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**Standard for Education, Training, Continuing Education,
and Certification of Forensic Toxicology Laboratory
Personnel**



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Standard for Education, Training, Continuing Education, and Certification of Forensic Toxicology Laboratory Personnel

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Foreword

This document was developed to provide minimum requirements for the ~~selection~~qualifications and development of forensic toxicology laboratory personnel ~~or~~and individuals performing evidentiary breath alcohol instrument calibration. ~~Appropriate~~Thus, when “laboratory” is used in this document, it is implied that both forensic toxicology testing and calibration laboratories should be included.

Defining appropriate educational requirements ~~are~~is important when evaluating ~~candidates~~prospective employees to work in a laboratory. This ensures they have a solid foundation that can be further enhanced through a ~~strong~~robust training program. Training includes evaluation of competency as the trainee progresses through the program. After completing a training program, personnel continue to learn, remain current on relevant topics, and stay engaged ~~with the field~~ through professional development activities. Certification of laboratory personnel provides an avenue for external evaluation of the person’s knowledge and training.

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 improving this document can be sent to the AAFS-ASB Secretariat at asb@aafs.org or 401 N 21st Street, Colorado Springs, CO 80904.

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Keywords: *forensic toxicology, personnel requirements, training, continuing education, professional development, certification, breath alcohol instrument calibration*

Table of Contents *(to be updated when the document is finalized)*

DRAFT

Standard for Education, Training, Continuing Education, and Certification of Forensic Toxicology Laboratory Personnel^a

1 Scope

This document provides minimum requirements for educational qualifications, training, competency, experience, continuing education, and certification of laboratory personnel performing, interpreting, or overseeing forensic toxicology analyses, ~~as well as anyone performing or evidentiary~~ breath alcohol instrument ~~calibration. This calibrations.~~ It 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), non-regulated employment drug testing, and other forensic testing (e.g., court-ordered toxicology, general forensic toxicology). The following are outside the scope of this document: ~~laboratory personnel that who~~ exclusively perform administrative or non-technical duties; individuals working as breath alcohol instrument operators; individuals performing calibration adjustments to breath alcohol instruments; ~~or~~ individuals who solely perform instrument maintenance activities, ~~or individuals engaged in expert consultation outside of a forensic toxicology laboratory.~~

2 Normative References

There are no normative reference documents. Annex ~~CD~~, Bibliography, contains informative references.

3 Terms and Definitions

For purposes of this document, the following definitions apply.

3.1

analyst-~~{~~

~~Individual, however named}~~

~~Individual, who conducts, directs, or reviews the analysis of forensic toxicology samples and/or breath alcohol instrument calibration activities, evaluates data^b. Analysts evaluate and reaches conclusions^c; interpret observations and calculations and~~ may sign a report for court or investigative purposes ~~as a consequence of such examinations.~~ The analyst may testify but does not provide ~~interpretive~~ opinions. Duties and responsibilities may include those of a technician.

3.2

certification

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

^aWhen “laboratory” is used in this document, it is implied as both forensic toxicology testing laboratories and breath alcohol instrument calibration laboratories.

^b“Evaluates data” refers to the evaluation of scientific data to meet reporting criteria.

^c“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
competency**

Technical skills and knowledge necessary to perform forensic analysis duties successfully.

**3.4
continuing education (CE)**

Educational activity (~~such as a~~ e.g., class, lecture series, conference, seminar, or short course) that updates participants in their relevant area of knowledge.

**3.5
course**

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 documents the student's successful completion.

**3.6
credential**

Formal recognition (e.g., diploma, license) of a professional's knowledge, skills, and abilities (~~e.g., diploma, license~~).

**3.7
experience**

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

~~3.8~~
knowledge, skills, and abilities
KSAs

~~Level of information, qualifications, and experience needed to perform assigned tasks.~~

3.8
interpretation

Explanation for observations and calculations.

NOTE In forensic toxicology, interpretations are the reported findings.

