) or accreditation/recognition activities. The use of OWM proficiency tests in sales, marketing, publication/presentation, or sharing or advertising of the results of any participating laboratory is strictly prohibited.
- A PT participant shall not falsify any measurement results or other information submitted to the PT Coordinator, PT Analyst, or OWM.
- Each PT participant shall keep details regarding the activity in confidence. Seeking to obtain measurement information for artifacts prior to participation in the proficiency test (collusion) is prohibited. Participants will share data only with the PT analyst or OWM personnel. Sharing any artifact information or measurement results between participants, which is provided in the proficiency test final report, is prohibited. Exception: The PT coordinator, PT analyst, or OWM personnel may communicate draft E_n values or significant error/bias to individual laboratories. This exception enables the PT coordinator, PT analyst, and/or OWM personnel to monitor immediate investigation, corrective action, and retesting (if needed) by the participant before the artifact is transferred to the next scheduled organization.
- An application is available for new organizations that have not previously been RMAP members. Any non-weights and measures laboratory seeking to participate in the RMAP proficiency tests must be approved by State members for Associate membership within the RMAP. Potential RMAP members must be sponsored by the state in which the organization resides. Applicants must agree to annual RMAP participation and compliance with policies as stated in this document. See Form 3, Application for

Membership and Form 2 for Staff Qualifications (if needed).

OWM reserves the right to refuse participation to any laboratory or participant if the laboratory or participant has violated quality policies including any one or all of the following: failing to meet training and/or qualification requirements, collusion to obtain advanced information about expected measurement results, falsification of reported results, failing to follow procedures for artifact care and handling, repeated schedule delays, or other technical issues that could adversely affect the results for the other PT participants. When OWM identifies a policy or technical violation that negatively impacts the PT activity, each participating organization and associated participants shall be notified in writing. In some cases, technical guidance may be provided to ensure that the laboratory has an opportunity for corrective action following the OWM Standard Administrative Procedure 5 for Handling Collusion, Falsification, or Participant Operational Failures (published in NISTIR 7214).

4.4 Recognition Requirements

A participant laboratory seeking initial OWM recognition (NIST Handbook 143), reinstating lapsed recognition, or maintaining ongoing recognition shall participate in the OWM PT program. Laboratories initiating recognition must complete at least one approved PT aligned with each major parameter within the requested measurement scope before a *Certificate of Measurement Traceability* is granted (as practical and available). Laboratories seeking ongoing recognition shall participate in at least one PT for each measurement area included in the laboratory's scope of recognition during a four-year period. Section 5 (PT Participation Plans) details these requirements.

Each laboratory shall develop a PT participation plan that is coordinated with the appropriate RMAP region. The laboratory PT participation plan shall be consistent with minimum PT program participation guidelines. An *example* PT participation plan is available within this document. The laboratory shall annually review the PT participation plan and consider any operational changes, such as facility, personnel, equipment, standards, methods, measurement scope, or other factors.

Unique measurement parameters, artifacts, or methods may require special PT considerations. If a suitable PT is unavailable, an alternative approach may be considered by and coordinated with OWM staff. All proficiency tests require completing a formal PT Plan and shall include OWM approval before commencing.

4.5 Laboratory and Individual Staff Competence Status

Laboratory recognition is contingent on successful PT participation. Each metrologist who has successfully performed within an OWM PT has demonstrated competence for that parameter. The laboratory organization must maintain at least one competent metrologist (Approved Signatory (see Handbook 143, Program Handbook for Approved Signatory definition and requirements) per measurement parameter within the recognized scope to achieve and retain recognition. Multiple approved signatories within a measurement parameter are permitted and encouraged. Metrologists that do not successfully demonstrate competence through an OWM PT, or who have demonstrated successive failures, shall not be granted approved signatory

status for the laboratory unless there is suitable and demonstrated corrective action.

Laboratory management shall ensure that each staff member is approved to perform calibrations within the recognized measurement scope and participate in each proficiency test when the artifact(s) arrives at the facility. This is an essential element of effective succession planning. Failing to comply with this requirement may impact the laboratory recognition status. Each person intending to participate in a PT must be explicitly named in the PT Plan document, be identified in the laboratory PT Follow Up forms, and identified in the 4-year laboratory analyses.

