

ASB Standard 173, First Edition
2024

**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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410 North 21st Street
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Foreword

This document was developed to provide minimum requirements for the qualifications and development of forensic toxicology laboratory personnel and individuals performing evidentiary breath alcohol instrument calibration. 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 is important when evaluating prospective employees to work in a laboratory. This ensures they have a solid foundation that can be further enhanced through a 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 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

1 Standard for Education, Training, Continuing Education, and Certification of 2 Forensic Toxicology Laboratory Personnel

3 **1 Scope**

4 This document provides minimum requirements for educational qualifications, training,
5 competency, experience, continuing education, and certification of laboratory personnel
6 performing, interpreting, or overseeing forensic toxicology analyses or evidentiary breath alcohol
7 instrument calibrations. It applies to the following sub-disciplines: postmortem toxicology, human
8 performance toxicology (e.g., drug-facilitated crimes and driving-under-the-influence of alcohol or
9 drugs), non-regulated employment drug testing, and other forensic testing (e.g., court-ordered
10 toxicology, general forensic toxicology). The following are outside the scope of this document:
11 personnel who exclusively perform administrative or non-technical duties; individuals working as
12 breath alcohol instrument operators; individuals performing calibration adjustments to breath
13 alcohol instruments; or individuals who solely perform instrument maintenance activities.

14 **2 Normative References**

15 There are no normative reference documents. Annex D, Bibliography, contains informative
16 references.

17 **3 Terms and Definitions**

18 For purposes of this document, the following definitions apply.

19 **3.1**

20 **analyst**

21 Individual, however named, who conducts, directs, or reviews the analysis of forensic toxicology
22 samples and/or breath alcohol instrument calibration activities. Analysts evaluate and interpret
23 observations and calculations and may sign a report for court or investigative purposes. The analyst
24 may testify but does not provide opinions. Duties and responsibilities may include those of a
25 technician.

26 **3.2**

27 **certification**

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

30 **3.3**

31 **competency**

32 Technical skills and knowledge necessary to perform duties successfully.

33 **3.4**

34 **continuing education**

35 **CE**

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

38 **3.5**

39 **course**

40 Program of instruction taught through an accredited college or university program in which an
41 official record of the institution documents the student's successful completion.

42 **3.6**

43 **credential**

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

45 **3.7**

46 **experience**

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

48 **3.8**

49 **interpretation**

50 Explanation for observations and calculations.

51 NOTE In forensic toxicology, interpretations are the reported findings.

52 **3.9**

53 **laboratory personnel**

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

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

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

59 **3.10**

60 **opinion**

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

63 **3.11**

64 **professional development**

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

67 **3.12**

68 **qualifications**

69 Combined education, training, and experience of an individual.

70 **3.13**

71 **technician**

72 Individual, however named, who performs basic analytical duties but does not evaluate and
73 interpret observations and calculations. Technicians may also perform instrumentation
74 verification, adjustment, and calibration duties. They may be named in reports to indicate their
75 contribution to the work.

76 3.14**77 training**

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

80 3.15**81 training records**

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

85 3.16**86 toxicologist**

87 Individual, however named, who provides factual information, interpretations, and opinions related
88 to the results of toxicological tests for court or investigative purposes. Duties and responsibilities
89 may also include those of an analyst.

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

92 3.17**93 toxicology technical leader**

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

97 4 Minimum Requirements for Personnel**98 4.1 Educational Qualifications****99 4.1.1 General**

100 **4.1.1.1** Upon publication of this document, all new hires and internal promotions in laboratories
101 adopting this standard should meet the educational requirements specified below.

102 **4.1.1.2** Laboratories shall ensure that all current employees meet the educational requirements
103 no later than December 31, 2034.

104 **4.1.1.3** Official academic transcripts shall be required as proof of credentials, including degree(s)
105 awarded.

106 4.1.2 Technician

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

110 4.1.3 Analyst

111 Personnel in Analyst positions shall have a Bachelor's degree or higher in natural science
112 (preference in chemistry, toxicology, biochemistry, pharmacology, or biology) or applied science

113 (e.g., forensic science, medical sciences) from an accredited institution and have successfully
114 completed general and organic chemistry courses with associated laboratory classes.