**3.9
laboratory personnel**

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

NOTE 1 Laboratory personnel include individuals who perform, interpret, or oversee breath alcohol instrument calibration duties

NOTE 2 Laboratory personnel include consultants who provide factual information, interpretations, and opinions related to the results of toxicological tests for court or investigative purposes.

3.10
opinion

View, judgment, or belief that considers other information besides observations, calculations, and interpretations.

3.103.11**professional development**

Education and training that contributes to career advancement and succession planning (e.g., administration, leadership, management, and fiscal responsibility).

3.113.12**qualifications**

Combined education, training, and experience of an individual.

3.13**technician {**

Individual, however named}

~~Individual, who performs basic analytical functions/duties but does not evaluate data or reach conclusions. May and interpret observations and calculations. Technicians may also perform functions related to instrumentation verification, adjustment, and calibration. May duties. They may be included/named in report signatures solely/reports to indicate their contribution to the work that they performed.~~

3.123.14**training**

Formal, structured teaching and assessment process, through which personnel reach a level of scientific knowledge and expertise required to perform specific duties.

3.133.15**training records**

Record used to document employee completion of the training program, continuing education, and professional development; maintained separately from other records (e.g., assessments, certifications, or discipline-related employment records).

3.143.16**toxicologist {**

Individual, however named}

~~Individual, who provides factual information, interpretations, and/or interpretive opinions related to the results of toxicological tests for court or investigative purposes. Duties and responsibilities may also include those of an analyst.~~

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

3.153.17**toxicology technical leader {**

Individual, however named}

~~Individual, who is responsible for the technical oversight of the toxicology and/or breath alcohol calibration laboratory. Duties and responsibilities may also include those of a toxicologist.~~

3.16**training**

~~Formal, structured process of teaching and assessment, through which personnel reach a level of scientific knowledge and expertise required to perform specific tasks.~~

4 Minimum Requirements for Personnel

4.1 Educational Qualifications

4.1.1 General

~~4.1.1.1— Laboratories adopting this standard shall ensure that employees meet all educational requirements contained below no later than December 31, 2033.~~

~~4.1.1.24.1.1.1 All~~ Upon publication of this document, all new hires and internal promotions in these laboratories adopting this standard should meet the educational requirements ~~upon publication of this document~~ specified below.

4.1.1.2 Laboratories shall ensure that all current employees meet the educational requirements no later than December 31, 2034.

4.1.1.3 Official academic transcripts shall be required as proof of credentials, ~~to include~~ including degree(s) ~~conferred~~ awarded.

4.1.2 Technician

Personnel in Technician positions shall have an Associate's degree or higher in natural science, applied science, or technology from an accredited institution. An equivalent number of semester hours can be substituted for an Associate's degree.

4.1.3 Analyst

Personnel in Analyst positions shall have a Bachelor's degree or higher in natural science (preference in chemistry, toxicology, biochemistry, pharmacology, or biology) or applied science (e.g., forensic science, medical sciences) from an accredited institution and have successfully completed general and organic chemistry courses with associated laboratory classes ~~accounting for at least 16 credit hours.~~

4.1.4 Toxicologist

Personnel in Toxicologist positions shall have a Bachelor's degree or higher in natural science (preference in chemistry, toxicology, biochemistry, pharmacology, or biology) or applied science (e.g., forensic science, medical sciences) from an accredited institution and have successfully completed general and organic chemistry courses with associated laboratory classes ~~(accounting for at least 16 credit hours),~~ at least one (1) college-level course from column A, and one (1) 36-hour workshop or college-level course from column B located in Annex BC.

4.1.5 Toxicology Technical Leader

Personnel in Toxicology Technical Leader positions shall have a Bachelor's degree or higher in natural science (preference in chemistry, toxicology, biochemistry, pharmacology, or biology) or applied science (e.g., forensic science, medical sciences) from an accredited institution and have successfully completed general and organic chemistry courses with associated laboratory classes ~~(accounting for at least 16 credit hours),~~ at least one (1) college-level course from column A, and one (1) 36-hour workshop or college-level course from column B located in Annex BC.

