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Standard for Education and Training of Forensic Toxicology Personnel

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410 North 21st Street
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Foreword

This document was developed to provide the minimum requirements for educational qualifications, training, competency, experience, continuing education, and certification of laboratory personnel performing or overseeing forensic toxicology analysis and breath alcohol instrument calibration.

The American Academy of Forensic Sciences established the Academy Standards Board (ASB) in 2015 with a vision of safeguarding Justice, Integrity and Fairness through Consensus Based American National Standards. To that end, the ASB develops consensus based forensic standards within a framework accredited by the American National Standards Institute (ANSI), and provides training to support those standards. ASB values integrity, scientific rigor, openness, due process, collaboration, excellence, diversity and inclusion. ASB is dedicated to developing and making freely accessible the highest quality documentary forensic science consensus Standards, Guidelines, Best Practices, and Technical Reports in a wide range of forensic science disciplines as a service to forensic practitioners and the legal system.

This document was revised, prepared, and finalized as a standard by the Toxicology Consensus Body of the AAFS Standards Board. The draft of this standard was developed by the Forensic Toxicology Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science.

Questions, comments, and suggestions for the improvement of this document can be sent to AAFS-ASB Secretariat, asb@aafs.org or 401 N 21st Street, Colorado Springs, CO 80904.

All hyperlinks and web addresses shown in this document are current as of the publication date of this standard.

ASB procedures are publicly available, free of cost, at www.aafs.org/academy-standards-board.

Keywords: *forensic toxicology, personnel requirements, training, continuing education, professional development, certification*

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Standard for Education and Training of Forensic Toxicology Personnel

1 Scope

This document provides minimum requirements for educational qualifications, training, competency, experience, continuing education, and certification of laboratory personnel performing or overseeing forensic toxicology analysis and breath alcohol instrument calibration. This applies to the following sub-disciplines: postmortem toxicology, human performance toxicology (e.g., drug-facilitated crimes and driving-under-the-influence of alcohol or drugs) and other forensic testing (e.g., court-ordered toxicology, general forensic toxicology). Laboratory personnel that exclusively perform administrative or non-technical duties are outside the scope of this document.

2 Normative References

The following references are documents that are indispensable for the application of the standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM 2917-19 *Standard Practice for Forensic Science Practitioner Training, Continuing Education, and Professional Development Programs*

3 Terms and Definitions

For purposes of this document, the following definitions apply.

3.1
analyst (however named)
An individual who conducts, directs or reviews the analysis of forensic toxicology samples, evaluates data[a] and reaches conclusions[b]; may sign a report for court or investigative purposes as a consequence of such examinations.

NOTE This person does not provide interpretive opinions related to the results of toxicological tests

3.2
apprenticeship
A relationship where an individual works for an entity while learning skills.

NOTE The program includes, but may not be limited to, requirements or specifications for reference materials, training of operators, maintenance and calibration of instrumentation, the evidential breath alcohol test sequence, and record retention.

[a] "Evaluates data" refers to the evaluation of scientific data to meet reporting criteria.
[b] "Reach conclusions" refers to the decision to report the substance as detected and quantify, if applicable, or not detected and submit those findings for review.

3.3
breath alcohol program
An organizational structure including policies, procedures, responsibilities and resources necessary for implementing core breath alcohol activities.

3.4
certification
Procedure by which a third party gives written assurance that a person, product, process, or service conforms to specific requirements.

3.5
competency
The demonstration of technical skills and knowledge necessary to perform forensic analysis successfully.

3.6
continuing education (CE)
An educational activity (such as a class, lecture series, conference, seminar, or short course) that is offered by a recognized organization or individual that updates participants in their relevant area of knowledge.

3.7
course
An officially recognized program of instruction that is taught through an accredited college or university program in which the student's successful completion is documented by an official record of the institution.

3.8
credential
A formal recognition of a professional's knowledge, skills, and abilities (e.g., diploma, license).

3.9
education
Formal coursework at an accredited college or university.

3.10
experience
Direct observation of and participation in the practice of a discipline.

3.11
internship
An in-depth educational or training program that offers a period of supervised practical experience in a forensic science setting.

