AGRICULTURAL MATERIALS

Developing a Competency Framework for U.S. State Food and Feed Testing Laboratory Personnel

Craig Kaml
International Food Protection Training Institute, Curriculum, Battle Creek, MI
Christopher C. Weiss
Global Food Protection Institute, Research and Dissemination, Battle Creek, MI
Paul Dezendorf
Western Carolina University, College of Health and Human Sciences, Cullowhee, NC
Maria Ishida
Florida Department of Agriculture and Consumer Services, Division of Food Safety, Bureau of Food Laboratories, Tallahassee, FL
Daniel H. Rice
New York State Department of Agriculture & Markets, New York State Food Laboratory, Albany, NY
Ron Klein
Association of Food and Drug Officials, York, PA
Yvonne Salfinger
Retired, Florida Department of Agriculture and Consumer Services, Division of Food Safety, Bureau of Food Laboratories, Tallahassee, FL

A competency-based training curriculum framework for U.S. state food and feed testing laboratories personnel is being developed by the International Food Protection Training Institute (IFPTI) and three partners. The framework will help laboratories catalog existing training courses/modules, identify training gaps, inform training curricula, and create career-spanning professional development learning paths, ensuring consistent performance expectations and increasing confidence in shared test results. Ultimately, the framework will aid laboratories in meeting the requirements of ISO/IEC 17025 (2005) international accreditation and the U.S. Food Safety Modernization Act (U.S. Public Law 111-353). In collaboration with the Association of Food and Drug Officials, the Association of Public Health Laboratories, and the Association of American Feed Control Officials, IFPTI is carrying out the project in two phases. In 2013, an expert panel of seven subject matter experts developed competency and curriculum frameworks for five professional levels (entry, mid-level, expert, supervisor/manager, and senior administration) across four competency domains (technical, communication, programmatic, and leadership) including approximately 80 competencies. In 2014 the expert panel will elicit feedback from peers and finalize the framework.

The International Food Protection Training Institute (IFPTI), in collaboration with the Association of Food and Drug Officials (AFDO), the Association of Public Health Laboratories (APHL), and the Association of American Feed Control Officials (AAFCO), has been developing a competency-based curriculum framework in 2013–2014 that will help aid the U.S. system of regulatory public health laboratories in meeting the requirements of ISO/IEC 17025 (2005) international accreditation and the U.S. Food Safety Modernization Act (FSMA; 1). The project, which is funded by a cooperative agreement with the U.S. Food and Drug Administration (FDA), will help laboratories catalog existing training courses/modules, identify training gaps, inform training curricula, and create career-spanning professional development learning paths, thus ensuring consistent performance expectations and increasing confidence in shared test results.

The U.S. system of regulatory public health laboratories includes state public health laboratories, local laboratories, state agricultural or environmental agency laboratories, laboratories under a state chemist, and subsidiary laboratories that test food and/or feed. This system of laboratories protects the public against diseases and health hazards through clinical diagnostic tests, disease surveillance, and food, feed, environmental, and radiological analytical testing (2). However, as of 2013 not all of these laboratories were accredited under the only internationally-recognized laboratory accreditation ISO/IEC 17025 (2005) of the International Organization for Standardization/International Electrotechnical Commission (3). Prior to the initial publication of ISO/IEC 17025 in 1999, there existed only widely differing national standards for accreditation. ISO/IEC 17025 (2005) sets forth quality management systems documentation and implementation requirements for testing and calibration laboratories. Obtaining accreditation to this ISO standard will help establish equivalency among food and feed laboratories at all levels (local, state, federal, and private), thus enabling them to share test results with confidence that the findings are accurate and comparable.

The curriculum framework will also help laboratories meet the standardization requirement of FSMA, the most comprehensive food safety legislation enacted in the United States in more than 70 years. Section 202 of FSMA calls for the development of model standards that laboratories must meet in order to be accredited by a recognized accreditation body. These standards

must address sampling techniques, analytical procedures, internal quality assurance, complaint response, employee qualification, and other criteria.

To obtain ISO accreditation and meet FSMA standards, laboratory professionals must have appropriate training and competency. Determining the scope and content of this training is the driving force behind Phase One—the development of a competency framework that describes the job competencies required by laboratory personnel. In Phase Two, the competency framework will guide the development of a training curriculum that will help identify training content areas, catalog existing training courses and modules, find gaps in existing training, and create new training to address those gaps. The curriculum framework will also allow food and feed laboratory professionals to identify gaps in their own professional development and allow those individuals to create personal learning paths.