PT performance is not independent from laboratory processes. Each PT participant is evaluated in conjunction with the laboratory operational system (e.g., facility, equipment, standards, methods, etc.). When a metrologist performs measurements in another laboratory organization or facility, they shall demonstrate competence within that unique measurement system.

5. PT Participation Plan

The information presented below provides guidance for planning PT activities to meet the OWM PT program policy requirements. The level of organization and frequency of proficiency tests provided in this document is based on the following considerations and guiding principles.

- a. Each Region (RMAP) shall develop a PT 4-year plan and schedules by each RMAP and updated at least annually so that proficiency tests can be organized on a regional and/or national level. NIST OWM participates in all planning discussions and evaluates each specific plan for compliance to program policies before authorizing the initiation of the activity. State laboratories are required to ensure that their laboratory scope is covered in the RMAP plan or seek additional PT opportunities. NIST OWM may develop and update a PT plan for programs that require national coordination.
- b. Each RMAP region shall annually review PT Participation Plans to determine if the “frequency” is appropriate and adequate. A maximum number of proficiency tests will be coordinated each year balancing between the full parameters/scopes of the laboratories and a reasonable PT workload. Coordination between RMAP regions is also acceptable to allow a new metrologist to participate in an PT within another region without having to wait an extended time period for the PT to be conducted in their region. Out-of-region participation requests shall be documented within individual PT plans and approved by OWM before the activity is initiated.
- c. The number of laboratories with the measurement capabilities for the specific metrology parameter affects whether a PT is conducted regionally or nationally. For common measurement parameters, multiple RMAPs shall simultaneously organize proficiency tests in the same measurement parameter to enable laboratories and metrologists to participate. For less common measurements, OWM will coordinate a PT on a national basis in order to have adequate number of participants that meet the PT requirements for the scope parameter.

- d. **Measurement Parameters.** Preference is given to measurement parameters with the largest workloads within the state laboratories. The number of measurements made within a specific measurement parameter is considered. For example, mass calibrations make up nearly 90 % and length calibration accounts for about 1 % of the State Laboratory Program workload. Therefore, more proficiency tests are required in mass than length. For this reason, a frequency greater than two years is allowed for some parameters. The historic stability of the standards used and tested within a specific metrology area shall be considered. Length standards in use within a laboratory have been shown to be more stable than mass standards. For this reason, fewer length proficiency tests are required to provide adequate demonstration of measurement competency.
- e. **Cost and Logistics.** The long-range PT participation plan for participant laboratories, RMAPs, and OWM shall include plans to develop proficiency tests for each measurement parameter as it is economically and logistically feasible. The cost and logistics of the PT will be considered in selecting artifacts and in scheduling shipping. For example, large volume (e.g., 100 gal) or large mass (e.g., 500 lb) proficiency tests that require the movement of a large trailer mounted prover through RMAP regions are coordinated and overseen by NIST with assistance from regional PT Coordinators. The frequency of this type of PT is also limited by cost of the standard because it is impractical to purchase multiple standards and the length of time necessary to circulate the standard to all laboratories within each region. In contrast, a 5 gallon test measure artifact is easily shipped at a modest cost. A large volume 100 gallon prover PT may be on a longer frequency (e.g., 5 year or 6 year) whereas small volume 5 gallon test measure, may be on a more frequent (e.g., 1 year or 3 year) schedule. Conducting proficiency tests with large calibration items such as weight carts, railroad test cars, provers for liquefied petroleum gas (LPG) is not considered feasible and these items are not required to be part of the PT plan. Demonstration of competency for such items is required during training and/or onsite assessments.
- f. **Minimum requirements.** Each State laboratory shall participate in one PT per major sub-area of their accredited or recognized scope at least every four years (and in each scheduled PT within their RMAP region when available). It is recommended that organizations participate in PT activities for each specific measurement parameter and calibration method that the laboratory employs as a part of ongoing measurement assurance program. Failure to participate in an available PT shall negatively impact accreditation/recognition and the approved measurement scope and may result in removal of measurements from a laboratory Scope.

Each State laboratory shall ensure their participation in the RMAP PT plans during each 4-year cycle.