NOTE Minimum standards for education are summarized in Annex AB for each ~~category of~~ employment ~~category~~. Applicable scientific topics are listed in Annex BC.

4.2 Training, Experience, and Competency

4.2.1 General

4.2.1.1 The laboratory shall ensure technical personnel are trained and demonstrate competency in each assigned ~~task prior to being authorized for independent casework in that area or breath alcohol instrument calibrations duty before being authorized for independent work. Duties may include but are not limited to handling test and calibration items, instrument maintenance, preparation of reference material, conducting and reviewing testing/calibration activities, evaluating data, reaching conclusions, signing reports, and providing testimony.~~

4.2.1.2 The length of training should consider the scope of work to be performed, as well as the individual's qualifications and experience.

4.2.2 Initial Training and Experience

4.2.2.1—Training Program

4.2.2.1 The laboratory shall have a documented training program ~~which addresses~~addressing the scientific knowledge, ~~skills,~~ and ~~abilities~~expertise necessary to perform ~~assigned job functions~~duties.

4.2.2.2 Specific training Training elements shall include the applicable ~~areas for the specific job duties~~content as summarized in ~~Table 1~~Annex A.

4.2.2.3 The source of training Training sources may be internal and ~~or~~ external to the forensic laboratory.

4.2.2.4 Sources for external training may include government agencies, academic institutions, training academies or institutions, private sector organizations, manufacturers, and professional societies.

4.2.2.5 The training program ~~documentation~~ shall ~~include the following~~specify:

- ~~— objectives that define the specific elements the trainee needs to demonstrate competency from Annex A;~~
- ~~— instructor qualifications;~~ that include competency and area(s) of expertise for specific training elements;
- ~~— trainee requirements;~~ to include the actions required of the trainee to meet the objectives of the training program (e.g., reading of specified literature; minimum number of surrogate test and calibration items analyzed)

Table 1—Training Elements

Element	Suggested Training Content
Administrative and Laboratory Policies	Accreditation; Document and record control; 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; Requirements for identification (ANSI/ASB 113 <i>Standard for Identification Criteria in Forensic Toxicology</i>); 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 (ANSI/ASB 053 <i>Standard for Report Content in Forensic Toxicology</i>); Verbal and nonverbal skills (Non-technical; Technical)
Evidence	Chain of custody; Collection; Concepts; Preservation; Retention
Forensic Science	General knowledge; Related disciplines
Human Factors	Factors such as cognitive bias that may affect testing strategies, interpretations, and reporting; understanding the scope and limitations (of methods and expertise)
Instrumentation	Chromatography; History; Limitations; Maintenance and troubleshooting; Mass spectrometry (ANSI/ASB 098 <i>Standard for Mass Spectral Analysis in Forensic Toxicology</i>); Operation; Technical functions (adjustment/calibration); Testing functions; Theory
Legal Aspects	Applicable federal, state, or local laws and rules (regulations); Case law; Terminology; Courtroom Procedures; Deposition and Courtroom Testimonies (ANSI/ASB 037 <i>Guidelines for Opinions and Testimony in Forensic Toxicology</i>); Legal factors related to other elements
Quality Assurance and Quality Control	ANSI/ASB 054 <i>Standard for a Quality Control Program in Forensic Toxicology Laboratories</i> ; Method development and validation (ANSI/ASB 036 <i>Standard Practices for Method Validation in Forensic Toxicology</i>); Metrological traceability (ANSI/ASB 017 <i>Standard Practices for Measurement Traceability in Forensic Toxicology</i>); Reference Material (Uses/Limitations; Preparation); Theory
Standards of Conduct	Ethics; Professionalism; Confidentiality
Statistical Analysis	Calculations; Control charts and/or trending; Measurement uncertainty; Terminology
Toxicology	Interpretation; Pharmacodynamics; Pharmacokinetics; Physiology

