# NATIONAL COMMISSION ON FORENSIC SCIENCE

National Institute of Standards and Technology
U.S. Department of Commerce

# Proficiency Testing in Forensic Science

## Subcommittee

Accreditation and Proficiency Testing

## Type of Work Product

Views Document

## View

The National Commission on Forensic Science (NCFS) has previously adopted the policy recommendation on the Universal Accreditation of all Forensic Science Service Providers (FSSPs).[1] Proficiency testing is required of all accredited FSSPs. As a recognized quality control tool, it is the view of the Commission that proficiency testing should also be implemented by nonaccredited FSSPs in disciplines where proficiency tests are available from external organizations.

## Introduction

Proficiency testing is one mechanism through which the performance of an organization can be checked to confirm its ability to adhere to the organization's procedures. Proficiency testing is a current requirement of accreditation programs offered by International Laboratory Accreditation Cooperation Mutual Recognition Arrangement signatory accreditation bodies and is a common requirement of regulatory and oversight programs.[2] Proficiency testing is a quality control tool that is available to FSSPs and can be utilized prior to achieving accreditation.

## Background

ISO/IEC 17043:2010[3] identifies proficiency testing as an evaluation of participant performance against pre-established criteria by means of interlaboratory comparisons for the determination of laboratory performance. ISO/IEC 17043 states that the "purposes of [proficiency testing] include:

a) evaluation of the performance of laboratories for specific tests or measurements and monitoring laboratories' continuing performance;

b) identification of problems in laboratories and initiation of actions for improvement which, for example, may be related to inadequate test or measurement procedures, effectiveness of staff training and supervision, or calibration of equipment;

c) establishment of the effectiveness and comparability of test or measurement methods; . . .

e) identification of inter-laboratory differences;

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[1] See National Commission on Forensic Science *Views Document on Definitions* .

[2] Examples include: State of Maryland, COMR, 10.51.04.01 Proficiency Testing—General, FBI Quality Assurance Standards for Forensic DNA Testing Laboratories, effective 9-1-2011, Section 13.1 Proficiency Testing, Clinical Laboratory Improvement Amendments of 1988 (CLIA), 42CFR493 Laboratory Requirements: Subpart H: Participation in Proficiency Testing in Laboratories Performing Non-waived Testing {493.801(b)(1)-(6)}, World Anti-Doping Agency (WADA) accredited laboratories are required to meet the proficiency testing requirements as specified in the current International Standard for Laboratories (ISL).

[3] ISO/IEC refers to standards published by the International Organization for Standardization (ISO) and by the and by the International Electrotechnical Commission (IEC).

f) education of participating laboratories based on the outcomes of such comparisons;

g) validation of uncertainty claims . . . "[4]

Depending on the forensic discipline, proficiency testing programs may address all or some of the above items.

Proficiency testing programs exist in different formats.[5] In the most comprehensive form, proficiency testing involves three distinct entities: the proficiency test participant (user), the proficiency test provider, and the bodies that accredit the proficiency test providers.[6] However, the roles of each entity may overlap. Although compliance standards vary between provider and accreditation bodies, accreditation programs require that the proficiency test user's results, however obtained, are reported within the participant's quality assurance system.

Proficiency tests come in different forms:

- Accrediting bodies may facilitate or host a proficiency test.
- Users may create and administer a proficiency test to internal and external users (i.e., round robin).
- Users may assess proficiency through alternatives such as observation, case presentation, or peer review.
- Proficiency tests may be purchased and results reported externally.
- Proficiency tests may be created or purchased externally and results reported internally.
- Proficiency tests may be created and results reported internally.

In forensic science, there are definable and distinct differences between competency testing and proficiency testing. Proficiency testing is not designed as a measure of an individual Forensic Science Practitioner's (FSP) competence.[7]

## Impact of increased proficiency testing participation

The implementation of a robust and standardized proficiency testing program is important to the FSSP's quality system and requires the allocation of resources. The expectation of improving the level of quality in the forensic sciences could ultimately encourage the development of useful technological innovations.

[4] ISO/IEC 17043:2010 Conformity Assessment—General Requirements for Proficiency Testing, 3 Terms and Definitions, 3.7

[5] See Appendix A, PT definitions.

