*Course Outline/Syllabus for "**Fundamentals and LAP Problems Preparation**"*

***BOX accounts to be established for EACH student to upload their OJT and assignments with ACCESS to instructors and NIST Staff so there is a permanent repository for each person and so it's not a bunch of emails going back and forth between students and instructors. Good File Management Instructions to be sent ahead of time to participants. Reference files to be posted for students to download as well.*

Pre-requisites (same as currently required for Fundamentals of Metrology):

Math pre-test (successfully completed)

Pre-work (same as currently required for Fundamentals of Metrology):

In addition to completing and submitting the Math Exercises, please read:

- NPL Beginner's Guide to Measurement (link is external)
- NPL Beginner's Guide to Measurement in Mechanical Engineering (link is external)
- ISO/IEC 17025:2017 "General Requirements for the Competence of Testing and Calibration Laboratories" (staff must demonstrate they have a copy of this standard).
- For reference, download NIST Special Publication 811 "Guide for the Use of the International System of Units (SI)" (needed for math pre-requisites).

Submit (Upload) Reading Outlines for NPL to instructors before first webinar session.

*On-the-job Training Pre-Work**

1. *Mentor Pre-work and Training (Mandatory (with potential waivers if all documented requirements are met)). *See additional document for requirements.*

2. *Conduct Pre-work OJT*

Document the following OJT using the previous form that was provided by OWM in OJT Training (unless the lab has their own) for the following items and submit OJT evidence to OWM before the first webinar session. (IF remote mentors – cameras might be an option. ABs with remote assessments are required to have a camera in the lab or they aren't qualified.)

- Laboratory Quality Management System training and familiarity with SAPs.

    - Must include: calibration certificate preparation and review; auditing, corrective and improvement action processes.
- Care and handling of standards and equipment in the laboratory (related to receipt and storage of submitted standards, operation of balances and standards, care and handling of laboratory standards (most labs also have SAPs that covers these items).
- DEMONSTRATE SOP 8 and SOP 19 for a) five 5 lb weights with a check standard and b) a 5 gal test measure with check standard. (All steps in the laboratory process from contract review to submitting a calibration certificate following the SOP, must include: reading the SOPs, traceability hierarchies for the lab, review of calibration certificates for standards used, demonstration by mentor, demonstration by trainee with mentor observing, entering control chart data and review of check standards, comparison of results between mentor and trainee, evaluation of uncertainty budget per the SOP, evaluation of the laboratory uncertainty files, and creation of calibration certificates.) Demonstrate use of laboratory software for data recording and calculations as used in the lab.
- Staff Assignments noted in the following curriculum may be completed in advance as part of laboratory OJT efforts; full documented evidence must be maintained, should be reviewed and updated if needed and submitted to instructors according to the agenda.

3. *Modules and Assignments (Offer as a 4 week "Semester") – All assignments and OJT can be completed prior to this schedule and would be good as an OJT framework but may need to supplement OJT based on guidance during first session?*

Order and Schedule for a "FOUR Week Course":

1. Webinar: Introduction to Webinars and LAP Problems – Pre-work OJT or after this session as DEMOS for SOP 8 and SOP 19 (all pieces)
2. Webinar: Calibration Certificates (SOP 1, appendices, and SAPs) (PART I)
3. Webinar: Traceability and Risk (GMP 11, 13, appendices, and lab documents)
4. Webinar: Measurement Assurance (SOP 30, 9, 17, 20, appendices, measurement assurance assessments and lab control charts)
5. Webinar: SOP 8 Webinar Lecture (and supporting procedures)
6. Webinar: SOP 19 (and supporting procedures)
7. Webinar: Basic Uncertainty (SOP 29, uncertainty 8 step worksheet)
8. Webinar: Proficiency Testing (GLP 1, PT follow up form)
9. Webinar: Calibration Certificates (SOP 1, appendices, and SAPs) (FINAL); Traceability Case Study for SOP 8 and 19
10. Webinar: Wrap Up and Feedback