- ~~relevant literature;~~
- ~~performance goals;~~
- required periodic assessments of the trainee (~~to include competency tests~~practical, written, or oral) with performance metrics to be met (e.g., predetermined grading criteria and passing criteria);
- ~~period of supervised casework or breath alcohol instrument calibrations;~~
- ~~program assessment mechanisms;~~
- defined criteria for successful completion of the training program ~~completion.~~

~~4.2.2.6~~4.2.2.5 The training program shall be reviewed for relevancy, efficacy, and content at an interval established by the laboratory, not to exceed every two years.

4.2.3 Ongoing Competency

4.2.3.1 After an individual assumes independent casework or breath alcohol instrument calibrations, ongoing evaluations shall be used to help demonstrate their continued competency.

4.2.3.2 To demonstrate ongoing competency of personnel, the laboratory shall:

- define appropriate activities (based on job duties) to monitor the competency of personnel (e.g., participation in proficiency testing, retesting, direct observation);
- establish a predetermined, acceptable level of performance;
- monitor the competency of personnel ~~on a continuous basis~~continuously and document annually;
- establish remediation and corrective action plans when expected outcome(s) are not achieved.

4.2.4 Experience for Technical Leaders

Technical Leaders shall have at least three years of experience performing independently as a Toxicologist.

4.3 Continuing Education and Professional Development

4.3.1—General

It is important for laboratory personnel to remain current within the discipline through continuing education and professional development activities that are appropriate for the scope of their job functions~~duties~~.

4.3.24.3.1 Laboratory Responsibilities

4.3.2.14.3.1.1 The laboratory shall ensure that the following resources are 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;
- relevant periodicals and peer-reviewed journals.

4.3.2.24.3.1.2 Laboratory management ~~should allocate~~ **shall provide** financial ~~resources and provide~~ support, time, and/or opportunities for continuing education and professional development.

4.3.34.3.2 Minimum Continuing Education and Professional Development Requirements

4.3.3.14.3.2.1 The minimum number of required CE ~~hours (or units)~~ varies by position (see Annex **AB**).

4.3.3.24.3.2.2 Technicians shall obtain at least ~~6~~ **1.5** CE ~~hours/units~~ per calendar year relevant to ~~their job function duties, forensic toxicology, or other professional development in the field,~~ with at least ~~4~~ **0.25** CE ~~hour being~~ **units** from sources external to the laboratory.

4.3.3.34.3.2.3 Analysts shall obtain ~~at least 2~~ CE ~~hours sufficient to maintain their certification or at least 8~~ CE ~~hours/units~~ per calendar year relevant to forensic toxicology with at least ~~2~~ **0.5** CE ~~hours~~ **units** from sources external to the laboratory.

4.3.3.44.3.2.4 Toxicologists ~~and Toxicology Technical Leaders~~ shall obtain ~~CE hours sufficient to maintain their certification or~~ at least ~~16~~ **4** CE ~~hours/units~~ per calendar year relevant to forensic toxicology with ~~4~~ **1** CE ~~hours/unit~~ from sources external to the laboratory.

~~**4.3.3.5** Toxicology Technical Leaders shall obtain CE hours sufficient to maintain their certification or at least 16 CE hours per calendar year relevant to forensic toxicology with 4 CE hours from sources external to the laboratory.~~

4.3.44.3.3 Sources of Continuing Education and Professional Development

4.3.4.14.3.3.1 ~~Continuing~~ **The laboratory shall define those activities that may be counted toward continuing** education and professional development ~~should be a combination~~ **activities, the appropriate number of CE units assigned to each activity, the participation required to receive credit, and whether the activities count as internal** ~~and/or~~ **external** ~~activities; training sources.~~

4.3.4.24.3.3.2 ~~The following are~~ **Assigned CE units for** commonly recognized sources of continuing education and professional development activities **should be consistent** with the ~~recommended assignment of CE hours for each following:~~