The competency-based training curriculum framework will be similar in concept to that created by IFPTI in 2012 for regulatory food protection professionals working at the federal, state, local, tribal, and territorial levels, at the request of and in collaboration with the FDA (4). The IFPTI framework is supported by the FDA, the World Bank, and other food and agriculture institutions and agencies. For example, IFPTI has had meetings with the Canadian Food Inspection Agency regarding implications and possible implementation of a similar framework for Canada.

Method

The development of the competency framework used a back mapping design process to plan results-based professional development (5). The process identifies desired training outcomes and designs a system to achieve those outcomes. IFPTI, AFDO, APHL, and AAFCO began Phase One by convening an expert panel of seven food and feed laboratory subject matter experts with an appropriate range and depth of knowledge, skills, and experience in state food and feed testing laboratories. The panel met on August 21–22, 2013 at the Kendall Center of Western Michigan University, adjacent to the IFPTI headquarters in Battle Creek, MI. The meeting was led by IFPTI, and the panel included (in alphabetical order):

Maria Ishida, Bureau Chief, Florida Department of Agriculture and Consumer Services, Division of Food Safety, Bureau of Food Laboratories;

Ron Klein, retired, former manager of the Alaska Food Safety and Sanitation Program, and AFDO Program Director;

Susan Murphy, Quality Assurance/Safety/Training Manager, Biosafety Officer, Virginia Division of Consolidated Laboratory Services;

Daniel Rice, Director, New York State Department of Agriculture & Markets, New York State Food Laboratory;

Yvonne Salfinger, retired, former Bureau Chief and AFDO Program Consultant, Bureau of Food Laboratories, Division of Food Safety, Florida Department of Agriculture and Consumer Services;

Steve Sobek, Director, Bureau of Laboratory Services, Wisconsin Department of Agriculture, Trade and Consumer Protection;

Kathleen Wickman, Laboratory Manager, Oregon Department of Agriculture.

The first step in Phase One defined the target audience. The panel defined the primary audience as state regulatory (public) food and feed testing laboratory professionals, although the audience could also include laboratory professionals working in the private sector. The term "food and feed laboratory professionals" was defined to include laboratory technicians, chemists, and microbiologists, but not administrative/support staff such as security officers, custodial personnel, secretarial staff, grounds-keeping personnel, and information technology staff (individuals who fix computers, load software, or set up networks for the laboratory as opposed to database managers and professionals responsible for Laboratory Information Management Systems).

Results

The second step in Phase One drafted a competency framework, which is a model that broadly defines the blueprint for excellent performance within an organization, sector, or profession. The competency framework helps identify desired outcomes or behavior, enumerates metrics by which competency can be measured, spells out observable and measurable characteristics, and provides evaluation criteria, e.g., "A food or feed laboratory professional at the entry level has achieved a technical competency if he or she can explain laboratory testing methods and perform laboratory tests independently and correctly." The second step included two initial tasks: identifying professional levels and identifying specific types of competency domains.

The panel identified a total of five professional levels, along with preliminary definitions for each level:

(1) *Entry level.*—Newly hired laboratory professionals who have been on the job for up to approximately 2 years and who have a limited testing scope and complexity.

(2) *Mid-level.*—Laboratory professionals with a more expanded and increased testing scope and complexity.

(3) *Expert level.*—Laboratory professionals with more than 5 years of experience who have an extensive range of testing scope, a high level of knowledge on testing principles, and the ability to independently perform problem-solving tasks.

(4) *Supervisor/manager level.*—Laboratory professionals who have laboratory skills, can manage laboratory workload and supervise entry, mid-level, and expert levels.

(5) *Senior administration level.*—Laboratory professionals who have laboratory, management, and leadership skills to oversee all administrative management duties for the laboratory.

Next, the panel identified and defined four types of competency domains that apply to each professional level:

(1) *Technical competency.*—The ability to perform tasks related to certain subject matter (e.g., chemistry, microbiology).

(2) *Communication competency.*—The ability to effectively and appropriately interact with others to achieve desired goals.

(3) *Programmatic competency.*—The ability to guide technical functions to accomplish the organizational mission.

(4) *Leadership competency.*—The skills and behaviors that contribute to superior performance.

The professional levels, along with the four domains, were then mapped onto a framework.