	Module	Length (h)	weeks	Day
1.	**Webinar:** Introduction to Webinars and LAP Problems Followed by Significant OJT (if not already completed)	1	1	Tue

2.	Assignment: Read SOP 1, Review 17025 section 7.8, and laboratory SAP related to Calibration Certificates. **Webinar:** Calibration Certificates and some of the proposed Assignments (Part I) – e.g., Supplier Evaluation	2	1	Tue
3.	(Done WITH INTRO Webinar)			
4.	Assignment: GMP 11, 13 (Review Laboratory Traceability Hierarchy and standard calibration intervals)		1	
5.	**Webinar:** Traceability and Risk and Assignments for LAP problems	4	1	Th
6.	Assignment: Statistics		2	
7.	Assignment: Read SOP 30, 9, 17 and 20. Review SOP 8 and 19, Section 4.		2	
8.	**Webinar:** Measurement Assurance and Assignments for LAP problems	4	2	Tue
9.	Assignment: Reading SOP 8, GMP 13, GMP 10a **Webinar:** SOP 8 and supporting procedures		2	
10.	Significant OJT Pre-work Submitted and Reviewed	4	2	Th
11.	Assignment: SOP 19, GMP 3, GMP 13, GLP 10b **Webinars** SOP 19 and supporting procedures		3	
12.	Significant OJT Pre-work Submitted and Reviewed	4	3	Tue
13.	Assignment: Read SOP 29 and Review SOP 8 and 19, Section 5.		3	

14.	**Webinar**: Basic Uncertainty and Assignments for LAP problems	4	3	Th
15.	**Webinar:** Proficiency Testing and Assignments for LAP problems	2	4	Tue
16.	**Webinar:** Calibration Certificates (Part II) – Feedback Final Traceability Case Studies for SOP 8 and SOP 19 (DONE with WRAP UP and Feedback Webinar)	2	4	Th
17.	**Webinar:** Wrap Up and Feedback	2	4	Th

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
1.	Assignment: Read SOP 1, Review 17025 section 7.8, and laboratory SAP related to Calibration Certificates.	Read and Complete and submit Reading Outlines for SOP 1. Assignment: Conduct a document review. Compare SOP 1, laboratory SAP, and 17025:2017 to identify any gaps and differences in compliance with 17025:2017. Are corrections needed? Can the documents be streamlined and improved? Are these laboratory documents as clear as needed for a new person? Assignment: Conduct a Supplier Evaluation of the latest calibration certificates for the standards used in the SOP 8 and SOP 19 OJT	Make sure trainee can recommend independent corrective action or improvement action using the laboratory SAP and forms. (Support their efforts…) (Will need to be familiar with calibration certificate, supplier evaluation, and lab corrective action standard administrative procedures and forms). Have trainee review the latest Supplier Certificate for practice (save as objective evidence of evaluation) for the weights and volume standards used during OJT.	

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
		activities. Complete laboratory forms for the supplier evaluations.		
2.	**Webinar:** Introduction to Webinars and LAP Problems	Introduction Slides (from Fundamentals or Fundamentals Overview). Add PURPOSE for this series of webinars. Downloaded File for LAP problems. Instructors review LAP problems and prior recorded webinars on LAP problems and possibly review sample work from prior students for reference.	Complete all OJT Mentor requirements. Attend introduction session to be familiar with expectations.	After covering concepts, using your notes and resources, you will be able to: IDENTIFY and use reference materials to ensure good quality, accurate, traceable measurement results EXPLAIN highlights and key concepts of each topic to each other and to your managers and show how these topics fit into a management system like ISO/IEC 17025 IMPLEMENT several simple tools, job aids, and references to use and improve your laboratory operations
3.	**Webinar:** Calibration Certificates (Part I) (Done in conjunction with Introduction)	Use slide and activities from Fundamentals, Mass and Volume (NOTE: ensure the "extra items needed on certificates per SOP 8 and SOP 19 Section 6 are covered). Conduct webinar – create discussion activities for possible errors that is normally done in a group. Demonstrate an example of a marked up certificate (like was done in the 17025 sessions for 2020 RMAPs)	Ensure trainee is familiar with laboratory SAPs on creating and amending certificates. Implement corrective action to template certificates if needed (throughout the series).	Using the checklists and resources provided, you will: IDENTIFY compliance with required components of a calibration certificate IDENTIFY gaps/non-conformities on calibration certificates APPLY knowledge of the checklists and review of the certificates EVALUATE certificates from your peers during this seminar CREATE and UPDATE your compliant calibration certificate