115 **4.1.4 Toxicologist**

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

122 **4.1.5 Toxicology Technical Leader**

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

129 NOTE Minimum standards for education are summarized in Annex B for each employment category.
130 Applicable scientific topics are listed in Annex C.

131 **4.2 Training, Experience, and Competency**

132 **4.2.1 General**

133 **4.2.1.1** The laboratory shall ensure technical personnel are trained and demonstrate competency
134 in each assigned duty before being authorized for independent work. Duties may include but are
135 not limited to handling test and calibration items, instrument maintenance, preparation of
136 reference material, conducting and reviewing testing/calibration activities, evaluating data,
137 reaching conclusions, signing reports, and providing testimony.

138 **4.2.1.2** The length of training should consider the scope of work to be performed, as well as the
139 individual's qualifications and experience.

140 **4.2.2 Initial Training**

141 **4.2.2.1** The laboratory shall have a documented training program addressing the scientific
142 knowledge and expertise necessary to perform assigned job duties.

143 **4.2.2.2** Training elements shall include the applicable content as summarized in Annex A.

144 **4.2.2.3** Training sources may be internal and external to the forensic laboratory. Sources
145 for external training may include government agencies, academic institutions, training academies
146 or institutions, private sector organizations, manufacturers, and professional societies.

147 **4.2.2.4** The training program shall specify:

148 — objectives that define the specific elements the trainee needs to demonstrate competency from
149 Annex A;

150 — instructor qualifications that include competency and area(s) of expertise for specific training
151 elements;

152 — trainee requirements to include the actions required of the trainee to meet the objectives of the
153 training program (e.g., reading of specified literature; minimum number of surrogate test and
154 calibration items analyzed)

155 — required periodic assessments of the trainee (practical, written, or oral) with performance
156 metrics to be met (e.g., predetermined grading criteria and passing criteria);

157 — defined criteria for successful completion of the training program.

158 **4.2.2.5** The training program shall be reviewed for relevancy, efficacy, and content at an interval
159 established by the laboratory, not to exceed every two years.

160 **4.2.3 Ongoing Competency**

161 **4.2.3.1** After an individual assumes independent casework or breath alcohol instrument
162 calibrations, ongoing evaluations shall be used to help demonstrate their continued competency.

163 **4.2.3.2** To demonstrate ongoing competency of personnel, the laboratory shall:

164 — define appropriate activities (based on job duties) to monitor the competency of personnel (e.g.,
165 participation in proficiency testing, retesting, direct observation);

166 — establish a predetermined, acceptable level of performance;

167 — monitor the competency of personnel continuously and document annually;

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

169 **4.2.4 Experience for Technical Leaders**

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

172 **4.3 Continuing Education and Professional Development**

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

176 **4.3.1 Laboratory Responsibilities**

177 **4.3.1.1** The laboratory shall ensure that the following resources are available and accessible to
178 laboratory personnel:

179 — reference texts in key subject areas (e.g., analytical chemistry, toxicology, pharmacology);

180 — reference literature containing physical, chemical, pharmaceutical, and/or analytical data;

181 — relevant periodicals and peer-reviewed journals.

182 **4.3.1.2** Laboratory management shall provide financial support, time, and/or opportunities for
183 continuing education and professional development.

184 **4.3.2 Minimum Continuing Education and Professional Development Requirements**

185 **4.3.2.1** The minimum number of required CE units varies by position (see Annex B).

186 **4.3.2.2** Technicians shall obtain at least 1.5 CE units per calendar year relevant to their job duties,
187 forensic toxicology, or other professional development in the field, with at least 0.25 CE units from
188 sources external to the laboratory.

189 **4.3.2.3** Analysts shall obtain at least 2 CE units per calendar year relevant to forensic toxicology
190 with at least 0.5 CE units from sources external to the laboratory.

191 **4.3.2.4** Toxicologists and Toxicology Technical Leaders shall obtain at least 4 CE units per
192 calendar year relevant to forensic toxicology with 1 CE unit from sources external to the laboratory.

193 **4.3.3 Sources of Continuing Education and Professional Development**

194 **4.3.3.1** The laboratory shall define those activities that may be counted toward continuing
195 education and professional development activities, the appropriate number of CE units assigned to
196 each activity, the participation required to receive credit, and whether the activities count as
197 internal or external training sources.

