Laboratory Staffing

(ISO/IEC 17025: Section 5.2)

Learning Objectives

At the end of this section, you should be able to:

• IDENTIFY and DESCRIBE training course availability, and training requirements for OWM Laboratory Recognition and ENSURE that laboratory documentation is complete and up to date;

• REVIEW and CREATE sample on the job training (OJT) outlines as a part of orienting a new employee;

• SHARE best practices in OJT; and

• CONTRIBUTE insights for a working group outline related to metrologist hiring, probation, promotion, retention, and succession planning.

"Knowing what's right doesn't mean much unless you do what's right." — Theodore Roosevelt

Training and Staffing (5.2)
Where are we going?

• OWM Training Requirements (for State W&M Laboratories)
  • Courses available to everyone….
• Laboratory Auditing Program (LAP) Problems
  • Fundamentals of Metrology
    • PT and Internal Audits
  • Advanced Mass Seminar Pre-work and Follow Up Measurements
    • Internal Audit + Measurements to support valid Uncertainties + PT
• Transferring learning to others
  • ADDIE Model
  • Learning Objectives
  • 4-step OJT process with practice
  • Documenting OJT

NIST Office of Weights and Measures
Laboratory Metrology Program

Training Requirements for State W&M Labs
Training Availability and Insights for Other Labs
## Laboratory Metrology Program

### Four Key Areas

- **Laboratory Recognition**
- **Training**
- **Proficiency Testing**
- **Documentary Standards**

## Laboratory Metrology Program Areas

<table>
<thead>
<tr>
<th>Reference(s)</th>
<th>Recognition</th>
<th>Training</th>
<th>Proficiency Testing</th>
<th>Documentary Standards</th>
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<td>NISTIRs 7082, 7214 ISO/IEC 17043</td>
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<td>Annual Submissions and Reviews</td>
<td>Applications (OWM Contact System)</td>
<td>Planning Conducting Evaluating Reporting</td>
<td>ANSI</td>
<td>OWM published process</td>
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<td>On site assessments</td>
<td>Training Evaluation</td>
<td>Reporting</td>
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<td>Training Needs Assessments</td>
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<tr>
<th>Measuring Results</th>
<th>Recognition</th>
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<th>Documentary Standards</th>
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<td>Maps NVLAP Scoring Model Workload Survey</td>
<td>Course Evaluations LAP Problems (PTs and Technical Assessments) Follow up: Application and Impact</td>
<td>Passing Percentage by Parameter and Year</td>
<td>Level of adoption Time to update</td>
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</table>

**Reference(s):**
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- NIST HB 105-1 through 105-8 ASTM USP
- ANSI
- OWM published process

**Processes:**
- Annual Submissions and Reviews
- On site assessments
- Applications (OWM Contact System)
- Training Evaluation
- Training Needs Assessments
- Planning Conducting Evaluating Reporting
- ANSI
- OWM published process

**Measuring Results:**
- Maps NVLAP Scoring Model Workload Survey
- Course Evaluations LAP Problems (PTs and Technical Assessments) Follow up: Application and Impact
- Passing Percentage by Parameter and Year
- Level of adoption Time to update
Training Activities

- Updated Calibration Procedures and Training Aids
  - Length Session in 2014 at C-RMAP
  - Added Excel Tools, including Control Charts into each course and as Job Aids
- ANSI/IACET Accreditation (2013)
  - Quality Manual and Procedures
  - Course Evaluation Methods to Measure Impact
- Metrology Training Redesign
  - ADDIE and Adult Learning
  - Alignment of Learning Objectives, Activities, and Assessments

Area 2: Laboratory Training

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<th>Weeks</th>
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**NOTE!** Old courses no longer available!!!

|       | **New Course Structure** |       |       |       |       |       |
| Math Pre-Test | Fundamentals of Metrology (2011) |       |       |       |       |       |
| with LAP Problems | Webinar: SOP 8 Part I and II | Volume (Basic and Intm.) (2013) |       |       |       |       |
Webinars

- Webinars Scheduled Throughout the Year
- Will be scheduled as requests are made....