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
		Assignment 1: Conduct individual certificate reviews for the SOP 8 and SOP 19 OJT using the laboratory templates; use SOP 1 and SP 811 to mark up the certificates. Review first pass on calibration certificates.		that will be turned in periodically for review during the sessions with final copy due at the end of this course From MASS Seminar: At the end of this module, using your notes and resources, you will be able to: ASSESS calibration certificates for mass to requirements; DESCRIBE a supplier evaluation process; CONDUCT a simple supplier evaluation to ensure traceability of standards and that certificates comply with requirements; and CREATE a calibration certificate that complies with all requirements of SOP 1 and ISO/IEC 17025:2017, Section 7.8. Remember: No Black Dots!!! From VOLUME Seminar: At the end of this module, using your notes and resources, you will be able to : ASSESS calibration certificates for volume to requirements; DESCRIBE a supplier evaluation process;

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				CONDUCT a simple supplier evaluation to ensure traceability of standards and that certificates comply with requirements; and CREATE a calibration certificate that complies with all requirements of SOP 1 and ISO/IEC 17025:2017, Section 7.8.
4.	Assignment: GMP 11, 13	Reading Assignments Submit Reading Outline for GMP 11 and GMP 13 Homework Assignments Identify and Review the laboratory traceability hierarchy, current status of standards used for SOP 8 and SOP 19, and calibration interval documentation (goal: familiarity)	Ensure trainee has access to the laboratory information, provide an orientation to the documents, discuss trainee observations, and answer any specific questions. Ensure corrective action forms are available. (Should have been completed as part of OJT)	
5.	Webinar: Traceability and Risk	From Fundamentals, Mass, and Volume with quizzes/polling embedded. Examples and demonstrations to come from SOP 8 and SOP 19. Homework Assignment: Complete Traceability Assessment(s) portion of LAP problems for SOP 8 and SOP 19. (Goal: *assess* and *evaluate*). Includes review of the calibration certificates for standards that	Ensure trainee has access to the laboratory information, provide an orientation to the documents, and answer any specific questions Make sure trainee can recommend independent corrective action or improvement action using the laboratory SAP and forms. (Support their efforts…)	Use “Case Study” later for SOP 8 and SOP 19. The case study activity session will have students do the assessment of their calibration certificates. After covering concepts, using your notes and resources, you will be able to: DEFINE Metrological Traceability, Calibration,

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
		were used; review of traceability hierarchies and database of standards and calibration intervals; completion of GMP 13 assessment form (Appendix C) for each completed PT for SOP 8 and for SOP 19. Action Item forms must be completed for any/all improvement actions and corrective actions and submitted with traceability assessment. Assignment: Evaluation calibration certificate "Traceability Statements" and update certificate if/as needed. Instructors will review the homework assignments on traceability assessments.		Measurand, Measurement Standard, Calibration and Measurement Capability (CMC) DESCRIBE why traceability matters LIST seven essential elements of metrological traceability APPLY concept of traceability hierarchies, essential elements, and risk/gap analysis to measurement activity for SOP 8 and SOP 19 Mass additions: DESCRIBE traceability of mass measurements to the SI; and ASSESS the evidence of traceability for your laboratory. Volume additions: IDENTIFY (then EVALUATE) traceability hierarchies for volume calibrations; and EVALUATE metrological traceability in your laboratory to ensure that there are no gaps in providing adequate evidence.
6.	Assignment: Statistics **TBD**	Complete the Statistics sections of the Basic Mass CD ROM (Self Study) Alternative: Reading Outlines?	Ensure download and use is possible.	