The panel then identified the technical, communication, programmatic, and leadership competencies necessary for each level of employee, beginning with the entry level and working up to the senior administration level. The competencies were placed in the appropriate cell in the competency framework as shown in Table 1.

For example, in order to demonstrate technical competency,

Table 1. Proficiency levels and mapping competencies onto the framework

Proficiency levels/domains	Technical competency	Communication competency	Programmatic competency[a]	Leadership competency
Senior Administration				Advocate for resources.
				Establish organizational culture.
				Lead strategic planning efforts.
Supervisor/Manager				
Expert				
Mid-Level		Present ideas clearly to his/her peers.		
		Write SOPs.		
		Create data summary reports.		
Entry Level	Explain laboratory testing methods.			
	Perform laboratory tests independently and correctly.			

[a] The expert panel determined that the same programmatic competencies would apply to both Entry Level and Mid-Level food and feed laboratory professionals.

an entry level laboratory professional should be able to explain laboratory testing methods and perform laboratory tests independently and correctly. In order to demonstrate competence in communication, a mid-level laboratory professional should be able to present ideas clearly to peers, write standard operating procedures, and create data summary reports. In order to demonstrate competence in leadership, a senior administration level laboratory professional should be able to advocate for resources, establish organizational culture, and lead strategic planning efforts. Competencies within a given domain are cumulative, which means that the competencies at one level build on the competencies of the previous level(s). Thus, a mid-level professional should have the competencies of an entry level professional and be working to acquire the competencies expected of a mid-level professional.

The panel initially identified more than 80 specific competencies and applied the competencies to the appropriate professional level and competency domain. Tables 2–5 represent the complete competency frameworks drafted by the group for the five proficiency levels/domains, beginning at the highest level (senior administration) and ending with the lowest level (entry level).

Table 2. Draft competency framework: senior administration level

Technical competency	Communication competency	Programmatic competency	Leadership competency
Anticipate and evaluate resource needs.	Distill complex technical information for a variety of audiences.	Strategically prioritize and allocate resources.	Advocate for resources.
	Interact with media organizations regarding sensitive issues.	Collaborate in the development of new program standards.	Establish organizational culture.
	Disseminate the vision, mission, goals, and objectives throughout the organization.	Create or modify policy.	Lead strategic planning efforts.
		Establish fee structures.	Promote an integrated food safety system.
		Oversee facility management.	

Table 3. Draft competency framework: supervisor/manager level

Technical competency	Communication competency	Programmatic competency	Leadership competency
Assess work performed by experts.	Interact with media organizations regarding non-sensitive issues.	Assess program performance using data.	Motivate laboratory professionals.
Determine if experts' conclusions are valid.	Write concise business reports.	Suggest new methods.	Implement the strategic plan.
Interpret a compilation of test results and explain the implications.	Conduct conflict resolution and negotiation.	Interpret and apply emerging technologies.	Advocate for laboratory staff members.
	Provide clear instructions to experts.	Implement new policies.	Engage in interagency collaboration.
	Inform senior administration of challenges, opportunities, resource needs, etc.	Ensure compliance with work rules, policies, and practices.	Engage in integrated food safety system activities.
	Effectively disseminate information.	Employ program standards relevant to the laboratory.	
	Produce effective written and oral interpersonal communications.	Administer accreditation or certification standards that pertain to the administrative operations.	

Table 4. Draft competency framework: expert level

Technical competency	Communication competency	Programmatic competency	Leadership competency
Troubleshoot problems.	Engage in public speaking.	Collaborate on applicable grant opportunities.	Participate in strategic planning.
Train laboratory professionals.	Write for publications.	Apply regulatory standards in assessing data and reporting results.	Mentor laboratory professionals.
Interpret and describe standard and nonstandard test results.	Independently interact with peers regarding technical information.		Demonstrate professional laboratory behavior.
Evaluate data using statistical modeling.	Participate in workgroups and professional organizations.	Administer accreditation or certification standards that pertain to the laboratory testing operations.	Contribute to professional field.
Evaluate and implement technologies.	Build collaborations.		
Conceptualize and develop novel approaches.	Write technical reports or documents.		
	Facilitate meetings.		

