ACCREDITATION OF FORENSIC LABORATORIES

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Abstract. The modern trial requires that the results of forensic research are credible reliable, carried out according to standard procedures, and that the experts performing them have the highest competences. The guarantee of precision, reliability and trust in forensic expertise is rightly observed in the most important international standard for research, EN ISO/IEC 17025. The article presents specific requirements relating to the mandatory accreditation of forensic laboratories that conduct genetic and dactyloscopic tests. The role played by the European Network of Forensic Science Institutes in the area of accreditation is also discussed, with particular emphasis on the most recent ENFSI initiative related to the development of the document entitled “Vision of the European Forensic Science Area 2030”.

Keywords: forensic experts; DNA tests; fingerprint examination; forensic science; EN ISO/IEC 17025

INTRODUCTION

Due to the rapid development of science and technology and its use by the judiciary, the issue of the quality of opinion and accreditation of forensic laboratories has gained in importance. Judicial proceedings require that the results of forensic examinations meet the criteria of: reliability; performance according to standard procedures; consistency with the results obtained in other countries, in other scientific circles and in internationally recognized institutions; that they are performed within a specified time frame in an effective and efficient manner [Ivanovic 2019, 21]. The forensic laboratory, in performing advanced tests, should therefore guarantee the high quality of services provided and the credibility of opinions drawn up on this basis. It is also important to employ professional experts with the highest competences and to have appropriate equipment by the reviewing institution.

The modern court trial rightly sees the most important international standard EN ISO/IEC 17025 “General requirements for the competence of testing and calibration laboratories” as a guarantee of precision, reliability and trust in forensic expertise1 [Hebenstreit 2007, 608; Wójcikiewicz

1 Hereinafter: ISO 17025.
The ISO 17025 standard formulates a number of requirements for the quality system in the laboratory and technical competence to carry out tests. The most important include: compliance with the quality management system, regular audits, training of experts, care for laboratory premises and appropriate equipment, validation of tests, quality control, standards for reporting test results, and continuous improvement [Skorecki 2008, 35-36]. Obtaining an accreditation certificate is possible after meeting the requirements specified in the standard. In view of the above, it should be emphasized that accreditation is the issuance of an official confirmation that the laboratory operates in accordance with a documented management system and is competent for tests specified in the scope of accreditation [Girdwoyń 2011, 107].

Accreditation and quality control are covered by the current Framework Decision of the EU Council of 30 November 2009 on the accreditation of forensic service providers performing laboratory activities. The aim of the regulation is to introduce common accreditation rules in accordance with ISO 17025 [Bednarek 2012, 80], which is to ensure that the results of laboratory tests carried out by accredited entities in one Member State are recognized by the judicial authorities in another Member State (Article 5 of the Framework Decision). The Framework Decision imposes on the Member States of the European Union the obligation to ensure that their forensic service providers, in performing laboratory activities in the field of DNA testing and dactyloscopic tests, are accredited by a national accreditation body for compliance with the EN ISO/IEC 17025 standard (Article 4 of the Framework Decision). In accordance with Article 3, the Framework Decision recognizes as a laboratory activity, any activity undertaken in the laboratory related to the disclosure and protection of traces on objects, examination, analysis and interpretation of evidence, in order to prepare an expert opinion. However, all activities carried out outside the laboratory (e.g. at the scene of the incident) are not covered by the Framework Decision.

Due to the extent of the issues outlined above, the element of this study is to present specific requirements relating to the accreditation of forensic laboratories performing genetic and fingerprint tests and to reveal the role played by the European Network of Forensic Science Institutes – an organization associating leading European laboratories and promoting

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3 In the field of DNA testing, the Framework Decision has been in force since 30 November 2013, and in the field of fingerprint tests – since 30 November 2015.
the introduction of international standards guaranteeing quality assurance and accreditation.