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		Alternative: Webinar with sample data Resource: Section 8 published with NISTIR 6969		
7.	Assignment: Read SOP 30, 9, 17 and 20. Read through SOP 8 and 19, Section 4.	Complete and submit Reading Outlines. Review the SOP 8 and SOP 19 control charts again for 5 lb and 5 gal check standards.	Provide additional review of Control Charts used for SOP 8 and SOP 19. (should have been done during OJT; review again if appropriate)	
8.	Webinar: Measurement Assurance	Use slides and content from Fundamentals, Mass, and Volume Seminars (as appropriate). Reinforce with statistics content (See Fundamentals Overview??). Review SOP 8 and 19, Section 4. May also need Section 8 from NISTIR 6969. Activities to be focused on Mass and Volume calibrations instead of Pennies. (Skip penny slides in favor of those examples from mass and volume seminars only at the level covered in SOP 8 and SOP 19). Review Q&A and discussions of Readings.	Good opportunity to stress within lab repeatability and agreement between mentor and trainee.	Learning Objectives: After this session, using your notes and references, you will be able to: DESCRIBE Measurement Assurance and give some examples of problems when it is absent from a laboratory and procedures REFERENCE applicable sections of ISO/IEC 17025 that relate to measurement assurance IDENTIFY and MATCH activities with different approaches to measurement assurance IDENTIFY control charts and components Variables Standard deviation Title, Axis, Statistical Control Limits RECOGNIZE control charts that are out of control, SHARE ideas

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
		Assignments: Complete LAP Problem reviews for SOP 9 and Measurement Assurance Assessment Summaries. Evaluate and submit control charts for the 5 lb weights and 5 gal test measures. Instructors will review homework assignments.		about causes and potential actions DESCRIBE check/control standards and some key points about their use APPLY measurement assurance concepts and practices to SOP 8 and 19 From Mass Seminar: EVALUATE the measurement assurance resources in YOUR laboratory, using the knowledge and tools provided in the Fundamentals of Metrology seminar and this seminar: Statistics; Measurement Assurance; and Uncertainty Analysis. Use SOP 9 to ENTER DATA and ANALYZE data and control charts for mass measurements. From Volume Seminar: After completing this module, using your notes, procedure, and experience from previous seminars and applications in your lab, you should be able to: IDENTIFY methods for measurement assurance in volume calibrations;

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				IDENTIFY statistical challenges in measurement assurance for volume; SELECT and CALCULATE the most appropriate standard deviations for a measurement process to use in uncertainty calculations; EVALUATE control charts and standard deviation charts after entering data; and POOL STANDARD DEVIATIONS if and when appropriate: determine if appropriate; and pool if acceptable.
9.	Assignment: Reading SOP 8 [a] modified substitution, GMP 13, traceability GMP 10, Good weighing practices; SOP 34 on selecting tare and sensitivity weights	Reading Assignment – Submit Completed Reading Outline for assigned procedures to instructors. Instructors will review and use this content for Q&A during the webinar session.	REVIEW Reading Outlines and answer questions before the session(s). Should be done with OJT pre-work on SOP 8 – review again at this stage of the training before submitting.	
10.	Webinar: SOP 8 Webinar Lecture(s)[a] Notes: Won't yet have discussions on tare, sensitivity weights, air density, buoyancy, mass	Lectures and videos for SOP 8. Val has recorded these sessions previously and demonstration videos are available. Consider Val's content and material from Mass seminar slides.	During OJT Pre-work, Mentor should have done this. *One suggestion was to have the mentor video the student performing the measurements and submit/upload the video. Instructors to provide guidance.	From Mass Seminar, SOP 4 – use as template to modify for SOP 8: • PERFORM mass calibration procedures, use and validate the job aids, and use reference materials to perform laboratory calibrations, including hands