[6] Asia Pacific Laboratory Accreditation Cooperation (APLAC) Mutual Recognition Arrangement (MRA) signatory accreditation bodies are recognized to accredit PT providers under ISO/IEC 17043:2010 Conformity Assessment— General Requirements for Proficiency Testing. https://www.aplac.org/aplac_mra.html

[7] See Appendix B, Proficiency Testing Compared with Competency Testing.

## Appendix A

## Proficiency Test Definitions

This document includes definitions commonly used in discussions of proficiency testing; however, please note that definitions can vary from discipline to discipline.

1. ACCREDITATION: Third-party attestation related to an organization conveying formal demonstration of its competence to carry out specific tasks related to a product, process, system, person, or body.[8]

2. INTERLABORATORY COMPARISON:[9] Organization, performance, and evaluation of measurements or tests on the same or similar items by two or more laboratories in accordance with predetermined conditions.

3. ISO/IEC 17043: 2010: The accreditation standard used by internationally recognized accreditation bodies to accredit proficiency test providers.

4. ISO/IEC 17043:2010: Identifies proficiency testing as an evaluation of participant performance against pre-established criteria by means of interlaboratory comparisons[10] for the determination of laboratory performance. The benefits of discipline-specific proficiency testing include:
    a) Evaluation of the performance of laboratories for specific tests or measurements and monitoring laboratories' continuing performance;
    b) Identification of problems in laboratories and initiation of actions for improvement that, for example, may be related to inadequate test or measurement procedures, effectiveness of staff training and supervision, or calibration of equipment;
    c) Establishment of the effectiveness and comparability of test or measurement methods.

5. OUTLIER:[11] Observation in a set of data that appears to be inconsistent with the remainder of that set.

6. PROFICIENCY TESTING: [12] [13] [14] Evaluation of participant performance against pre-established criteria by means of interlaboratory comparisons. This description includes, but is not limited to:
    - Quantitative scheme—where the objective is to quantify one or more measurands of the proficiency test item.
    - Qualitative scheme—where the objective is to identify or describe one or more characteristics of the proficiency test item.

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[8] ISO/IEC 17000: 2004 "Conformity Assessment Vocabulary and General Principles," Section 5.6

[9] ISO/IEC 17043: 2010 Conformity Assessment—General Requirements for Proficiency Testing, 3 Terms and Definitions, 3.4

[10] ISO/IEC 17043: 2010 Conformity Assessment—General Requirements for Proficiency Testing, 3 Terms and Definitions, 3.7

[11] ISO/IEC 17043: 2010 Conformity Assessment—General Requirements for Proficiency Testing, 3 Terms and Definitions, 3.5

[12] ISO/IEC 17043: 2010 Conformity Assessment—General Requirements for Proficiency Testing, 3 Terms and Definitions, 3.7

[13] Maryland Code of Maryland Regulations (COMAR) 10.51.01.03 Definitions, "(71) 'Proficiency testing' means determining the ability of an individual or a forensic laboratory to perform a forensic analysis to obtain a correct test result."

[14] The National Environmental Laboratory Accreditation Conference (NELAC) Institute, TNI Standard, Field Sampling and Measurement Organization Sector, Volume 2, FSMO-V2-ISO-2014-Rev.2.0 "Proficiency Testing (PT): A means of evaluating an organization's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by a proficiency testing provider."

- Sequential scheme—where one or more proficiency test items are distributed sequentially for testing or measurement and returned to the proficiency testing provider at intervals.
- Simultaneous scheme—where proficiency test items are distributed for concurrent testing or measurement within a defined time period.
- Single occasion exercise—where proficiency test items are provided on a single occasion.
- Continuous scheme—where proficiency test items are provided at regular intervals.
- Sampling—where samples are taken for subsequent analysis.
- Data transformation and interpretation—where sets of data or other information are furnished and the information is processed to provide an interpretation (or other outcome).

Types of proficiency tests:

a) BLIND PROFICIENCY TEST: References to "blind" proficiency testing can refer to several things:
   i. Where the laboratory does not know it is being tested (also sometimes referred to as double blind);[15]
   ii. Where the individual taking the test does not know he or she is being tested; or
   iii. Where the result of the test is unknown.[16]

b) EXTERNAL PROFICIENCY TEST:[17] A proficiency test obtained from and reported to a proficiency test provider external to the participant's quality assurance system.

c) INTERNAL PROFICIENCY TEST:[18] A proficiency test created and administered within the participant's quality assurance system.

d) OPEN OR DECLARED PROFICIENCY TEST: A proficiency test in which participants know they are being tested

7. PROFICIENCY TEST PARTICIPANT:[19] Laboratory, organization, or individual that received proficiency test items and submits results for review by the proficiency testing provider.