NOTE ~~If an individual is certified (see Section 4.4), it is within the purview of their certification body to assign the CE hours for these various activities:~~

- ~~attending instructor-led courses;~~

- ~~— degree seeking (post-secondary educational level) – 10 CE hours/3 credit hours;~~
- ~~— non-degree career training – 10 CE hours/3 credit hours;~~
- ~~— participating as a visiting scientist – 0.25 CE hour/contact hour;~~
- publishing scientific articles – 5 CE ~~hours~~units;
- presenting at a conference – 5 CE ~~hours~~units;
- presenting at a workshop – 1 CE ~~hour~~unit/contact hour;
- performing a literature review – 0.25 CE ~~hour~~unit per article;
- peer-reviewing a technical manuscript – 1 CE ~~hour~~unit per manuscript;
- peer-reviewing a technical abstract – 0.25 CE ~~hour~~unit per abstract;
- mentoring students or other toxicologists – 1 CE ~~hour~~unit/contact hour;
- instruction of a seminar, lecture, or class – 1 CE ~~hour~~unit/contact hour;
- ~~— service on scientific committees and working groups – 1 CE unit/year;~~
- attending seminars, lectures, professional meetings, and classes – 0.25 CE ~~hour~~unit/contact hour;
- attending instrument operation or maintenance courses – 0.25 CE ~~hour~~unit/contact hour;
- attending distributed learning:
 - on-line education – 0.25 CE ~~hour~~unit/contact hour,
 - webinars – 0.25 CE ~~hour~~unit/contact hour;
- participating in independent learning – 0.25 CE ~~hour~~unit/contact hour;
- performing laboratory inspections (audits, assessments) – 5 CE ~~hour~~hours per inspection.

NOTE If an individual is certified (see Section 4.4) or licensed, the certification or licensing body has the authority to assign CE units for the above activities.

4.3.54.3.4 Components of Continuing Education and Professional Development Activities

4.3.514.3.4.1 Continuing Laboratories shall ensure that continuing education and professional development activities **shall include** are structured by including the following components, as applicable:

- written goals and objectives; for the activity;
- the use of subject matter expert instructors; and

- written syllabus or program description;
- ~~an assessment mechanism;~~
- ~~official records of completion of the activities.~~

4.3.4.2 Laboratories shall ensure that the outcome of continuing education and professional development activities are measurable by establishing an assessment mechanism.

NOTE Assessment mechanisms may include oral or written examinations, amount of time spent on a training activity, instructor or presenter evaluation, an oral or written summary of what was learned from a training activity, practical exercises, observation of technical performance, and criteria for passing tests.

4.4 Certification

~~Certification by an accredited certifying body in forensic or clinical toxicology is a component of professional development.~~ Certification provides the public and the judicial system a means of identifying ~~those practitioners who have with~~ the ~~educational attainment~~ education and ~~knowledge~~ appropriate ~~knowledge~~ for the field. ~~It~~ ~~Certifying bodies~~ also ~~helps hold individuals to a code of~~ ~~provide guidance for professional conduct and~~ ethical ~~conduct~~ behavior.

~~4.4.1 Minimum standards for forensic or clinical toxicology certification requirements may vary based on the category of employment.~~

~~4.4.24.4.1~~ Analysts and toxicologists should obtain certification commensurate with job duties.

~~4.4.34.4.2~~ Toxicology Technical Leaders shall obtain relevant certification within three 3 years of their appointment to the position or a laboratory's adoption of this standard.

NOTE These minimum standards for certification are summarized in Annex AB for each ~~category of~~ employment ~~category~~.

~~4.4.44.4.3~~ An acceptable certification program is one that:

- is accredited under ISO/IEC 17024;
- has a formal application process;
- verifies minimum educational qualifications;
- reviews official transcript(s) from accredited colleges or universities that are sent directly to the certification body;
- reviews professional references from practitioners with knowledge of the applicant's experience in forensic toxicology submitted directly to the certification body;
- verifies required training and experience;
- requires a statement of adherence to a professional code of conduct and ethical behavior;

- performs a proctored written examination appropriate to the level of certification and predefines criteria for successful completion;
- has a periodic requalification process and a process to reapply for certification ~~in the event~~ if an individual does not qualify.