1. SPECIFICITY OF ACCREDITATION OF LABORATORIES PERFORMING GENETIC AND DACTYLOSCOPIC TESTS

Accreditation of forensic laboratories that perform DNA and fingerprint tests under the 2009 Council Framework Decision is mandatory. In Poland, the accreditation body is the Polish Centre for Accreditation (PCA), which operates on the basis of the Act on conformity assessment and market surveillance systems of 13 April 2016. The Polish Centre for Accreditation, acting in accordance with national and international requirements, has developed a number of documents regulating the principles of evaluation of laboratories wishing to operate in the accreditation system. Laboratories performing tests in the above-mentioned fields, when applying for accreditation, should therefore meet: A) General accreditation requirements indicated by the PN-EN ISO/IEC 17025 standard, B) Specific accreditation guidelines specified in: the Framework Decision of the Council of 2009 and in the document of the Polish Centre for Accreditation – “Accreditation of research laboratories – forensic service providers performing laboratory activities” DAB-10.

The DAB-10 document deserves special attention in the context of the discussed issues. This regulation was developed by the Polish Centre for Accreditation and introduced by Communication No. 330 of 15 December 2020, and is valid from 15 March 2021. Due to the framework of this article, the characteristics of the specific accreditation guidelines set out in the aforementioned DAB-10 document (which was developed to harmonize the approach to accreditation of forensic service providers performing laboratory activities, with particular emphasis on genetic testing and dactyloscopic testing), will be presented.

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4 Journal of Laws of 2022, item 1854.
1.1. Structure requirements

The laboratory management system should concern activities involving laboratory activities, i.e. the disclosure and securing of traces on objects, examination, analysis, evaluation and interpretation of forensic evidence, in order to develop an expert opinion or exchange forensic evidence. It is also required to implement a procedure for managing the process of formulating an expert opinion and interpreting research results.

1.2. Personnel requirements

Experts performing genetic tests on their own should at least: have higher biological, chemical, medical or related education, have one year of experience in the use of molecular biology techniques, have formal confirmation of competence by their supervisor and participate in intra-laboratory confirmation of the validity of test results with a positive result. Moreover, an employee of the laboratory authorizing a genetic test report is required, in addition to higher education in the above-mentioned fields, to have a formal confirmation of competence by their supervisor and to participate in an intra-laboratory confirmation of the validity of test results with a positive result. It is also necessary to have two years of professional experience in the field of performing tests under supervision and/or to develop 100 drafts of test reports carried out under supervision and to participate in PT/ILC programs with a positive result [Bednarek and Miąskiewicz 2010, 23-24].

The laboratory employee performing dactyloscopic examinations and authorizing test reports must have higher education, two years of experience in performing this type of activities and/or develop 150 drafts of test reports carried out under supervision, have formal confirmation of competence by the supervisor, participate in PT/ILC programs with a positive result and participate in intra-laboratory confirmation of the validity of test results with a positive result.

Both experts issuing opinions in the field of DNA testing and experts giving opinions in the field of fingerprint testing must have documented, advanced knowledge of the research method used, estimating its uncertainty

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6 According to the PCA document “Policy on participation in proficiency tests” (DA-5 of 12 April 2023), PT – a proficiency testing is: assessment of the results of the participant’s activities according to a previously established criterion, using interlaboratory comparisons, while ILC – an interlaboratory comparison is: organization, performance and evaluation of measurements or tests of the same or similar objects, by at least two laboratories, in accordance with previously determined conditions. Document available on the PCA website, https://www.pca.gov.pl/publikacje/dokumenty/pca/dokumenty-ogolne/pty on the PCA website [accessed: 30.08.2023].
and the requirements of legal provisions related to a given area of research. The indicated detailed requirements of persons employed in an accredited laboratory create a standard of competence, allowing to ensure the credibility and reliability of experts giving opinions for the purposes of court proceedings.