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	and force (think TECHNICIAN)!!	Discussion of reading outlines, observations and Q&A. Verify answers people got from their OJT mentors. Modules in the Basic Mass CD ROM cover Good Weighing Practices and SOP 8 and can be used/assigned as supplemental. There are videos there as well. Assignment: submit calibration certificate with evaluation of data and ensure it is complete per Section 6 of the SOP 8. (to include conformity assessment!) Level of Effort:	DEMONSTRATE SOP 8, including selection of standards, identifying working and check standards as well as their traceability hierarchy and calibration due dates, entering and reviewing check standard data in control charts, reducing data for calculations (validating spreadsheet calculations), calculation of uncertainties, creating a calibration certificate. (One to three specific measurements would provide standardized activities for instruction that can be carried through to other activities for control charts, uncertainties, traceability, etc..: e.g., five 5 lb weights in kits. OBSERVE trainee performing SOP 8 steps as demonstrated and review/compare check standard values and measurement result (passing E_n assessments). EVALUATE trainee measurement results to OJT mentor results that can be used in the short term for the webinar but agreement between the two individuals must be within 2 standard deviations on the laboratory process control	on handling of mass standards and balances, calculation of measurement results, integration of measurement assurance, uncertainty analysis, and software validation to produce valid calibration results and certificates. Limited slides from SOP 8 Webinar; worked step by step by showing procedure. Slides only include learning objectives. From Webinar, Part I: • Describe the process of SOP 8 • Identify sources of error • Identify when use of SOP 8 is appropriate • Correctly implement SOP 8 From Webinar, Part II: • Identify the components of uncertainty for the SOP 8 process and use them to develop an uncertainty budget • Quantify the components of uncertainty for the SOP 8 process

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
			chart. Beyond that limit there is insufficient agreement within the lab to validate the trainee measurements. The trainee measurements must be made with no input from the OJT mentor until review/comparison is completed. Then feedback and corrective action can be provided. SUBMIT all OJT evidence to NIST and to instructors for review. *Trainee completes PT for SOP 8 as soon as possible.*	• Calculate the uncertainty of your SOP 8 process From Tare and Sensitivity Weight Slides: • DETERMINE appropriate tare weight(s); • SELECT a suitable sensitivity weight; and • CALCULATE the impact of sensitivity weight choices and sensitivity errors.
11.	Assignment: SOP 19, GMP 3, GMP 13, GLP 10[b]	Reading Assignment – Submit Completed Reading Outline for assigned procedures to instructors. Instructors will review and use this content for Q&A during the webinar session.	REVIEW Reading Outlines and answer questions before the session(s).	
12.	Webinar: SOP 19[b] GLP 10 (water quality) GMP 3 (meniscus) GMP 13 (traceability) Notes: Won't yet have discussions on expansion, temperature effects,	Lectures and videos for SOP 19 (supplement with a few GMP 3 and GLP 10 slides). Use Val's content and material from webinars and from Volume seminar. **There is a video posted on-line with SOP 18 and SOP 19 for**	Conduct an SOP 19 OJT (should have been done during pre-work). *One suggestion was to have the mentor video the student performing the measurements and submit/upload the video. DEMONSTRATE meniscus reading and CONDUCT abbreviated	SOP 18 from Volume seminar: At the end of this module, using the notes, procedures, and practice, you will be able to: IDENTIFY and follow proper pour and/or drain operations; EVALUTE temperature to determine implications of measurement errors;