198 **4.3.3.2** Assigned CE units for commonly recognized sources of continuing education and
199 professional development activities should be consistent with the following:

200 — publishing scientific articles – *5 CE units*;

201 — presenting at a conference – *5 CE units*;

202 — presenting at a workshop – *1 CE unit/contact hour*;

203 — performing a literature review – *0.25 CE unit per article*;

204 — peer-reviewing a technical manuscript – *1 CE unit per manuscript*;

205 — peer-reviewing a technical abstract – *0.25 CE unit per abstract*;

206 — mentoring students or other toxicologists – *1 CE unit/contact hour*;

- 207 — instruction of a seminar, lecture, or class – *1 CE unit/contact hour*;
- 208 — service on scientific committees and working groups – *1 CE unit/year*;
- 209 — attending seminars, lectures, professional meetings, and classes – *0.25 CE unit/contact hour*;
- 210 — attending instrument operation or maintenance courses – *0.25 CE unit/contact hour*;
- 211 — attending distributed learning:
 - 212 — on-line education – *0.25 CE unit/contact hour*,
 - 213 — webinars – *0.25 CE unit/contact hour*;
- 214 — participating in independent learning – *0.25 CE unit/contact hour*;
- 215 — performing laboratory inspections (audits, assessments) – *5 CE hours per inspection*.

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

218 **4.3.4 Components of Continuing Education and Professional Development Activities**

219 **4.3.4.1** Laboratories shall ensure that continuing education and professional development
220 activities are structured by including the following components, as applicable:

- 221 — written goals and objectives for the activity;
- 222 — the use of subject matter expert instructors; and
- 223 — written syllabus or program description.

224 **4.3.4.2** Laboratories shall ensure that the outcome of continuing education and professional
225 development activities are measurable by establishing an assessment mechanism.

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

229 **4.4 Certification**

230 Certification provides the public and the judicial system a means of identifying practitioners with
231 the education and knowledge appropriate for the field. Certifying bodies also provide guidance for
232 professional conduct and ethical behavior.

233 **4.4.1** Analysts and toxicologists should obtain certification commensurate with job duties.

234 **4.4.2** Toxicology Technical Leaders shall obtain relevant certification within three 3 years of
235 their appointment to the position or a laboratory's adoption of this standard.

236 NOTE These minimum standards for certification are summarized in Annex B for each employment category.

- 237 **4.4.3** An acceptable certification program is one that:
- 238 — is accredited under ISO/IEC 17024;
- 239 — has a formal application process;
- 240 — verifies minimum educational qualifications;
- 241 — reviews official transcript(s) from accredited colleges or universities that are sent directly to
242 the certification body;
- 243 — reviews professional references from practitioners with knowledge of the applicant's
244 experience in forensic toxicology submitted directly to the certification body;
- 245 — verifies required training and experience;
- 246 — requires a statement of adherence to a professional code of conduct and ethical behavior;
- 247 — performs a proctored written examination appropriate to the level of certification and
248 predefines criteria for successful completion;
- 249 — has a periodic requalification process and a process to reapply for certification if an individual
250 does not qualify.

251 **5 Documentation of Training, Competency, Continuing Education, Professional
252 Development, and Certification**

253 **5.1 General**

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

256 **5.2 Documentation of Training**

257 **5.2.1** Records that demonstrate an employee's completion of the requirements of the laboratory's
258 training elements or program (Section 4.2.2.1) shall permanently be maintained unless superseded
259 by state statute, regulation, or law.

260 **5.2.2** Appropriate documentation of training shall include:

- 261 — records showing progress through and completion of training modules (e.g., checklists, grids);
- 262 — results of assessments (including initial competency tests (section 4.2.2.1.4) of trainee's
263 knowledge, skills, and abilities);
- 264 — Laboratory authorization of employee to perform activities affecting casework or breath
265 alcohol instrument calibrations (e.g., memorandum).

266 **5.3 Documentation of Ongoing Competency**

267 **5.3.1** Records demonstrating an employee's completion of ongoing competency activities (section
268 4.2.3) shall be maintained for at least seven years unless superseded by state statute, regulation, or
269 law.

270 **5.3.2** Appropriate documentation of ongoing competency shall include:

271 — records of the activities used to monitor the competency of employees (e.g., specific proficiency
272 tests);

273 — results and assessment of the competency activities;

274 — remediation when the expected outcome is not achieved.