1.3. Requirements for the laboratory and its equipment

It is necessary for the laboratory to monitor, control and document the environmental conditions that may affect the validity of the test results, including, among others, temperature and humidity in rooms for storing evidence and reagents, in refrigerators and freezers where, for example, samples and evidence are stored, in rooms where there is measuring equipment. The accredited laboratory should have appropriate equipment, including measuring devices that are technically and qualitatively appropriate. The devices should be checked before they are put into use during testing activities, and then periodically calibrated and checked according to the relevant instructions. Activities related to the supervision of equipment must be planned and documented. In an accredited forensic laboratory, ensuring compliance with procedures and instructions regarding the equipment used during laboratory activities is a guarantee of the reliability of tests, and also prevents the use of devices that do not work properly.

1.4. Requirements for the selection and validation of the research method

The laboratory should use documented research methods that are described in professional literature, methodological studies of renowned technical organizations, or national or international institutions that result from the current state of scientific knowledge. In the event of unavailability of the methods described in professional publications, the laboratory may approve and use its own methods provided that they are validated. The entire validation process is carried out by qualified personnel using technically efficient and calibrated devices.

In genetic testing, validation must include at least: specificity, sensitivity, repeatability, reproducibility, resistance to external factors, limits of detection and quantification of the method under repeatability and reproducibility conditions, as well as evaluation of DNA extraction efficiency and measurement uncertainty. Validation of methods in the case of fingerprint tests concerns: specificity, sensitivity, repeatability, reproducibility, identification of uncertainty components and estimation of uncertainty of false positive or false negative opinion.
1.5. Requirements for handling the research material

Handling the research material entering the laboratory, including its movement, preparation and activities performed during the tests, should eliminate changes that could affect the validity of the research results. Notably, it is necessary to: have and apply procedures for revealing and securing traces and preparing samples for researching, keep documentation in this regard, ensure the performance of activities by qualified personnel, return objects not used for testing to the Principal or store in the laboratory, record the destruction or wear of the entire test objects in the appropriate documentation, and assess the suitability of the objects (the test materials). The accreditation requirements also emphasize the obligation to keep and maintain complete technical records of the tests performed for a period of not less than 5 years.

1.6. Research and opinion requirements

It is necessary for the forensic laboratory to ensure an adequate degree of confidence in the results of the conducted research as part of establishing and maintaining the consistency of the results. In genetic testing, the following should be used: certified reference materials provided by accredited manufacturers, molecular weight standards, DNA concentration patterns, DNA sequence patterns and human DNA patterns. In contrast, in dactyloscopic research, the correct reference is the use of a numerical standard, specifying the occurrence of 12 common features on the trace and comparative print. It is permissible to use the rules established by Edmund Locard, i.e. the desire to indicate compliance of at least 12 minutias, and when there is a smaller number of common features (8-11), the DAB-10 document indicates the need to take into account the identification value of the minutia (legibility of the trace, frequency of occurrence, presence of the pattern center and deltas), as well as poroscopic and edgeoscopic features. When performing fingerprint tests, a catalog of classic special features of the construction of fingerprints should be used.

The laboratory must also monitor the validity of the test results. In the case of DNA testing, for example, by testing samples with known characteristics or monitoring the stability of research methods. In fingerprint tests, activities in this regard will include: observation of at least two tests performed by each expert during the year in terms of the selection of the sequence of techniques used, substantive verification of at least two opinions (categorical, positive) performed by each expert during the year. The accredited laboratory is also obliged to participate in proficiency tests (PT/ILC) once a year.
It is also important to estimate the measurement uncertainty. Indeed, the laboratory is obliged to identify the components of measurement uncertainty. In this area, all components, including those resulting from sampling, should be taken into account and the measurement uncertainty assessed [Pękała and Marciniak 2008, 48-49].