8. PROFICIENCY TESTING PROVIDER:[20] [21] An organization that takes responsibility for all tasks in the development and operation of a proficiency testing scheme.

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[15] ISO/IEC 17043:2010 Conformity Assessment—General Requirements for Proficiency Testing, Section A.3.1 "One special application of proficiency testing, often called 'blind' proficiency testing, is where the proficiency test item is indistinguishable from normal customer items or samples received by the laboratory. This type of proficiency testing can be difficult, since it requires coordination with a normal laboratory customer. In addition, because of unique packaging and shipping needs, bulk processing is usually not feasible and homogeneity testing is difficult."

[16] NELAC Standard (EPA/600/R-04/003)—2003, page 42, Blind Sample is defined as "a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process."

[17] Maryland COMAR 10.51.01.03 Definitions, "(43) 'External proficiency test' means an analysis performed on a proficiency testing sample provided to a forensic laboratory by an approved proficiency testing provider external to the laboratory or laboratory system."

[18] Maryland COMAR 10.51.01.03 Definitions, "(49) 'Internal proficiency tests' means samples or specimens developed by the laboratory director or the director's designee and administered to an analyst or examiner for analysis or examination as unknown samples or specimens."

[19] ISO/IEC 17043:2010 Conformity Assessment—General Requirements for Proficiency Testing, 3 Terms and Definitions, 3.6

9. PROFICIENCY TESTING SCHEME:[22] Proficiency testing designed and operated in one or more rounds for a specified area of testing, measurement, calibration or inspection.

10. ROUND ROBIN TESTING:[23] Internal evaluation of participant performance against pre-established criteria (e.g., two or more staff approved to perform the same examination perform the same examination, and results are compared for consistency and accuracy).

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[20] ISO/IEC 17043:2010 Conformity Assessment —General Requirements for Proficiency Testing, 3 Terms and Definitions, 3.9

[21] The NELAC Institute, TNI Standard, EL-V4-2009-Rev0.1: General Requirements for an Accreditor of Environmental Proficiency Test Providers "3.2 Proficiency Testing Provider (PT Provider): A person or organization accredited by the TNI-approved Proficiency Testing Provider Accreditor to operate a TNI-compliant PT program."

[22] ISO/IEC 17043:2010 Conformity Assessment—General Requirements for Proficiency Testing, 3 Terms and Definitions, 3.11

[23] GE Aviation, GE S-400—Sourcing Quality Specification, Definitions, "ROUND ROBIN TESTING: Testing of specimens from the same set by different laboratories and/or by different test methods/or equipment/or personnel."

## Appendix B

## Proficiency Testing Compared with Competency Testing

Proficiency testing is intended as an evaluation of participant performance against pre-established criteria by means of interlaboratory comparisons for the determination of service provider performance. Proficiency testing is commonly used by FSSP management to evaluate staff, training, and method validation; appropriateness of test methods; traceability of measurements and calibrations to national standards; calibration and maintenance of test equipment; documentation, sampling, and handling of test items; and quality assurance of data, including reporting of results. In forensic science, proficiency testing is used not only as a measure of the FSSP's overall performance and quality system (e.g., facility, equipment, procedures, and training programs) but also as a tool for monitoring an individual FSP's continued ability to perform work in a specific discipline or tasks. The use of proficiency testing to evaluate individual examiners continuing ability to perform specific tasks should not be confused with competency testing.

Competency testing, which is not addressed in this document, is the demonstration that an FSP has acquired and demonstrated specialized knowledge, skills, and abilities in the standard practices necessary to conduct examinations in a discipline and/or category of testing prior to performing independent casework. Competency testing is an integral part of the forensic training process and is administered as part of a comprehensive assessment of technical skills and knowledge during basic training. Competency testing includes written and/or practical testing as part of a thorough evaluation of education, training, and practical experience. It also does **not** address the FSSP's overall quality system and performance, methods, procedures, testimony, reports, documentation, equipment, validation, measurement uncertainty, facilities, evidence handling, security, or safety procedures used by the individual practitioner.

Proficiency testing and competency testing are different tools that assess and evaluate distinct aspects of FSSPs for different objectives. They are not interchangeable, but both are necessary to strengthen and improve forensic science.