UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

May 20, 2026

MEMORANDUM FOR Students Completing Fundamentals of Metrology Laboratory Auditing Program (LAP) problems

From: Micheal Hicks, Elizabeth Koncki, and Tobias Herman
NIST/Office of Weights and Measures/Laboratory Metrology Program

Subject: Laboratory Auditing Program Problems for Participants of Fundamentals of Metrology Seminar

Problem Assignment and Approved Signatory Status
These Laboratory Auditing Program (LAP) problems provide new metrologists in the NIST Office of Weights and Measures (OWM) State Laboratory Program a mechanism for recognition of Approved Signatory status, once they have completed the Mass and Volume seminars. These problems may be completed and submitted prior to or after attending the Mass and Volume seminars. A one year time frame after the completion of the Fundamentals of Metrology is normally given to participants to complete LAP Problems.

Successful completion of these LAP problems requires that a Mass PT and a Volume PT are successfully completed with all analyses that are described on the next page. A detailed summary must be generated for **each** Mass and Volume segment that covers all the required analyses (template included here). The problem summary should include a statement of the purpose of the problem, an explanation of what data was evaluated and from what source it came, what analyses were performed, what action items were identified, how action items were integrated into the normal laboratory operations, and any conclusions the participant has drawn about their laboratory measurement system based on the data and analyses.

Note: As these are auditing problems, the observations, findings, recommended improvements, and corrective actions need to flow into the laboratory's internal audit and management reviews. They need to include the plans/results of corrective action, preventive action, or improvement action that resulted from the problems – as used as an audit. If you don't have the authority to assign and complete action items in your laboratory, coordinate with your laboratory management to accomplish these goals.

Step 1: Complete Proficiency Tests (PTs)
Complete a Mass PT and a Volume PT through your regularly scheduled Regional Measurement Assurance Program PT Plan. (You may contact Micheal Hicks if one is not available within the one year time period.) Completion of a PT means performing the measurements, submitting a calibration certificate, getting feedback on the results via the NIST issued Final PT Report. You may request an interim PT report if the participant is ready to submit LAP Problems to OWM prior to the completion of the PT scheme.

Step 2: Complete LAP problem Assessments

Complete the additional assessments and PT follow-up forms as described in the below LAP Problem Assessment section. These items can be completed in parallel and do not need to wait until the PT results are final.

Step 3: Write the LAP Problem Summary

Write your Summary of the Process and Results, including the status of Action Items, how they were handled and expected completion dates. (Action Plan form available at: https://www.nist.gov/document/8-9-action-plan-form-log)

Step 4: Submission

a) Submit the LAP problems to NIST OWM as a single electronic submission (do not send them as pieces). Be sure to put your name, state, title, and date on your submission file(s) (e.g. BaucomIsabel_LAP problems-NIST-YYMMDD). Be sure that you have included sufficient objective evidence for each component of the LAP problems and cross referenced in summary write up.

Preferred method: NIST Box (https://nist.app.box.com/f/db9b1525ebd24a21a4676cf6843cf57a); contact Micheal Hicks (micheal.Hicks@nist.gov) for uploading/login instructions to NIST Box if you encounter difficulties

Alternative method: NIST issued USB memory stick (it will not be returned) mailed to:

NIST NIST Office of Weights and Measures
Attn.: **Elizabeth Koncki**
100 Bureau Drive, MS 2600
Gaithersburg, MD 20899

Training Requirements

1. Internal on-the-job training (OJT) on your laboratory Quality Management System (including administrative procedures).
2. Fundamentals of Metrology – do not *start* the problems until you have successfully completed this class or demonstrate equivalent training.
3. Mass: Completion of NIST Mass Seminar or equivalent
4. Volume: Completion of NIST Volume Seminar or equivalent

The problems are generally due within one year of completing the Fundamentals of Metrology seminar. *If you are not able to complete the Mass and/or Volume training requirements or options within that one-year period, you can request an extension of the due date from OWM.*

Potential for Conditional Recognition

If there are no other approved signatory staff available in the laboratory, successful completion of these problems *may* also enable Conditional NIST OWM Recognition of a laboratory prior to participating in Mass and Volume Seminars. By completing the LAP problems, the associated SOP 7/8 and SOP 18/19 preliminary training, and successfully completing the prescribed proficiency tests, a laboratory may be granted Conditional Recognition to support State weights and measures activities. The Conditional

Recognition will be valid for one year. The participant will be required to complete the Mass and Volume seminars in that year.