Table 5. Draft competency framework: mid-level and entry level

	Technical competency	Communication competency	Programmatic competency	Leadership competency
Mid-Level	Apply testing knowledge and skills to similar testing methods. Apply knowledge and skills to use similar technologies. Participate in trouble-shooting problems. Describe results in terms of work performed.	Present ideas clearly to peers. Write SOPs. Write in a grammatically-correct style. Create data summary reports. Write corrective action reports. Articulate issues. Present information about work performed as evidence in legal proceedings.	Describe regulatory programs that the laboratory supports. Explain roles and responsibilities in the quality system. Articulate roles and responsibilities in a safety program. Explain the roles and responsibilities of personnel and programs within their laboratory.	Initiate problem resolution. Recommend innovative solutions. Recognize and proactively address issues and gaps.
Entry Level	Explain laboratory testing methods. Perform laboratory tests independently and correctly.	Clearly record observations. Follow written and verbal directions. Seek assistance or clarification when necessary. Discuss laboratory-related issues clearly, logically, and succinctly.		Consistently behave in ethical manner. Pursue professional growth. Assume responsibility and accountability for actions.

The panel then began the process of validating all the competencies identified during their August 2013 meeting. This validation involves identifying existing competencies from other sources and/or vetting the competency framework with state food and feed testing laboratory peers and colleagues. The group will then map any new additional competencies onto the competency framework and revise the draft competencies as shown above.

Discussion

The IFPTI competency-based training curriculum project is creating an evidence-based, national framework of professional laboratory personnel competencies in conjunction with a national training curriculum framework. The project provides a major, essential tool for all U.S. state food and feed testing laboratories that seek to gain ISO/IEC 17025 (2005) international accreditation and to meet the regulatory requirements of FSMA.

A substantial part of this project's success in meeting FDA Cooperative Agreement requirements and partner expectations is that it builds directly on the national curriculum framework for public regulators, an IFPTI-led activity from 2011–2012. That framework has been approved not only by the FDA, but also by the World Bank and foreign governments.

The competency-based training curriculum project has multiple benefits for U.S. state food and feed testing laboratories.

At the individual laboratory level, the project will assist laboratories in efficiently applying staff training and development funds by providing a common set of competency domains across professional levels for laboratories and training providers. This application, in turn, will aid in the identification of content that should be included in competency- and standards-based training programs. Once finalized, the competency framework will serve to inform a training curriculum framework, which will catalog existing training courses/modules and help identify gaps in existing training. These gaps can then be filled through the development of new training.

Establishing equivalency of competencies among laboratories, will improve their interaction with food and feed safety programs and other laboratories, and will allow for the sharing of accurate and reliable test results. In doing so, the laboratories will be assisted in meeting the standardization requirement of FSMA. Section 202 of FSMA calls for the development of model standards that laboratories must meet in order to be accredited by a recognized accreditation body. Finally, the project will assist all U.S. food and feed testing laboratories in gaining international accreditation under ISO/IEC 17025 (2005).

For laboratory professionals, the project will aid in creating personal career learning paths by identifying the technical, communication, programmatic, and leadership skills they should acquire to become more advanced laboratorians, i.e., achieve

knowledge, skills, and abilities to progress in their careers. In doing so, the food and feed testing laboratory profession will gain in professional recognition and presumably benefit from improved attraction as a career.

IFPTI welcomes any comments and/or suggestions regarding the competency framework for food and feed laboratory professionals. Please contact Craig Kaml, IFPTI's Vice President of Curriculum, at craig.kaml@ifpti.org.

Acknowledgments

References

(1) FDA Food Safety Modernization Act (2011) *U.S. Public Law 111-353*, U.S. Government Printing Office, Washington, DC

(2) Association of Public Health Laboratories (2013) *About Public Health Labs*. http://www.aphl.org/AboutAPHL/aboutphls/Pages/default.aspx (accessed December 4, 2013)

(3) United Nations Industrial Development Organization (2009) *Complying with ISO 17025: A Practical Guidebook for Meeting the Requirements of Laboratory Accreditation Schemes-Based on ISO 17025:2005 or Equivalent National Standard*. http://www.unido.org/fileadmin/user_media/Publications/Pub_free/Complying_with_ISO_17025_A_practical_guidebook.pdf (accessed December 4, 2013)

(4) International Food Protection Training Institute (2013) *Curriculum Framework for an Integrated Food Safety System*. http://www.ifpti.org/food-protection-curriculum (accessed December 4, 2013)

(5) U.S. Department of Education (2006) *Back Mapping: A Process for Results-Based Staff Development*. http://www2.ed.gov/admins/tchrqual/learn/nclbsummit/gentile/edlite-slide005.html (accessed December 4, 2013)