3.12
knowledge (KSA)
The level of information, qualifications, and experience needed to perform assigned tasks.

3.13
laboratory personnel
Individuals who perform analytical or laboratory-based functions of a technical nature.

NOTE This excludes administrative or non-technical support staff.

3.14
literature review
An evaluation of a scientific, professional, or academic manuscript for publication to evaluate the claims, methods, interpretations, and conclusions.

3.15
methodology
The analytical processes and procedures used to support forensic toxicology (e.g., chromatography, spectroscopy or immunoassay).

3.16
professional development
The education and training that contributes to career advancement and succession planning (e.g., administration, leadership, management and fiscal responsibility).

3.17
qualifications
The combined education, training, and experience of an individual.

3.18
reference material
A material or substance, sufficiently homogenous, stable, and of known concentration with respect to one or more specified properties, which has established to be fit for its intended use in a measurement process.

3.19
technician (however named)
An organization employee who performs analytical techniques on forensic samples under the supervision of a qualified analyst.

NOTE Technicians generally do not interpret data, reach conclusions, or prepare final reports.

3.20
training records
A record used to document the continuing education and professional development, maintained separately from other records, i.e., assessments, certifications, or discipline-related deployment records.

3.21
toxicologist (however named)
An individual who provides factual information and/or interpretive opinions related to the results of toxicological tests for court or investigative purposes.

NOTE May be further defined by role [e.g., toxicologist (general), toxicologist (alcohol), toxicologist (breath alcohol)].

3.22
toxicology technical leader (however named)
An individual who is responsible for the technical oversight of the toxicology laboratory.

3.23
training
The formal, structured process of teaching and assessment, through which personnel reach a level of scientific knowledge and expertise required to perform specific tasks.

4 Background

This document supplements ASTM 2917-19 *Standard Practice for Forensic Science Practitioner Training, Continuing Education, and Professional Development Programs*. It provides greater detail in requirements and recommendations for forensic toxicology related to the topics of personnel requirements, training, continuing education, professional development, and certification. It also includes requirements for laboratory management and documentation of the above activities.

5 Minimum Requirements for Personnel

5.1 Educational Qualifications

5.1.1 General

One indication of professional standing is educational qualifications. Diplomas and formal academic transcripts are required as proof of academic credentials.

Minimum standards for education are summarized in Annex A for each category of employment. Applicable scientific topics are listed in Annex B.

5.1.2 Technician

Associate's degree in natural science, applied science, or technology from an accredited institution.

5.1.3 Analyst

Bachelor's degree in natural science (preference in chemistry, toxicology, biochemistry, pharmacology, or biology) or applied science (forensic science, medical sciences) from an accredited institution; completion of general and organic chemistry with associated laboratory classes.

5.1.4 Toxicologist

Bachelor's degree in natural science (preference in chemistry, toxicology, biochemistry, pharmacology, or biology) or applied science (forensic science, medical sciences) from an accredited institution; completion of general and organic chemistry with associated laboratory classes; at least one (1) college-level course from column A and one (1) from column B located in Annex B. Supplemental trainings (36-hour workshop or time equivalent to 3 credit courses) can be substituted for interpretive coursework.

5.1.5 Toxicology Technical Leader

Bachelor's degree in natural science (preference in chemistry, toxicology, biochemistry, pharmacology, or biology) or applied science (forensic science, medical sciences) from an accredited institution; completion of general and organic chemistry with associated laboratory classes; at least one (1) college-level course from column A and one (1) from column B located in Annex B. Supplemental trainings (36-hour workshop or time equivalent to 3 credit courses) can be substituted for interpretive coursework.

5.2 Training, Experience, and Competency

5.2.1 General

Personnel shall be trained for competency. The length of the initial training provided to the individual depends upon the scope of work to be performed, as well as the qualifications of the individual. The depth of the training shall be appropriate for the job function(s). Regardless of qualifications, all technical personnel shall be provided training to ensure competency in all assigned areas detailed in the training elements section. Prior to assuming independent casework, personnel must successfully demonstrate competency in their job function(s).

Minimum standards for training and experience are summarized in Annex A for each category of employment.