The discussed DAB – 10 document allows the client to participate in genetic and dactyloscopic tests. The judicial body may reserve its presence at all or some stages of the laboratory activities, provided that the test results are not adversely affected. The accredited laboratory is obliged to determine the rules of presence during the tests, taking into account: impartiality and independence of the laboratory, confidentiality of information and protection of customers’ property rights, and the lack of involvement of the client’s representative in activities that may affect the validity of the test results.

The test report should be prepared in the form of a paper or electronic document and contain unambiguous and objective test results. It is necessary to take into account: the data of the persons performing the tests and the data and signature of the person authorizing the test results, information on all observed deviations from the methods of performing the tests, preparation of illustrative material (boards, photographs, printouts, CDs, DVDs, sketches), interpretation of the results obtained, as well as the name, degree, scientific title, position in the laboratory and signature of the person responsible for issuing the opinion. The test report should also contain information about the accreditation held by the laboratory.

1.7. Environmental management system requirements

The accredited laboratory must conduct internal audits of all technical activities, including observation of the tests performed. Of relevance, auditors must have knowledge in the field of auditing the management system in laboratories and knowledge and experience in carrying out activities in genetic or dactyloscopic research. In addition, the laboratory should define detailed rules for the supervision of records establishing the identification, storage, protection, backup, archiving, retrieval, retention and deletion of records created during research.

2. THE ROLE OF THE EUROPEAN NETWORK OF FORENSIC SCIENCE INSTITUTES IN THE PROCESS OF ACCREDITATION OF FORENSIC LABORATORIES

Established in 1995, the European Network of Forensic Science Institutes (ENFSI) plays an important role in the area of accreditation of forensic laboratories. The organization currently brings together 72 laboratories from
39 countries. In Poland, ENFSI cooperates with the Central Forensic Laboratory of the Police, the Forensic Research Office of the Internal Security Agency and the Institute of Forensic Experts named after Professor Jan Sehn, in Krakow.

From the beginning of its existence, ENFSI has set itself the goal of promoting quality in the performance of laboratory tests, improving the mutual exchange of information in the field of forensic sciences, enhancing the quality of forensic research carried out by experts and ensuring the best conditions for the development of forensic sciences [Filewicz 2003, 5-13]. The Constitution adopted by the Network emphasizes in § 2 that one of its basic tasks is to introduce among all member laboratories, the principles of good laboratory practice and international standards guaranteeing the quality of tests and the competence of persons performing them.\(^7\) It should be pointed out that according to § 4 of the Constitution, any laboratory that meets a number of detailed criteria may become a member of ENFSI. Herein, three of the more important issues are: a) having a wide range of expert services – over 50% of the research areas represented by ENFSI Expert Working Groups; b) employing at least 25 experts in the fields represented by Expert Working Groups; c) having an accreditation certificate certifying the competence of the laboratory according to ISO 17025 or documenting progress in quality assurance with a clear plan to obtain accreditation within 3 years.\(^8\)

The Network includes seventeen Expert Working Groups, referred to as ENFSI scientific and organizational facilities [Rybicki 2009, 9], which coordinate and supervise individual departments of forensic sciences. Currently, ENFSI has groups from the following thematic areas: Animal, Plant and Soil Traces, Digital Imaging, DNA, Documents, Drugs, Explosives, Fingerprint, Firearms/GSR, Fire and Explosions Investigation, Forensic Information Technology, Forensic Speech and Audio Analysis, Handwriting, Marks, Paint, Glass & Taggants, Road Accident Analysis, Scene of Crime, Textile and Hair.\(^9\)

The European Network of Forensic Science Institutes has also established a standing committee – The Quality and Competence Committee (QCC). Its main task is to ensure the development of quality and competence policy by advising Working Groups and member laboratories, as well as helping laboratories affiliated to ENFSI to comply with international best practices

