GUIDELINE FOR THE TRAINING OF STAFF IN FORENSIC DNA-LABORATORIES

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GENERAL REMARKS

One of the requirements of the current ISO 17025 standard [1] is that the laboratory shall ensure adequate training as well as the maintenance of staff competence.

Further related guidance that is relevant to training and competence can also be found in the following documents:

- ILAC-G19 [2];
- ENFSI Quality Assurance Programme for DNA laboratories [3];
- ENFSI DNA Contamination prevention guidelines [4].

The implementation of this guideline should be customized according to the organizational structure of the forensic DNA laboratory and should reflect the specific procedures and tasks it performs.

1. AIMS

The aim of this document is to provide guidance for training and assessment of competence of forensic DNA laboratory staff based on appropriate criteria.

2. SCOPE

This document focuses on the training and competence testing of forensic DNA laboratory staff that process casework and database samples, report and present results.

3. TERMS AND DEFINITIONS

Expired competence: loss of competence that was acquired in the past and needs to be updated or maintained.

Competence is assumed to be expired when the staff no longer performs the specific task for a predefined period of time, established by the laboratory.

Initial training: staff's first training in a laboratory procedure to achieve competence.

Maintenance of competence: keeping staff's competence at the required level.

SOP: Standard Operating Procedure.

4. TRAINING

The laboratory should provide relevant training material (for example: laboratory standard operating procedures (SOPs), external documents, scientific papers) applicable to the job role. The relevant qualifications and experience of the trainer, including competency to conduct training of staff should be mandated and verified by the organization.

All training related activities should be planned, documented, authorized and dated by appropriate personnel.

The training programme should cover initial and ongoing training requirements including training after expired competence.

The staff within the forensic DNA laboratories shall be trained according to a specific training programme that describes the competence criteria applicable to the job role.

During the training period, the trainee should be supervised by an experienced and competent staff member.

However, due to unforeseen events or if some further training is needed, the timeframe can be extended, authorized and documented.

Training should cover both relevant theoretical and practical aspects.

Assessment shall be performed on the proper application of the training to ensure that the documented competency criteria are fulfilled. Assessment could be performed in different ways:

- observation and evaluation of practical performance of (a) laboratory task(s);
- written or oral tests or a combination of both to check for theoretical knowledge.

The manner of assessment should be defined by the laboratory.

The laboratory should define the types and volume of samples required for training so that the documented competency criteria are demonstrated. This can be adjusted on a case-by-case basis and can depend on for example:

- the former relevant experience and qualifications of the trainee;
- the performance of the trainee during training.

The use of test samples where expected outcome is known (for example mock samples, proficiency test samples) is recommended for training. Where permitted, casework samples may be used for training under strict supervision of competent staff.

5. GENERAL COMPETENCIES

The trainee should be able to demonstrate satisfactory knowledge in the various areas of the forensic DNA process where he/she will be assigned for the following:

5.1 Legal aspects

- Relevant national laws and regulations.

5.2 Health and safety

- Laboratory health and safety awareness and safe working practices.

5.3 Quality Management System (including current ISO standard)

- Code of conduct, impartiality.
- Information security, and the principles of confidentiality.
- Validation/verification guidelines.
- The various control stages and the use of specific controls (administrative or technical) in the workflow and reporting (peer review).
- The measures to minimize the risk, detect and monitor contamination.
- Non-conformity reporting and the implementation of relevant corrective actions.
- Risk assessment in relation to the work flow, technical procedures and reporting of results.

5.4 Handling of items and samples

- The chain of custody procedures.
- Measures taken to avoid contamination.
- The risks of compromising evidentiary material/DNA traces.
- The appropriate storage of items and sample types.
- How to identify and trace items as well as individual samples within a batch.

5.5 Laboratory Workflow and Processes

- The SOPs.
- The scientific principles of the method(s) used and results of validation studies.
- The ability to place specified methods and SOPs in the context of the laboratory workflow.
- The contents of solutions used, how to prepare them and their storage requirements.
- Monitoring, calibration, maintenance, trouble shooting and proper handling of equipment used.
- Aspects that can improve the analysis (for example, re-sampling, re-amplification, etc.).

5.6 Data Recording and Management

- Recording of data, use of relevant paperwork and computer systems.
- Data security rules and procedures within the organization.

5.7 Validation

- The competency to conduct validation should be verified and mandated by the organization.

5.8 General competences criteria that apply to the technical procedures (see 6.1 to 6.8)

- The theoretical knowledge is satisfactory/up to date.
- Trainee demonstrates knowledge of chain of custody procedures.
- Trainee is successful in correct item and sample handling.
- Trainee performs correct item and sample recording.
- Trainee demonstrates the ability of handling the equipment/perform the method according to the SOPs and can determine if the equipment/method does not function as expected.
- There is no evidence of any detectable contamination attributed to the trainee's activities.
- Trainee demonstrates correct interpretation of the data.
- The results of test samples are as expected.

The responsible manager or the trainer supervising the trainee will decide, with the agreement of the trainee, when competence to perform the task independently has been achieved.

6. TECHNICAL COMPETENCY

6.1 Item examination for biological traces

The trainee should have theoretical knowledge as well as practical skills regarding the basic tools for trace search, screening tests and recovery including different sampling strategies.