5.2.2 Training and Experience

5.2.2.1 General

The source of training can be internal and/or external to the forensic laboratory. Sources may include government agencies, academic institutions, training academies or institutions, private sector organizations, manufacturers, professional societies, and mentors.

5.2.2.2 Training Program

The laboratory shall have a documented training program which must address both theoretical and practical knowledge, skills and abilities necessary to perform job functions. Documentation of training program completion shall be retained by the forensic laboratory. The relevance and content of the training program shall be evaluated by the organization annually.

Specific training elements shall include the following areas where applicable for the specific job duties as summarized in Table 1.

Table 1—Training Elements

Element	Suggested Training Content
Administrative and Laboratory Policies	Accreditation; Document and record control; Method validation; Quality management; Safety and security (Biological, chemical, and physical hazards; Security); Standard operating procedures
Alcohol toxicology	Interpretation (Mathematical calculations); Pharmacodynamics; Pharmacokinetics; Physiology (Blood to breath ratio)
Analytical Methodology	Aliquoting; Isolation techniques; Qualitative analysis; Quantitative analysis; Theory
Calibrating device	Dry gas cylinder (Barometric pressure; Theory; Uses/limitations; Wet/dry offset); Wet bath simulator (Partition ratio; Temperature; Theory; Uses/limitations)
Communication	Report writing; Verbal and nonverbal skills (Non-technical; Technical)
Evidence	Chain of custody; Collection; Concepts; Preservation; Retention
Human Factors	Factors such as bias that may affect analytical results and interpretations; understanding the scope and limitations (of methods and expertise)
Instructional development	Adult learning principles; Knowledge and/or development of curriculum; Use of assigned multi-media equipment
Instrumentation	History; Limitations; Maintenance and troubleshooting; Operation; Technical functions (adjustment/calibration); Testing functions; Theory
Legal aspects	Applicable federal, state, or local laws and rules (regulations); Case law; Terminology; Testimony (Courtroom procedure; Deposition and courtroom)
Quality control	Reference Material (Uses/Limitations; Preparation; Traceability); Theory
Standards of conduct	Ethics; Professionalism
Statistical analysis	Calculations; Control charts and/or trending; Measurement assurance; Measurement uncertainty; Terminology
Toxicology	Interpretation; Pharmacodynamics; Pharmacokinetics; Physiology

5.2.2.3 Experience

Experience is a component of building competency prior to performing the job function. Experience includes both practical and theoretical aspects of the discipline.

Minimum standards for training and experience are summarized in Annex A for each category of employment.

5.2.3 Competency

5.2.3.1 Initial Competency

Regardless of academic qualifications or past work experience, all individuals shall satisfactorily complete a competency assessment prior to assuming independent casework. The format for initial competency assessment(s) are specified in the training program (see 5.2.2). The program may use different formats such as oral, written, and video as a means of ensuring and documenting competency. Verification document(s) demonstrating that personnel achieved the required competence must be maintained by the laboratory.

5.2.3.2 Ongoing Proficiency

The laboratory shall:

— monitor proficiency of personnel on a continuous basis and document annually;

— assess proficiency at the appropriate level to commensurate with job duties;

— establish a predetermined, acceptable level of performance;

— establish remediation and corrective action plans when expected outcome(s) are not achieved.

5.3 Continuing Education and Professional Development

All laboratory personnel shall remain current within the discipline through continuing education and professional development activities appropriate for the scope of job functions. Individuals should strive to advance the profession. This may be accomplished through professional involvement such as research, mentoring, teaching, participating in professional organizations, scientific publications and other professional activities. All continuing education and professional development shall be documented. The laboratory is responsible for maintaining permanent, official training records.

Continuing education activities also include an individual's contribution to the field of forensic toxicology when those activities provide the individual with new information or critical feedback. Examples include presentations, publications in peer-reviewed literature, or authorship of books or chapters.

Continuing education and professional development is a combination of internal and external activities. The sources of external continuing education and professional development are diverse (e.g., government agencies, academic institutions, training academies or institutions, private sector organizations, professional societies, vendors). Continuing education and professional development can be delivered in-person or online. Continuing education and professional development from

organizations that provide recognized continuing education credits are preferred. Assignment of CEUs for various activities is within the purview of the respective Certification Body.