<table>
<thead>
<tr>
<th>Lab Metrology Webinar List</th>
<th>17025 Section (Basis of Need)</th>
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<tr>
<td>Document Control and Record Keeping</td>
<td>3.1, 4.13</td>
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<td>Conducting an Effective Management Review</td>
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<td>Calibration Method Validation</td>
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<td>Advanced Measurement Assurance</td>
<td>3.9, SOP 30, 9, 17, 20</td>
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<td>Proficiency Testing &amp; Root Cause Analysis</td>
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<td>Mentoring or Data Review</td>
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<tr>
<td>Software Verification &amp; Validation</td>
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<td>Laboratory Admin Workshop</td>
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<td>Customer Service</td>
<td>3.7, 4.8</td>
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<tr>
<td>Uncertainty Budget Tables for SOP 14</td>
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</table>

Updated Training Requirements

- Handbook 143, Table 2 updated 2011, 2013, 2015
  - Circulated and Posted
- 2007 version still valid for current staff if they completed all requirements
- Anyone out of the lab (out of calibration function) needs refresher training!
- Considering: Laboratory Administration Seminar as a part of the Core Requirements (submit input)
Activity

• Review Quality Manual and Administrative Procedures for “Training Requirements” for your laboratory.

Action Items

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
Laboratory Auditing Program (LAP) Problems

“Specialized Technical Auditing”
Fundamentals of Metrology
Advanced Mass Pre-work and LAP Problems

LAP Problems.....integrate into lab operations!

- Explain what was done at each step and what it means. (Ability to communicate technical results not just measure.)
- With Follow Up Inquiries via email; Letter re status and Approved Signatory status (or not)
In vain have you acquired knowledge if you have not imparted it to others.

Deuteronomy Rabbah, (c.900, commentary on the Book of Deuteronomy)

In today’s environment, hoarding knowledge ultimately erodes your power. If you know something very important, the way to get power is by actually sharing it.

Joseph L. Badaracco, Jr, 1948, professor of Business ethics at Harvard Business School

Effective On the Job Training

Desire + Knowledge + Tools

Share your knowledge. It’s a way to achieve immortality.

Dalai Lama (1357-1419, high lama of Tibetan Buddhism)

Often, we are too slow to recognize how much and in what ways we can assist each other through sharing expertise and knowledge.

Owen Arthur, *1949, Barbadian politician

ADDIE Training Model
Analysis

- Needs Assessment & Perspectives
  - Metrologist
  - Lab Management
- Who is the audience?
- What is the overall expected outcome of the session (big picture)?

Sources of Input

- Prior courses
- Evaluation forms
- Surveys
- Annual submissions
- Inquiries
- PT/ILC data
- Instructor workshops
- Standards
- Requests

Design

- Write Learning Objectives – Bloom’s Taxonomy
- Evaluate and Select “Best” Delivery (Teaching Methods) and Techniques (Activities)
  - Lecture
  - Hands-on/Laboratory
  - Computer based (CD, DVD, Internet)
  - Casts: podcast, webcast, video cast, VHS
- Style:
  - 4-step Model (we will cover)
  - Read, Demo, Do, Evaluate, Share
  - Collaborative (Team)
  - Investigative (Assign Problem)
  - Self Study
  - Mentoring, Guided
- Evaluate – what is “best” approach to meet objectives? (Assessment)
Learning Objectives

**Definition:** A statement in specific and measurable terms that describes what the learner will know or be able to do as a result of engaging in a learning activity.

1. Must be learner centered
2. Select a verb for performing the task (action). Determine if the verb you have chosen best describes the type of behavior that the learners need to display after training (see Bloom's Taxonomy).
3. Under what conditions (resources) must the task be performed?
4. Determine to what standards (quality) the task must be performed.

- Example:
  - Using the presented procedure, you will accurately list at least three characteristics that are required in the uncertainty analysis and reporting process.

Learning Objectives: Related to performance, observable

**Bloom’s Cognitive Levels**

- **Knowledge:** Define, Repeat, Record, List, Recognize
- **Comprehension:** Restate, Discuss, Describe, Explain, Express
- **Application:** Interpret, Apply, Employ, Use, Calculate, Estimate, Illustrate, Operate, Schedule, Sketch
- **Analysis:** Distinguish, Analyze, Differentiate, Appraise, Calculate, Experiment, Test, Compare, Contrast, Criticize, Diagram, Inspect, Debate, Inventory, Question, Relate
- **Synthesis:** Compose, Plan, Propose, Design, Formulate, Arrange, Collect, Construct, Create, Set up, Organize, Manage, Prepare
- **Evaluation:** Judge, Appraise, Evaluate, Rate, Compare, Value, Revise, Select, Choose, Assess, Estimate, Measure, Score, Justify, Defend
VERBS..... Avoid generic “Know” and “Understand”

- **Know**
  - describe, identify, recall, arrange, define, duplicate, label, list, memorize, name, order, recognize, reproduce state.

- **Comprehend**
  - comprehend, give example, classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate,

- **Apply**
  - apply, change, construct, compute, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, write.

- **Analyze**
  - analyze, break down, relate, appraise, calculate, categorize, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, make inferences, find evidence, test.

- **Synthesize**
  - summarize, arrange, combine, categorize, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, write.