5 Documentation of Training, Competency, Continuing Education, Professional Development, and Certification

5.1 General

The laboratory shall have a policy to maintain records of employees' training, competency, continuing education, professional development, and certification.

5.2 Documentation of Training

~~5.2.1 Training records~~ **Records** that demonstrate an employee's completion of the requirements of the laboratory's training ~~elements or~~ program (Section 4.2.2.1) shall permanently be maintained ~~unless superseded by state statute, regulation, or law.~~

5.2.2 Appropriate documentation of training shall include:

- records showing progress ~~through~~ and completion of training modules (e.g., checklists, grids);
- results of assessments (including initial competency tests (~~Section~~ ~~section~~ 4.2.3.1.4) of trainee's knowledge, skills, and abilities);
- ~~Laboratory~~ authorization of employee to perform activities affecting casework or breath alcohol instrument calibrations (e.g., memorandum).

5.3 Documentation of Ongoing Competency

5.3.1 Records ~~shall be maintained for at least seven years that demonstrated~~ **demonstrating** an employee's completion of ongoing competency activities (~~Section~~ ~~section~~ 4.2.3.2) ~~shall be maintained for at least seven years unless superseded by state statute, regulation, or law.~~

5.3.2 Appropriate documentation of ongoing competency shall include:

- records of the activities used to monitor ~~the~~ competency of employees (e.g., specific proficiency ~~test(s)); tests~~);
- results and assessment of the competency activities;
- remediation when ~~the~~ expected outcome is not achieved.

5.4 Documentation of Continuing Education and Professional Development

5.4.1 Continuing education and professional development shall be documented to count toward the minimum number of required CE ~~hours~~ **units** listed in 4.3.2. and Annex ~~AB~~.

NOTE Examples of appropriate documentation of continuing education and professional development activities include:

- verification of attendance:
 - certificates of completion:
 - date;
 - location;
 - duration of training;
 - instructor;
 - sponsoring organization;
 - title of event;
 - virtual (online) or in-person;
 - scientific conference agenda;
 - workshop agenda and learning objectives
- course syllabus;
- abstract of provided scientific presentation (e.g., oral or poster);
- copy of published manuscript (e.g., peer-reviewed article, white paper, application note);
- copy of continuing education credits awarded ~~from~~ for review of manuscripts (e.g., Journal of Analytical Toxicology ~~manuscripts~~);
- recording of presentation, webinar, or exercise;
- number of contact hours for training activities.

5.4.2 Continuing education and professional development activities shall be independently verifiable to count towards the minimum requirements defined in Annex AB.

5.4.3 In the absence of objective evidence of these activities (e.g., self-directed literature reviews), the laboratory shall define ~~the~~ a mechanism ~~in which such~~ to verify completion ~~requirements will be~~ verified.

5.4.4 Records of completion of continuing education and professional development activities (Section 4.3) shall be maintained for at least seven years unless superseded by state statute, regulation, or law.

5.5 Documentation of Certification

5.5.1 Documentation of an employee's certification shall include a copy of a certificate, letter, or printout card from ~~website~~ the certifying body that specifies:

- name of certificant;
- certificate number;
- name of certifying body;

- certification category;
- date certification was granted;
- expiration date of certification.