The forensic laboratory shall ensure that the following resources shall be available and accessible to laboratory personnel: Reference texts in key subject areas (e.g., analytical chemistry, toxicology, pharmacology), reference literature containing physical, chemical, pharmaceutical and/or analytical data, and relevant periodicals and peer-reviewed journals. Laboratory management has an ongoing responsibility to provide support and opportunities for continuing education and professional development.

Minimum standards for CE hours or units may vary based on the category of employment. Technicians require 4 hours per calendar year relevant to job function with 1 hour from external sources. Analysts require CE hours/units sufficient to maintain certification or 8 hours/units per calendar year relevant to forensic toxicology with 2 hours/units from external sources. Toxicologists require CE hours/units sufficient to maintain certification or 16 hours/units per calendar year relevant to forensic toxicology with 4 hours/units from external sources. Toxicology Technical Leaders require CE hours/units sufficient to maintain certification. Minimum standards for continuing education are summarized in Annex A for each category of employment.

Continued education and professional development may be accomplished through professional involvement such as research, mentoring, teaching, participating in professional organizations, scientific publications and other professional activities. Multiple approaches are as follows:

- instructor-led courses:
  - degree seeking (post-secondary educational level),
  - non-degree career training;
- internship/apprenticeship;
- research;
- scientific publications;
- conference/workshop presentations;
- literature review;
- peer-review;
- mentoring;
- teaching:
  - direct,
  - presentations by trainee/employee;
- seminars, lectures, professional meetings, and classes;

— instrument operation or maintenance courses taught by vendors;

— distributed learning:

  — on-line education,

  — webinars;

— independent learning;

— laboratory inspections (audits, assessments);

— other professional activities.

5.4 Certification

Certification is a component of professional development. Certification provides the public and the judicial system a means of identifying those practitioners who successfully demonstrate competency. It provides an additional means of verifying ethical standards and is an external review of ongoing competency.

Minimum standards for certification requirements may vary based on the category of employment. Analysts and toxicologists should obtain certification. Toxicology Technical Leaders shall obtain certification within 3 years of their appointment to the position or adoption of this standard. Operators (e.g. law enforcement) of breath alcohol testing instruments may be authorized by local or state statutes, and are exempt from certification by certification bodies.

Requirements for certification bodies shall include the following:

— be accredited under ISO/IEC 17024;

— formal application process;

— verification of minimum educational qualifications;

— review of official transcript(s) from an accredited college or university sent directly to the certification body;

— review professional references from practitioners with knowledge of the applicant's experience in forensic toxicology submitted directly to the certification body;

— verification of required training and experience;

— statement of adherence to a professional code of conduct;

— perform a proctored written examination appropriate to the level of certification;

— predefine criteria for successful completion;

— have a periodic requalification process and a process to reapply for certification in the event an individual does not qualify.

Minimum standards for certification are summarized in Annex A for each category of employment.

6 Laboratory Management Responsibility

The laboratory management shall provide support or opportunities for continuing education and professional development. The laboratory should establish a process to allocate financial resources and time to continued education and professional development. The laboratory shall establish a process to oversee, coordinate, and document all training.

All continuing education and professional development shall be documented. The laboratory is responsible for maintaining permanent, official records.

It is the responsibility of the laboratory to ensure that the following resources shall be available and accessible to laboratory personnel to include the following.

— Reference books in key subject areas (e.g., analytical chemistry, toxicology, pharmacology).

— Reference literature containing physical, chemical, pharmaceutical and/or analytical data.

— Relevant periodicals and peer-reviewed journals.

7 Documentation of Training, Continuing Education, and Professional Development Activities

The laboratory and/or personnel shall maintain documentation of training, continuing education, and professional development activities. The activities must be independently verifiable and may include attending seminars, conferences, coursework, professional meetings, or documented training sessions/workshops in relevant subject areas. Recognition of any training, continuing education, or professional development requires proper documentation. The laboratory shall have a written policy to designate maintenance and retention of official documentation. The records could include the following:

— verification of attendance:

  — certificates of completion:

    — date,

    — duration of training,

    — instructor,

    — sponsoring organization,

    — title of event;

  — travel documentation noting city, state, country:

- virtual (online) or in-person;
- scientific conference agenda,
- workshop agenda and learning objectives;
- course syllabi;
- copy presented abstract (e.g., oral or poster);
- copy of published manuscript (e.g., peer-reviewed article, white paper, application note)
- recording of presentation, webinar, or exercise;
- number of contact hours for training activities.