275 **5.4 Documentation of Continuing Education and Professional Development**

276 **5.4.1** Continuing education and professional development shall be documented to count toward
277 the minimum number of required CE units listed in 4.3.2. and Annex B.

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

280 — verification of attendance:

281 — certificates of completion:

282 — date;

283 — location;

284 — duration of training;

285 — instructor;

286 — sponsoring organization;

287 — title of event;

288 — virtual (online) or in-person;

289 — scientific conference agenda;

290 — workshop agenda and learning objectives

291 — course syllabus;

292 — abstract of provided scientific presentation (e.g., oral or poster);

293 — copy of published manuscript (e.g., peer-reviewed article, white paper, application note);

294 — copy of continuing education credits awarded for review of manuscripts (e.g., Journal of Analytical
295 Toxicology);

296 — recording of presentation, webinar, or exercise;

297 — number of contact hours for training activities.

298 **5.4.2** Continuing education and professional development activities shall be independently
299 verifiable to count towards the minimum requirements defined in Annex B.

300 **5.4.3** In the absence of objective evidence of these activities (e.g., self-directed literature reviews),
301 the laboratory shall define a mechanism to verify completion.

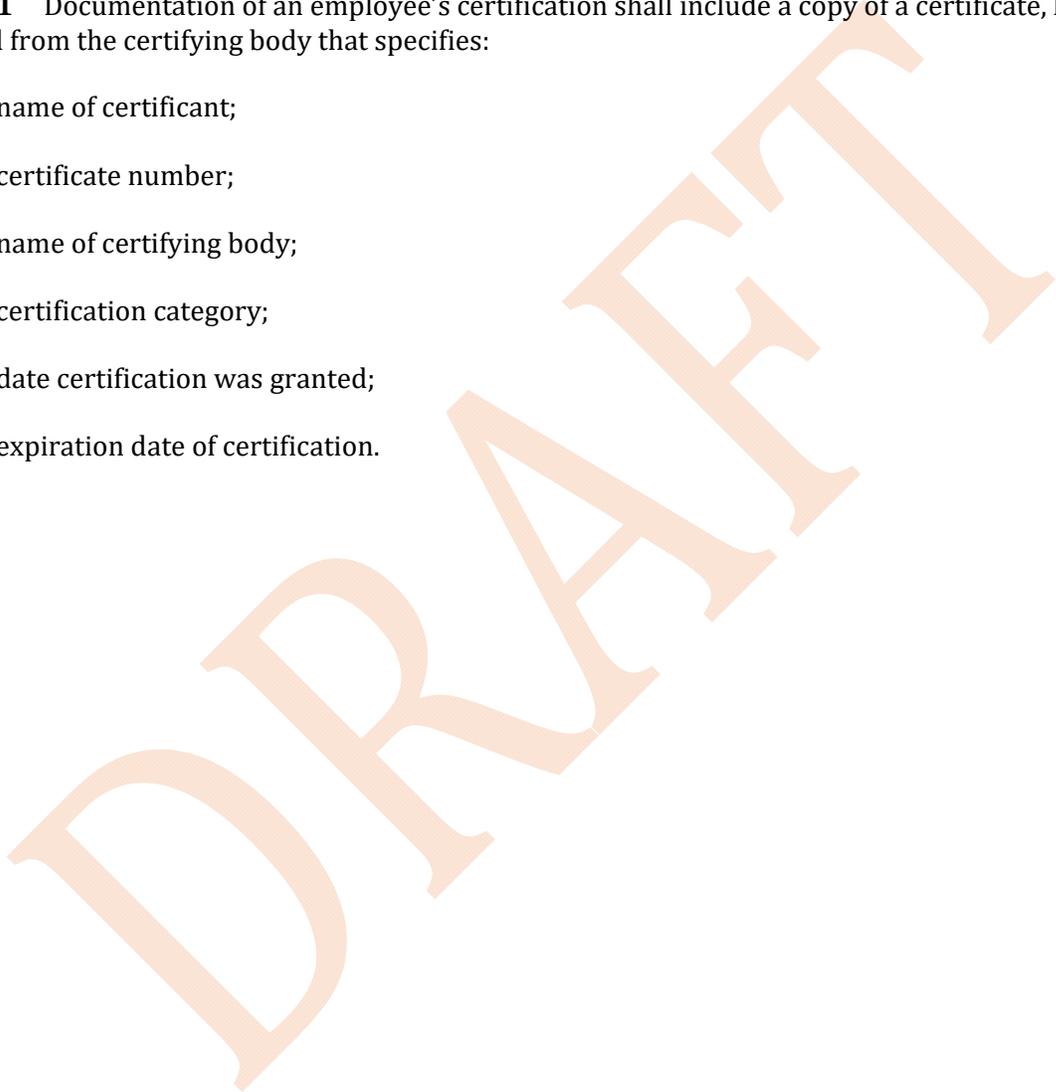
302 **5.4.4** Records of completion of continuing education and professional development activities
303 (Section 4.3) shall be maintained for at least seven years unless superseded by state statute,
304 regulation, or law.