- **Evaluate**
  - appraise, interpret, argue, assess, attach, compare, defend, estimate, judge, predict, rate, core, select, support, value, evaluate, prove, deduct.
Develop

• Develop Materials
  • Instructor materials, outline, notes (e.g., outline and SOP)
  • Student handouts (SOP and work instructions)
  • Case studies and resources (e.g., demonstration and calibration)
  • Additional learning tools and aids (videos, CD ROM)
• Evaluate content – will it achieve objectives?
• Convert technical content – difficult? Easy?

Implement

• Course logistics – based on location
• Contracts
• Facility
• Equipment & standards – maintenance, updating, shipping
• Printing/duplicating materials – shipping if needed
• Present the training – instructor development (key KSAs)
  • Know the technical content (metrology)
  • Know and apply learning/teaching body of knowledge
  • Be able to develop objectives, select strategies
  • Be able to present and interact effectively
  • Teach to achieve the objectives
• Evaluate: which of these does NOT contribute to learning?
Evaluate

- Evaluate all steps in the ADDIE processes
- Evaluate learning at all stages
- Conduct Course Evaluation: Kirkpatrick & Phillips Models
  - Satisfaction
    - smile sheets
  - Learning
    - pre-test, post-test, self assessment
  - Application
    - Intention to apply, calibration report development in class, 45-day follow up, LAP problems, graded projects
  - Impact
    - applied on the job – measurement quality meets needs; improved PTs/ILCs
- Return on Investment
  - costs, values, research

Writing Learning Objectives

Elements:

1. Learner centered
2. Verb (action)
3. Conditions (resources)
4. Standards (quality)
Activity – What will you or your staff know or do after this class?

- Class:
  - Internal Auditing Best Practices, Webinar

- Stated objectives:
  During this webinar, using your notes and ISO/IEC 17025 or NIST HB 143, you will:
  - IDENTIFY internal auditing criteria (Section 4.14) in ISO/IEC 17025:2005 & NIST HB 143:2007;
  - IDENTIFY the steps of an audit cycle;
  - DESCRIBE the difference between a “desk audit,” “functional audit,” “technical audit,” and “management system audit”;
  - IDENTIFY template checklists and other tools that can be used to successfully document the audit process; and
  - APPLY best practices to CONDUCT an effective internal management system audit within your laboratory.

Notes
Activity – What do you want (your employee) to know or do?

• Example VERBS:
  • Read (the SOP)
  • Pour (water)
  • Demonstrate (for another staff or manager)
  • Evaluate (against tolerance)
  • Read (a meniscus)
  • Measure (temperature)
  • Measure (weight)
  • Calculate (volume)
  • Calculate (density)
  • Evaluate (ID)
  • Test (coefficient of cubical expansion)
  • Identify (material)
  • Assess design (vs specifications)
Activity – What do you want (your employee) to know or do?

At the end of this session, you will be able to:

Reminder:
1. Learner centered ☑
2. Verb (action)
3. Conditions (resources)
4. Standards (quality)
Planning: Keep Alignment and Performance Expectations in Mind!

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<tr>
<th>Objectives</th>
<th>Activities</th>
<th>Assessment</th>
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OJT Worksheets (and resource job aids)

- Skill Assessment – *think* through the task
- 4-Step Process for OJT
- OJT Planning and Documentation – document the plan, document the observations

- More information: NCSLI Recommended Practice 17
Ensuring Objective Evidence!

Documenting: Laboratory Training Plan Log

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<tr>
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<th>JONES</th>
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Activity – Sharing Best Practices

Notes
Laboratory Staffing Working Group

Recommendations for Laboratory Metrology Personnel Requirements

Lifecycle Activities
- Outreach: K to 12, University
- Job Descriptions: OPM and SOC
- Hiring: posting and sharing
- Interviews (assessments)
- Training
- Retention (Compensation, Benefits, Culture)
- Retirement

Biggest Challenges???

Notes
REVIEW: Learning Objectives

• NOW, you should be able to:
  • IDENTIFY and DESCRIBE training course availability, and training requirements for OWM Laboratory Recognition and ENSURE that laboratory documentation is complete and up to date;
  • REVIEW and CREATE sample on the job training (OJT) outlines as a part of orienting a new employee;
  • SHARE (IDENTIFY) best practices in OJT; and
• CONTRIBUTED insights for a working group outline related to metrologist hiring, probation, promotion, retention, and succession planning.

Reflection: Concepts and Applications

• Make a note about a key concept or idea you have learned that you can share with someone after this class.
• Identify one gap or weakness in your laboratory or identify one tool you can use to make improvements. Write it down on your application notes.