- g. The specific ranges selected within each measurement parameter will be considered

and should vary from PT to PT. For example, the range of 20 kg to 2 kg may be selected one year and the range 1 kg to 1 mg may be selected in another. Single weights and/or sets may also be considered.

- h. Additional Special proficiency tests are permitted. Additional types of PT or Interlaboratory Comparison activities are permitted. Examples of special PT activities include the evaluation of: calibration of masses with unique densities or surface finishes, mass standard density or magnetism, tests of environmental equipment used in buoyancy corrections (temperature, pressure, relative humidity), key comparisons, tests for new designs of field standards used in weights and measures, tests for evaluation of environmental effects on calibration values and uncertainties, tests for comparison of measurement procedures, and tests for evaluation and verification of measurement traceability.
- i. The OWM PT quality system procedures, forms, and tools are used to implement PT activities, including planning and reporting (see NISTIR 7214, Office of Weights and Measures Quality Manual for Proficiency Testing and Interlaboratory Comparisons). A Good Laboratory Practice (GLP) for PT Follow-Up is available to help guide laboratories in conducting measurement assurance assessments using the results of proficiency tests. The PT Follow-up Form in the GLP is required for State laboratories as a part of annual recognition reviews. PT follow-up tools include forms to help the laboratory document a successful PT as well as analyze and implement appropriate corrective action when unsuccessful PT results occur.

The sample matrix shown in Table 3 illustrates an example of how a laboratory can document not only a 4-year plan but a proficiency testing strategy that will ensure each parameter within the accredited/recognized measurement scope is evaluated according to the requirements of this policy. Both the laboratory and the accreditation/recognition body can observe at a glance all planned proficiency activities, confirming compliance to this policy or identifying gaps with ease. During a laboratory assessment, the laboratory scope, staff participation, and compliance to past plans is often evaluated. Ensuring completion of the 4 or more year plan is the responsibility of each laboratory.

Table 3. Example PT Participation Plan according to CMC.

Parameter	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Mass Echelon I		1 kg to 1 mg 4 yr		20 kg to 1 kg 4 yr		1 kg to 1 mg 4 yr		20 kg to 1 kg 4 yr		1 kg to 1 mg 4 yr
Mass Echelon II	1 kg to 1 mg 4 yr	100 g to 1 mg 2 yr	20 kg to 1 kg 4 yr	100 g to 1 mg 2 yr	1 kg to 1 mg 4 yr	100 g to 1 mg 2 yr	20 kg to 1 kg 4 yr	100 g to 1 mg 2 yr	1 kg to 1 mg 4 yr	100 g to 1 mg 2 yr

Parameter	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Mass Echelon III	25 kg to 100 mg 4 yr		50 lb to 0.001 lb 4 yr	500 lb 6 yr	25 kg to 100 mg 4 yr		50 lb to 0.001 lb 4 yr		25 kg to 100 mg 4 yr	500 lb 6 yr
Volume Echelon I	5 gal slicker 4 yr	100 gal prover 6 yr	1 qt to 1 gi glass 4 yr	1 L to 100 mL glass 4 yr	5 gal slicker 4 yr		1 qt to 1 gi glass 4 yr	100 gal prover 6 yr	5 gal slicker 4 yr	1 L to 100 mL glass 4 yr
Volume Echelon II	5 gal test measure 2 yr	100 gal prover 6 yr	5 gal test measure 2 yr		5 gal test measure 2 yr		5 gal test measure 2 yr	100 gal prover 6 yr	5 gal test measure 2 yr	
Length		18 in ruler 4 yr		100 ft tape 4 yr		18 in ruler 4 yr		100 ft tape 4 yr		18 in ruler 4 yr
Temperature All Echelons			thermometer 4 yr				thermometer 4 yr			
Frequency	tuning fork 4 yr				tuning fork 4 yr				tuning fork 4 yr	
Time		stop-watch 4 yr				stop-watch 4 yr				stop-watch 4 yr
Hydrometers			hydrometer 4 yr				hydrometer 4 yr			

6. Appendices (duplicated from NISTIR 7214)

Form 1: OWM PT Feedback and Inquiry and Complaint Form

Form 2: OWM PT Participation Request – Training/Qualification Form

Form 3: RMAP Associate Membership Application

Form 7: Examples of Proficiency Test 4-Year Plan and History/Log