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\(^9\) Information available on the ENFSI website, [https://enfsi.eu/about-enfsi/structure/working-groups/](https://enfsi.eu/about-enfsi/structure/working-groups/) [accessed: 30.08.2023].
and standards.\textsuperscript{10} The Quality and Competence Committee promotes accreditation of laboratories affiliated to ENFSI certifying technical competence according to the international ISO 17025 standard. QCC activities are also concerned with the implementation of ISO 17020 on-site work.\textsuperscript{11}

The Committee has developed a number of documents, guidelines, recommendations and manuals of good practices, allowing experts and laboratories to achieve and maintain the highest quality standards [Soltyszewski and Wójtowicz 2002, 17]. Reference should be made here to the two main studies: “Guidance on the Assessment of Competence for Forensic Practitioners” (QCC-CAP-006-001)\textsuperscript{12} and “Performance Based Standards for Forensic Science Practitioners” (QCC-CAP-003-002).\textsuperscript{13} These documents emphasize that, in accordance with the ENFSI policy, all member laboratories should have a formal and documented system for assessing the competence of experts and must comply with the Code of Conduct (BRD-GEN-003).\textsuperscript{14} It is important that the competence assurance system is an integral part of the quality system in accordance with ISO 17025 and, where applicable, ISO 17020. The indicated regulations set standards for people performing forensic examinations, based on work performance indicators. These indications should be used both during research activities and in the process of education and training of experts by institutions conducting activities in the field of forensic sciences and by academic centers.

The Quality and Competence Committee is also responsible for the implementation of the Framework Decision already mentioned at the outset. The data collected by the Committee shows that virtually all European countries have been accredited by their forensic institutions, most often according to the ISO 17025 and ISO 17020 standards [Ivanovic 2019, 20-21].

It is worth recalling that already in 2011, during the Polish Presidency of the Council of the European Union, the creation of the European area of forensic sciences (EFSA 2020) was approved, and the document: “Council conclusions on the vision for European Forensic Science 2020 including the creation of a European Forensic Science Area and the development of forensic science infrastructure in Europe” was prepared, approved and released.

\textsuperscript{10} Information available on the ENFSI website, https://enfsi.eu/about-enfsi/structure/standing-committees [accessed: 30.08.2023].


This listed a number of key directions for the development of European forensic sciences, among others: accreditation of forensic science institutes and laboratories; respect for minimum competence criteria for forensic science personnel; establishment of common best practice manuals and their application in daily work of forensic laboratories and institutes; conducting of proficiency tests/collaborative exercises in forensic science activities at international level; application of minimum quality standards for scene-of-crime investigations and evidence management from crime scene to court room; recognition of equivalence of law enforcement forensic activities with a view to avoiding duplication of effort through cancellation of evidence owing to technical and qualitative differences; and achieving significant reductions in the time taken to process crimes with a cross-border component.15

On 9 June 2016, the Council approved the “Council Conclusions and Action Plan on the way forward in view of the creation of an European Forensic Science Area.”16

EU documents have highlighted the need to ensure high quality standards for expert research, to take into account recognized quality standards in relation to the collection, processing and use of data obtained during forensic research, and to educate and train law enforcement and judicial staff. The Council of the European Union has appointed ENFSI as one of the main coordinators of the activities specified in the above-mentioned documents. When EAFS 2020 came to an end, the European Network of Forensic Science Institutes, using its experience, decided to pave a new way to improve the reliability and validity of forensic sciences and to support the implementation of new technologies.

One of the latest ENFSI initiatives is the development of the document “Vision of the European Forensic Science Area 2030.”17 The vision consists of three pillars that are important for ENFSI when developing strategic plans and defining the subject of new projects. These are: 1) “Meeting the Future” including: Biometrics, Applications of Artificial Intelligence, New tools for crime scene investigation, Emerging Biological and chemical evidence types’ – omics’, Emerging technologies and Industry 4.0; 2) “Strengthening the impact of forensic results” including: Transfer, persistence

and background abundance, Forensic data sharing, Facing the challenges with Migration-Trafficking-Smuggling; 3) “Demonstrating Reliability in Forensic Results” including: Fundamentals in Forensic Science, “Forensic human factors, Quality and competence assurance.”