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	limited on meniscus and water quality as needed (think TECHNICIAN)	**orientation and OJT and self study.** OWM doesn't recommend SOP 18, but "allows" it and provides training on it with the temperature limitations noted. Val has recorded webinars previously. Discussion of reading outlines, observations and Q&A. Verify answers people got from their mentors. Assignment: submit calibration certificate with evaluation of data and ensure it is complete per Section 6 of the SOP 19. (to include conformity assessment!) Level of Effort:	meniscus reading activity (provide handout from volume seminar). DEMONSTRATE SOP 19, including selection of standards, identifying working and check standards as well as their traceability hierarchy and calibration due dates, entering and reviewing check standard data in control charts, proper meniscus readings and temperature measurements, reducing data for calculations (validating spreadsheet calculations), calculation of uncertainties, creating a calibration certificate. OBSERVE trainee performing SOP 19 steps as demonstrated and review/compare check standard values and measurement result (passing E_n assessments). Measurement results must agree within 2 standard deviations as noted for the SOP 8 activity. Use a 5 gal test measure – options could be 3 in neck, or 4 in neck depending on what check standards and control charts are available in the lab. All details of the measurements, results,	PERFORM a correct calibration using SOP 18; PREPARE a calibration certificate; EVALUATE conformity to specifications (Handbook 105-3); and MEASURE effects of temperature gradients. To be discussed more later: Replicate measurements (Run 1 and Run 2) for measurement assurance Uncertainty analysis SOP 19 Learning Objectives: At the end of this module, using the procedure, your notes, and instructions, you will be able to: • IDENTIFY and FOLLOW proper pour and/or drain operations; • *EVALUATE temperature implications for measurement errors;* • PERFORM correct calibration using SOP 19; • PREPARE a calibration certificate; • EVALUATE conformity to specifications (NIST Handbook 105-3); and

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
			calculations, control charts as so on to be documented and submitted with OJT evidence. Submit all OJT evidence. *Trainee completes PT for SOP 19 as soon as possible.*	• CONSIDER effects of temperature gradients in uncertainty calculations. GMP 3, Meniscus Reading At the end of this module, using your notes, experience, and meniscus reading tools, you will be able to • Correctly READ meniscus and RECORD observations using 2 methods; • DESCRIBE the effects of alignment, level, and lighting on meniscus reading; and • ESTIMATE the potential impact due to errors meniscus readings. GLP 10, Learning Objectives
13.	Assignment: Read SOP 29 and Review SOP 8 and 19, Section 5.	Complete Reading Outline for SOP 29. Learn about laboratory uncertainty tables. Submit uncertainty tables to instructors for use as examples and to review.	Ensure trainee is familiar with location and processes used with laboratory uncertainty tables and approaches documented for SOP 8 and 19. (Cover when are they reviewed and updated; how often are control charts reviewed with standard deviations and degrees of freedom updated, etc.?)	

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
14.	Webinar: Basic Uncertainty	Use content from Fundamentals, Fundamentals Overview, or prior Webinar sessions. Reinforce with statistics content. Definitions module ok as is. Application Module – probably better to supplement 8-step slides with content from Mass SOP 8 and Volume SOP 19 and those seminars and content from the SOPs, section 5. Activities and Examples to focus on uncertainties for SOP 8 and SOP 19. Assignment: Complete independent SOP 29, 8-step documentation and calculation process for SOP 8 and SOP 19 – THEN compare to laboratory uncertainty values. (Implement LAP problem assessment). Assignment: Review the SOP 8 and SOP 19 uncertainties for 5 lb and 5 gal check standards and unknowns.	Provide explanations for all components used in the uncertainty tables as well as any unique calculations that are being used to identify and quantify components.	Learning Objectives: • DEFINE and DESCRIBE "uncertainty" • DEFINE standard uncertainty, combined uncertainty, expanded uncertainty and *k* values • IDENTIFY two methods for determining uncertainty components At the end of this module, using your notes and resources, you will be able to: • IMPLEMENT uncertainty analysis and reporting methods consistent with the Guide to the Expression of Uncertainty in Measurement (GUM) and the 8 step process of SOP 29. This means, to correctly: • SPECIFY the measurand and measurement equation • IDENTIFY uncertainty components • QUANTIFY each component in appropriate units • CONVERT to standard uncertainties • COMBINE using appropriate equation (often Root Sum Square)