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Annex A (normative)

Training Elements and Content

<u>Element</u>	<u>Training Content</u>
<u>Administrative and Laboratory Policies</u>	<u>accreditation; document and record control; quality management; safety (e.g., biological, chemical, and physical hazards); security; standard operating procedures</u>
<u>Alcohol Toxicology</u>	<u>interpretation (e.g., mathematical calculations); pharmacodynamics; pharmacokinetics; physiology (e.g., blood-to-breath ratio)</u>
<u>Analytical Methodology</u>	<u>aliquoting; isolation techniques; qualitative analysis; quantitative analysis; requirements for identification (e.g., ANSI/ASB 113 <i>Standard for Identification Criteria in Forensic Toxicology</i>); theory</u>
<u>Calibrating Device</u>	<u>dry gas cylinder (e.g., barometric pressure; theory; uses/limitations; wet/dry offset); wet bath simulator (e.g., partition ratio; temperature; theory; uses/limitations)</u>
<u>Communication</u>	<u>report writing (e.g., ANSI/ASB 053 <i>Standard for Report Content in Forensic Toxicology</i>); verbal and nonverbal skills (e.g., non-technical; technical)</u>
<u>Evidence</u>	<u>chain of custody; collection; concepts; preservation; retention</u>
<u>Forensic Science</u>	<u>general knowledge; related disciplines</u>
<u>Human Factors</u>	<u>factors such as cognitive bias that may affect testing strategies, interpretations, reporting, and testimony; understanding the scope and limitations of methods and expertise</u>
<u>Instrumentation</u>	<u>theory; operation; limitations; maintenance; adjustments; calibrations (e.g., ANSI/ASB 055 <i>Standard for Breath Alcohol Measuring Instrument Calibration</i>); troubleshooting; mass spectrometry (e.g., ANSI/ASB 098 <i>Standard for Mass Spectral Analysis in Forensic Toxicology</i>)</u>
<u>Legal Aspects</u>	<u>case law and applicable federal, state, or local laws and regulations; terminology; courtroom procedures; deposition and courtroom testimonies (e.g., ANSI/ASB 037 <i>Guidelines for Opinions and Testimony in Forensic Toxicology</i>); admissibility (e.g., <i>Daubert, Frye</i>); disclosure obligations (e.g., <i>Brady</i>); confrontation (e.g., <i>Melendez-Diaz; Bullcoming</i>)</u>
<u>Quality Assurance and Quality Control</u>	<u>ANSI/ASB 054 <i>Standard for a Quality Control Program in Forensic Toxicology Laboratories</i>; Method development and validation (e.g., ANSI/ASB 036 <i>Standard Practices for Method Validation in Forensic Toxicology</i>); metrological traceability (e.g., ANSI/ASB 017 <i>Standard Practices for Measurement Traceability in Forensic Toxicology</i>); reference material (e.g., uses/limitations; preparation); theory</u>

<u>Element</u>	<u>Training Content</u>
<u>Standards of Conduct</u>	<u>ethics; professionalism; confidentiality</u>
<u>Statistical Analysis</u>	<u>calculations; control charts and/or trending; measurement uncertainty; terminology</u>
<u>Toxicology</u>	<u>interpretation; pharmacodynamics; pharmacokinetics; physiology</u>

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Annex B (normative)