Due to the subject matter of this study, the third indicated area of issues deserves special attention, in which, in specifying the activities in the field of “Fundamentals in Forensic Science”, “Forensic human factors” and “Quality and competence assurance”, it was emphasized that ENFSI supports research on the foundations of forensic science, including indicating a wide range of possible areas for research and development, while respecting the methods currently used. It is important to understand the impact of interpersonal interactions on decisions made at all levels of investigation, from the scene of the crime to the courtroom. In turn, ENFSI considered the issue of quality and ensuring competence to be the most important in the study of new techniques and methods of forensic science that are not yet fully established in the forensic environment. The vision states that in order to achieve this goal, it is necessary to disseminate training (including e-learning) for experts and to conduct proficiency tests.

In the light of the above, the Council of the European Union considered it necessary to continue work to create a European area of forensic science and to support law enforcement and judicial authorities in the European Union in the field of forensic science. To this end, based on the “Vision of the European Forensic Science Area 2030”, the Council adopted two documents: 1) Council Conclusions on the vision of the European Forensic Science Area 2.0 – EFSA 2.0 (13 October 2022),18 2) Council Conclusions on the Action Plan for the European Forensic Science Area 2.0 (9 March 2023).19

The Council Conclusions approved by the Council of the European Union in 2022 emphasize the important role of ENFSI in developing minimum quality requirements for forensic research, facilitating international cooperation and identifying important systemic needs arising in the environment of forensic sciences. The Council of the European Union, based on the Vision developed by ENFSI, confirmed all the thematic areas defined within the three pillars indicated therein.

The second document, referring to the Action Plan on the European Forensic Science Area 2.0, was also developed on the basis of work carried out in this regard by the European Network of Forensic Science Institutes.

This Action Plan, in relation to the issues discussed in this study, emphasizes that the constant development of quality and competence is an issue of fundamental importance for the implementation of new technologies and the maintenance of trust in forensic sciences. The actions to be taken in this regard are primarily the development of training programs for forensic practitioners and the definition of opportunities for the development and hosting of platforms (part C, point 6 of the Action Plan). It was also considered important to facilitate training and disseminate training materials intended for end users using forensic evidence. These trainings should take into account the subject matter related to the interpretation of research results obtained as part of forensic sciences and the understanding of the strength of forensic evidence (part C, point 7 of the Action Plan). Part C, point 8 of the Action Plan contains the need for action aimed at strengthening the quality assurance of non-accredited forensic services, both existing and new, in order to ensure their legitimacy.

There is no doubt that the indicated initiatives and activities emphasize the importance of continuous improvement of forensic research, increasing its quality and credibility, as well as its accreditation – and the important role played by the European Network of Forensic Science Institutes in this process [Waltoś 2015, 33].

CONCLUSIONS

The use of up-to-date scientific knowledge in court proceedings requires from experts great responsibility, reliability, possession of the highest qualifications and their continuous improvement. Accreditation of forensic laboratories is undoubtedly one of the important pillars of improving the quality and credibility of research carried out by experts. This is particularly important from the point of view of both international and national cooperation in the field of forensics, and in particular, in increasing confidence in the research methods applied. The functioning of forensic laboratories performing DNA tests and dactyloscopic tests in the accreditation system allows us to assume that all laboratory procedures carried out comply with the ISO 17025 standard, the Framework Decision and the detailed guidelines specified by the Polish Centre for Accreditation in the DAB-10 document.

Accreditation of forensic laboratories is also one of the priority activities of the European Network of Forensic Science Institutes. The identification by ENFSI of the most important needs in the area of improving the credibility of forensic science and determining the directions of its development is of fundamental importance in building the European area of forensic sciences 2030.
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