The activities shall be independently verifiable and should include attending seminars, conferences, coursework, professional meetings, or documented training sessions/classes in relevant subject areas.

Regular literature review shall be conducted by personnel. A mechanism should be employed to document scientific literature review to satisfy continuing education, professional development, and accreditation requirements.

Annex A
(informative)

Personnel Requirements Listed By Position

	Technician* **(Breath Alcohol, Blood Alcohol, and Drug Toxicology)**	**Analyst*** **(Breath Alcohol, Blood Alcohol, and Drug Toxicology)**	**Toxicologist*** **(Breath Alcohol, Blood Alcohol, and Drug Toxicology)**	**Toxicology Technical Leader***
Scope*	Performs basic analytical functions but does not evaluate data, reach conclusions or sign a report for court or investigative purposes. May also perform functions related to instrumentation including maintenance, verification, adjustment, calibration, and other activities.	Conducts, directs or reviews the analysis of forensic toxicology samples, evaluates data and reaches conclusions; may sign a report for court/investigative purposes based on examinations. The analyst may testify but does not provide interpretive opinions. Duties and responsibilities may also include those of a Technician.	Provides interpretive opinions related to the results of toxicological tests for court or investigative purposes. Duties and responsibilities may also include those of an Analyst.	Responsible for the technical oversight of the toxicology or breath laboratory. Duties and responsibilities may also include those of a Toxicologist.
Education	Associate's degree in Natural Science, Applied Science, or Technology	Bachelor's degree in Natural Science (Preference in Chemistry, Toxicology, Biochemistry, Pharmacology or Biology) or Applied Science (Forensic Science, Medical Sciences)	Bachelor's degree in Natural Science (Preference in Chemistry, Toxicology, Biochemistry, Pharmacology or Biology) or Applied Science (Forensic Science, Medical Sciences)	Bachelor's degree in Natural Science (Preference in Chemistry, Toxicology, Biochemistry, Pharmacology or Biology) or Applied Science (Forensic Science, Medical Sciences)
Required Courses	Chemistry (6 semester h)	General & organic chemistry (16 semester h).	General & organic chemistry (16 semester h), 1 analytical and 1 interpretive course.	General & organic chemistry (16 semester h), 1 analytical and 1 interpretive course.

Supplemental trainings	N/A	N/A	Supplemental training can be substituted for interpretive coursework.	Supplemental training can be substituted for interpretive coursework.
Training and Experience	Completion of formal, structured training program appropriate to job function	Completion of formal, structured training program appropriate to job function	Completion of formal, structured training program appropriate to job function	Completion of formal, structured training program and a minimum of 3 years experience
Certification	Not required	Preferred	Preferred	Required
Continuing Education	4 hours per calendar year relevant to job function with 1 hour from external sources.	Sufficient to maintain certification or 8 hours per calendar year relevant to forensic toxicology with 2 hour from external sources.	Sufficient to maintain certification or 16 hours per calendar year relevant to forensic toxicology with 4 hour from external sources.	Sufficient to maintain certification

*An individual (however named) who fulfills scope.

Annex B
(informative)

Applicable Scientific Courses

Column A Analytical Science Courses	Column B Interpretive Science Courses
Analytical chemistry Chemical informatics Instrumental analysis Mass spectrometry Quantitative analysis Separation science Spectroscopic analysis	Biochemistry Drug metabolism Forensic toxicology Medicinal chemistry Pharmacology Physiology Toxicology Supplemental training (36-hour workshop or time equivalent to 3 credit courses)

Annex C
(informative)

Bibliography

1] Scientific Working Group for Forensic Toxicology (SWGTOX) *Standard for Laboratory Personnel*

2] Scientific Working Group for Forensic Toxicology (SWGTOX) *Standard for Breath Alcohol Personnel*

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