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 <u>Individual who performs</u> basic analytical functions <u>duties</u> but does not evaluate data, reach conclusions, or sign a report for court or investigative purposes. May <u>and interpret observations and calculations. Technicians may</u> also perform functions related to instrumentation verification, adjustment, and calibration <u>duties. They may be named in reports to indicate their contribution to the work.</u>	Conducts <u>Individual who conducts,</u> directs, or reviews the analysis of forensic toxicology samples, evaluates data, and reaches conclusions; or <u>breath alcohol instrument calibration activities. Analysts evaluate and interpret observations and calculations and</u> may sign a report for court or <u>investigative purposes based on examinations.</u> The Analyst <u>analyst</u> may testify but does not provide interpretive <u>opinions.</u> Duties and responsibilities <u>may also</u> include those of a Technician <u>technician.</u>	Provides interpretive <u>Individual who provides factual information,</u> interpretations, and <u>opinions</u> related to the results of toxicological tests for court or investigative purposes. Duties and responsibilities <u>may also</u> include those of an Analyst <u>analyst.</u>	Responsible <u>Individual who is responsible</u> for the technical oversight of the toxicology and/or <u>breath alcohol calibration</u> laboratory. Duties and responsibilities <u>may also</u> include those of a Toxicologist <u>toxicologist.</u>
Education	Associate's degree in Natural Science, Applied Science, or Technology <u>or equivalent number of semester hours</u>	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	None required	General & organic chemistry (16 credit hours) <u>with associated laboratory courses</u>	General & organic chemistry (16 credit hours) <u>with associated laboratory courses, one</u> analytical course, and one <u>interpretive</u> course or workshop	General & organic chemistry (16 credit hours) <u>with associated laboratory courses, one</u> analytical course, and one <u>interpretive</u> course or workshop
Training and Experience	Completion of formal, structured training program appropriate to job function <u>duties</u>	Completion of formal, structured training program appropriate to job function <u>duties</u>	Completion of formal, structured training program appropriate to job function <u>duties</u>	3 years of experience performing independently as a <i>Toxicologist</i>
Certification	Not required	Preferred <u>Recommended</u>	Preferred <u>Recommended</u>	Required within 3 years of appointment to the position

<p>Continuing Education</p>	<p>6 hours<u>1.5 units</u> per calendar year relevant to job function<u>duties</u> with 1 hour<u>0.25 units</u> from external source<u>source(s)</u></p>	<p>Sufficient to maintain certification or 8 hours<u>2 units</u> per calendar year relevant to forensic toxicology with 2 hours<u>0.5 units</u> from external source<u>source(s)</u></p>	<p>Sufficient to maintain certification or 16 hours<u>4 units</u> per calendar year relevant to forensic toxicology with 4 hours<u>1 unit</u> from external source<u>source(s)</u></p>	<p>Sufficient to maintain certification or 16 hours<u>4 units</u> per calendar year relevant to forensic toxicology with 4 hours<u>1 unit</u> from external source<u>source(s)</u></p>
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*An individual (however named) who fulfills scope.

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Annex BC
(normative)

Applicable Scientific Courses

Column A Analytical Science Courses ^d	Column B Interpretive Science Courses or Workshops
Analytical chemistry <u>Chemistry</u> Chemical informatics <u>Informatics</u> Instrumental analysis <u>Analysis</u> Mass spectrometry <u>Spectrometry</u> Quantitative analysis <u>Analysis</u> Separation science <u>Science</u> Spectroscopic analysis <u>Analysis</u>	Biochemistry Drug metabolism <u>Metabolism</u> Forensic toxicology <u>Toxicology</u> Medicinal chemistry <u>Chemistry</u> Pharmacology Physiology Toxicology 36-hour interpretive workshop (or time equivalent to a 3-credit hour course) ^e

^d This list serves as examples of acceptable course titles offered by accredited colleges or universities. It is not meant to exclude courses with similar content bearing different titles.

^e Or time equivalent to a 3-credit hour course.

Annex **CD** (informative)

Bibliography

The following bibliography is not intended to be an all-inclusive list, review, or endorsement of literature on this topic. The goal of the bibliography is to provide examples of publications addressed in the standard.

- 1] ASTM 2917-19 *Standard Practice for Forensic Science Practitioner Training, Continuing Education, and Professional Development Programs*.
- 2] ISO/IEC 17024:2012 – *Conformity Assessment – General Requirements for Bodies Operating Certification of Persons*.
- 3] “Scientific Working Group for Forensic Toxicology (SWGTOX) Standard for Laboratory Personnel” *Journal of Analytical Toxicology*, Volume 39, Issue 3, April 2015, Pages 241–250,^f
- 4] “Scientific Working Group for Forensic Toxicology (SWGTOX) Standard for Breath Alcohol Personnel” *Journal of Analytical Toxicology*, Volume 39, Issue 3, April 2015, Pages 211–240,^g

^f <https://doi.org/10.1093/jat/bku125>

^g <https://doi.org/10.1093/jat/bku124>

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