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
		Assignment: submit calibration certificate with evaluation of uncertainty statement per SOP 29 and the GUM. Assignment: Instructors to assign certificates from this stage to peers in the group (use instructions from 2020 RMAP certificate reviews) for additional level of reviews. All marked up certificates to be sent to all trainees for feedback. Looking for 17025 compliance, SP 811 compliance, and black dots. Level of Effort:		• EXPAND using appropriate coverage factor • EVALUATE the result for accuracy, suitability, compliance, fit for purpose • REPORT the result, rounded to two significant digits, with an explanatory Statement that includes the components and how determined, coverage factor, degrees of freedom, and confidence interval Mass Learning Objectives (not all applicable for SOP 8): At the end of this module, using your notes and resources, you will be able to: • DEFINE uncertainty terminology; • APPLY 8-step process of SOP 29 to mass calibrations; • CALCULATE uncertainties for mass calibrations that are: • Complete (include required components), Accurate (calculated correctly), and • Appropriate for the specific SOP mass calibration. • CALCULATE P_n values and (for conformity assessment and decision rules)

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
				• EVALUATE uncertainties; and • DESCRIBE effective degrees of freedom and the impact of degrees of freedom associated with individual uncertainty components. (will be challenging without using the standard Excel files for the Mass seminar; consider additional slides from the Basic Uncertainty Webinar. Learning Objectives for Volume (should be updated to address the additional content covered in the Volume seminar…these are identical to the FoM module 1 on uncertainty; use something like the ones for Mass… following the Uncertainty Budget Tables in SOP 19) • DEFINE and DESCRIBE "uncertainty"; • DEFINE standard uncertainty, combined uncertainty, expanded uncertainty and k values; and • IDENTIFY two methods for determining uncertainty components.

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
15.	Webinar: Proficiency Testing	Content from Fundamentals or Fundamentals Overview. Embed quiz with calculations of E_n and P_n. Assignment: Complete PT Follow Up form for 5 lb and 5 gal measurements AS IF it was a PT, OR for the PTs that have actually been completed as needed for LAP Problems. Assignment: Read OWM Supplemental PT Report for explanations of E_n, P_n, and Z values. Instructors will review assignments. FYI – Sample PT follow up forms NOT to be used for LAP problems. Students must complete an actual PT for both mass and volume measurements to complete final PT follow up form for LAP Problems.	If laboratory has its own PT follow up form, be sure to use that.	Learning Objectives (no separate topics on this covered in Mass and Volume seminars, but part of GLP 1 and ensuring the validity of measurement results and section 7.7 in 17025. At the end of this module, using your notes and resources, you will be able to: • DESCRIBE purposes of an Interlaboratory Comparison; • DEFINE an Interlaboratory Comparison and Proficiency Test; • DESCRIBE where, when, and why PTs are performed; • CALCULATE Normalized Error and Precision Test results; and • ASSESS your PT data using the Normalized Error and Normalized Precision calculation results.
16.	Webinar: Calibration Certificates (Part II)	Certificate and traceability assessment feedback and summary from Instructors.	Ensure trainee is familiar with laboratory SAPs on creating and amending certificates. Implement corrective action to template certificates if needed.	

	Module	Instructors	Laboratory OJT Mentor	Learning Objectives
	Final Traceability Case Studies for SOP 8 and SOP 19 (DONE with WRAP UP and Feedback Webinar)	Do group exercises to wrap up traceability essential elements and everything that has been done during the course and how it feeds into the 7 essential elements. Assignment: complete LAP problem section for certificate evaluations for the completed PTs; document all actions taken up to completing the final certificate.		
17.	Webinar: Wrap Up and Feedback	Level of Effort:		

<[a]> for those who haven't completed the Mass Seminar.
<[b]> for those who haven't completed the Volume Seminar.