305 **5.5 Documentation of Certification**

306 **5.5.1** Documentation of an employee's certification shall include a copy of a certificate, letter, or
307 card from the certifying body that specifies:

- 308 — name of certificant;
- 309 — certificate number;
- 310 — name of certifying body;
- 311 — certification category;
- 312 — date certification was granted;
- 313 — expiration date of certification.

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Annex A (normative)

Training Elements and Content

Element	Training Content
Administrative and Laboratory Policies	accreditation; document and record control; quality management; safety (e.g., biological, chemical, and physical hazards); security; standard operating procedures
Alcohol Toxicology	interpretation (e.g., mathematical calculations); pharmacodynamics; pharmacokinetics; physiology (e.g., blood-to-breath ratio)
Analytical Methodology	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
Calibrating Device	dry gas cylinder (e.g., barometric pressure; theory; uses/limitations; wet/dry offset); wet bath simulator (e.g., partition ratio; temperature; theory; uses/limitations)
Communication	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)
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, reporting, and testimony; understanding the scope and limitations of methods and expertise
Instrumentation	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>)
Legal Aspects	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>)
Quality Assurance and Quality Control	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

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

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Annex B (normative)

Personnel Requirements Listed by Position

	Technician*	Analyst*	Toxicologist*	Toxicology Technical Leader*
Scope	Individual who performs basic analytical duties but does not evaluate and interpret observations and calculations. Technicians may also perform instrumentation verification, adjustment, and calibration duties. They may be named in reports to indicate their contribution to the work.	Individual who conducts, directs, or reviews the analysis of forensic toxicology samples and/or breath alcohol instrument calibration activities. Analysts evaluate and interpret observations and calculations and may sign a report for court or investigative purposes. The analyst may testify but does not provide opinions. Duties and responsibilities may include those of a technician.	Individual who provides factual information, interpretations, and opinions related to the results of toxicological tests for court or investigative purposes. Duties and responsibilities may also include those of an analyst.	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.
Education	Associate's degree in Natural Science, Applied Science, or Technology or equivalent number of semester hours	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 with associated laboratory courses	General & organic chemistry with associated laboratory courses, one analytical course, and one interpretive course or workshop	General & organic chemistry with associated laboratory courses, one analytical course, and one interpretive course or workshop
Training and Experience	Completion of formal, structured training program appropriate to job duties	Completion of formal, structured training program appropriate to job duties	Completion of formal, structured training program appropriate to job duties	3 years of experience performing independently as a <i>Toxicologist</i>
Certification	Not required	Recommended	Recommended	Required within 3 years of appointment to the position
Continuing Education	1.5 units per calendar year relevant to job duties with 0.25 units from external source(s)	Sufficient to maintain certification or 2 units per calendar year relevant to forensic toxicology with 0.5 units from external source(s)	Sufficient to maintain certification or 4 units per calendar year relevant to forensic toxicology with 1 unit from external source(s)	Sufficient to maintain certification or 4 units per calendar year relevant to forensic toxicology with 1 unit from external source(s)

*An individual (however named) who fulfills scope.

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Annex C (normative)

Applicable Scientific Courses

Column A Analytical Science Courses ^a	Column B Interpretive Science Courses or Workshops
Analytical Chemistry Chemical Informatics Instrumental Analysis Mass Spectrometry Quantitative Analysis Separation Science Spectroscopic Analysis	Biochemistry Drug Metabolism Forensic Toxicology Medicinal Chemistry Pharmacology Physiology Toxicology 36-hour interpretive workshop ^b

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^a 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.

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

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Annex D (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.^c
- 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.^d

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

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

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