LAP Problem Assessments

1. **Perform a Proficiency Test (PT).**
   Complete a PT on artifact(s) provided by NIST or another RMAP PT as instructed and submit a formal/signed Calibration Certificate by an approved signatory for **each** (**mass and volume**), as PTs should be treated no differently than customer work.
   Objective Evidence: laboratory data and observations, any hand calculations, computer print-out or file(s) used in the process, final/amended calibration certificates, amendment procedure if amended, action items and log, and PT Report (final or interim).

2. **Conduct a "certificate review" of the Calibration Certificate(s).**
   Use the job aid SOP 1 Appendix B and the Manuscript evaluation included with SP 811 (page v): https://www.nist.gov/pml/owm/laboratory-metrology/documentary-standards-and-resources/sops and https://www.nist.gov/pml/special-publication-811/nist-guide-si-check-list-reviewing-manuscripts. Submit amended reports as required (follow the lab procedure for this). Objective evidence will include a certificate that is marked up, amended certificate including corrections, and action items and log.

3. **Conduct a "traceability assessment".**
   Conduct traceability assessments of the measurement processes for the standards used in your PTs. Use the job aid Traceability Assessment Form in GMP 13, Appendix C: https://www.nist.gov/pml/owm/laboratory-metrology/documentary-standards-and-resources/gmps. Identify and document action items.
   Objective Evidence:
   The objective evidence will include the completed GMP 13, Appendix C form as well as:
   a. Copies of all *relevant* calibration certificates for the standards used within your laboratory (for the PT) and that demonstrate/establish metrological traceability.
   b. Copies of the *relevant* traceability hierarchies (see Appendix A in GMP 13 for examples).
   c. Lab's version of GMP 11's posted standards inventory that list lab's standards and calibration due dates (https://www.nist.gov/pml/owm/laboratory-metrology/documentary-standards-and-resources/gmps).

4. **Conduct a "measurement assurance" assessment.**
   Evaluate the control charts, range charts, or standard deviation charts and associated analyses used to obtain standard deviations of the measurement process that are included in the uncertainty analysis for these PTs. If you don't have a control chart for the process at this time, you will need to perform at least 7 measurements to create control charts (following SOP 9, SOP 17, SOP 20); remember, you need at least 25 measurements for valid uncertainties. There are two assessments for this; include the completed forms (a. and b. below) as objective evidence. Be sure to identify and document action items.
   Objective Evidence:
   a. Use Appendix A included in SOP 9 to evaluate the charts themselves.

b. Use the job aid for measurement assurance assessments that is posted (https://www.nist.gov/pml/owm/laboratory-metrology/documentary-standards-and-resources/sops) with SOP 30 (Measurement Assurance System Assessment (Latest Date-2010)) to assess the measurement assurance system in your laboratory. You will also need to review the SOP used for the PTs to make sure that it is followed in your laboratory.

5. **Provide a documented "uncertainty analysis" to support the calibrations in item 1.**
   This uncertainty assessment should be **your** analysis, not a "laboratory documented solution". Use the job aid Uncertainty Evaluation Form (DOC), SOP 29 Worksheet (DOC) or the Uncertainty Budget Template (Excel) posted with SOP 29 (https://www.nist.gov/pml/owm/laboratory-metrology/documentary-standards-and-resources/sops). Once you have completed this assessment, evaluate it against the SOP used for the PT to make sure it is complete. Then evaluate your assessment against the Uncertainty Budgets submitted for Laboratory Recognition (latest update) and identify and recommend resolution for any differences. Be sure to identify and document action items.
   Objective evidence should include at least one of the SOP 29 job aids list above, the lab's recognition uncertainty budget, and a discussion of comparison and analysis of the two budgets (your's and the lab's) provided in the summary file.

6. **Complete the PT Follow-Up Form.**
   Finally, conduct the PT follow-up assessment and complete the PT Follow-up Form for each PT (https://www.nist.gov/pml/owm/laboratory-metrology/documentary-standards-and-resources/recognition). Note that even if everything passes there can be follow-up actions to complete in your laboratory.
   Submit the completed PT Follow Up Form as objective evidence along with any other evidence of corrective actions.

   Before submitting, please consider the following:
   - Include the Summary Assessments and Action Items per the instructions or the problem status will be incomplete.
   - Each item will include objective evidence.
   - Use descriptive but short file names and include the revision dates in the file names. Electronic File Organization Tips can be found at https://www.nist.gov/pml/owm/laboratory-metrology/documentary-standards-and-resources/recognition.
   - Conduct a final quality check on the files before sending them to NIST OWM.

Assessments and Reviews

OWM will review the submission to identify any missing pieces and provide initial feedback as soon as possible; it is common for OWM to identify one or more issues during the review requiring clarification or follow-up from the participant. Action Items that are identified in your assessments do not necessarily need to be completed prior to submitting the problems, but significant gaps may impact laboratory recognition status and significant concerns will need to be immediately resolved. Action items are expected to be resolved by the laboratory.

The problems are intended to be completed independently by each metrologist. However, the summary action items will need to be reviewed with laboratory management and shall follow the documentation process used in your laboratory for action items (corrective, risk minimization, improvement, etc.), internal audits, and management reviews.

Summary Report and/or Assessment. This comprises of two separate files, about 2 to 3 pages for Mass and 2 to 3 pages for Volume. Include references to attachments/files (and their file directory path) that are submitted as objective evidence. Below is an example of an outline of a summary report.

1. Purpose of the Problem (Mass or Volume)
2. High-level overview and Observations of PTs (Mass or Volume)
3. Certificate Review and Findings (Mass or Volume)
4. Traceability Assessment and Findings (Mass or Volume)
5. Measurement Assurance Assessments and Findings (Mass or Volume)
6. Uncertainty Assessment and Findings (Mass or Volume)
7. PT Follow Up (Mass or Volume)
8. Conclusions (Mass or Volume)

Fundamentals of Metrology Laboratory Auditing Program Problems Summary Template

For: *NAME*

Date: *mmm dd, yyyy*

1. Purpose of the Problem (Mass or Volume)

Click or tap here to enter text.

Objective Evidence Files Submitted (file path/ directory):

Click or tap here to enter text.

2. High-level overview and Observations of PTs (Mass or Volume)

Click or tap here to enter text.

Objective Evidence Files Submitted (file path/directory):

Click or tap here to enter text.

3. Certificate Review and Findings (Mass or Volume)

Click or tap here to enter text.

Objective Evidence Files Submitted (file path/directory):

Click or tap here to enter text.

4. Traceability Assessment and Findings (Mass or Volume)

Click or tap here to enter text.

Objective Evidence Files Submitted (file path/directory):

Click or tap here to enter text.

5. Measurement Assurance Assessments and Findings (Mass or Volume)

Click or tap here to enter text.

Objective Evidence Files Submitted (file path/directory):

Click or tap here to enter text.

6. Uncertainty Assessment and Findings (Mass or Volume)

Click or tap here to enter text.

Objective Evidence Files Submitted (file path/directory):

Click or tap here to enter text.

7. PT Follow Up (Mass or Volume)

Click or tap here to enter text.

Objective Evidence Files Submitted (file path/directory):

Click or tap here to enter text.

8. Conclusions (Mass or Volume)

Click or tap here to enter text.

Objective Evidence Files Submitted (file path/directory):

Click or tap here to enter text.