The trainee should examine items covering the range of items normally submitted to the laboratory (for example, swabs, cigarette butts, clothing, weapons, various packaging

material), determine and perform appropriate biological trace screening tests, determine appropriate sampling strategy and perform sampling. This may include joint examinations or subsequent examinations by other forensic disciplines.

In addition to the general competence criteria (see 5.8), the trainee is considered competent if he/she fulfills the criteria below:

- Identifies items that require special treatment in cases where for example, inhibition or high/low DNA-concentration is expected.
- Prioritizes tests where limited sample material is available.
- Has knowledge of the risk of possible false positive/negative results when using screening tests.
- Has knowledge of the appropriate sample preparation for extraction methods that should be used for the distinct materials or samples taken.

6.2 Manual and Automated DNA Extraction Methods

The trainee should perform extraction method(s) for appropriate samples for example reference samples, casework samples and quality control samples.

The trainee should process an appropriate number of samples/batches as defined by the laboratory, covering the range of samples analyzed by the laboratory, including reagent blank and positive controls to check for contamination, sample handling and appropriate allele designation of the positive control.

In addition to the general competence criteria (see 5.8), the trainee is considered competent if he/she:

- Extracts a satisfactory yield of DNA in accordance with the nature of the sample. (Mock samples with an expected outcome could be used to monitor the yield.)
- The profiles of the test samples are as expected.

6.3 DNA Quantification (real time etc.)

The trainee should process a number of samples/runs defined by the laboratory.

In addition to the general competence criteria (see 5.8), the trainee is considered competent if:

- The standard curves have expected results.
- He/she identifies samples that require special treatment in cases where inhibition or low/high DNA concentration or DNA degradation is demonstrated by the quantification procedure.

6.4 DNA Amplification: Polymerase Chain Reaction (PCR)

The trainee should process an appropriate number of samples/batches as defined by the laboratory, covering the PCR protocol(s) to be used, including controls.

In addition to the general competence criteria (see 5.8), the trainee is considered competent if the results of the samples are as expected.

6.5 Capillary Electrophoresis

The trainee should process an appropriate number of samples/batches as defined by the laboratory, covering the protocol(s) to be used, including controls and allelic ladders.

In addition to the general competence criteria (see 5.8), the trainee is considered competent if the results of the samples are as expected.

6.6 Quality Review and Evaluation of the Run Data

The trainee should evaluate the data of an appropriate number of samples/batches as defined by the laboratory, covering the PCR protocols to be evaluated.

In addition to the general competence criteria (see 5.8), the trainee is considered competent if:

- He/she demonstrates understanding of the performance of the method and review of the quality of the run (including checking the positive and reagent blank controls, internal standard, allelic ladder, knowledge of sample and electrophoresis problems and requirements for re-electrophoresis, etc.).
- The run is analyzed correctly (able to identify any non-conformity with the run and suggest appropriate remedial and/or corrective actions).

6.7 MPS-technology

The trainee should process an appropriate number of samples/batches/runs as defined by the laboratory using different protocols (STRs, SNPs, mtDNA if applicable), including controls and carry out sequencing using the massive parallel sequencing platform (following the method described in the SOPs).

For the laboratory activities, the trainee should be able to:

- prepare libraries manually (if applicable) and with a liquid handler (if applicable);
- understand the quantitation results and standardize the libraries;
- prepare the template using the correspondent procedure.

For the data analysis, the trainee should be able to:

- evaluate the data (understanding of the QC parameters, adequate coverage (reads);
- understand and use the software to interpret results.

In addition to the general competence criteria (see 5.8), the trainee is considered competent if the profiles of the test samples are as expected.

6.8 Rapid-DNA technology

The trainee should process an appropriate number of samples/runs as defined by the laboratory. In addition to the general competence criteria (see 5.8), the trainee is considered competent if he/she:

- Operates the Rapid DNA System in accordance with the SOPs.
- Performs appropriate DNA data management tasks according to their job role (for example, operator level/administrator level/data analyst).
- The profiles of the test samples are as expected.

Note:
These requirements do not cover the use of Rapid DNA Systems outside the forensic DNA-laboratory.

6.9 Reporting of results

It is advisable that the trainee has a period of practical training in relevant areas of the laboratory process in order to meet the requirements of the knowledge needed for the interpretation of the results.

Besides the general competencies described in chapter 5.8 the trainee should demonstrate satisfactory knowledge of and/or the ability to perform (if applicable):

- The search and recovery of biological traces, including screening tests.
- The different sampling strategies, extraction, quantification, PCR, electrophoresis and data analysis/analytical techniques.
- The procedure for submitting data to the DNA-database(s).
- The agreements (for example, Service Level Agreement) between (external) parties (police etc.).
- The interpretation of the results (including DNA-mixtures, low template DNA, Y-STR, mitochondrial DNA, in the context of the case) as applicable.
- The statistical calculations and relevant software as applicable.
- The interpretation and relevant software if applicable to kinship analysis.
- The writing of reports covering a range of simple to complex cases applying standardized phrases as defined and used in the laboratory.

The trainee is considered competent if:

- The preparation of a range of case reports under the supervision of the trainer, fulfils the requirements of the laboratory reporting SOP.
- The trainee can answer relevant questions about those cases correctly.

6.10 Presentation of results in court

The trainee should acquire:

- Knowledge of their national judicial system with regards to expert testimonies.
- Knowledge of the court process by for example, attending court hearings.
- Experience of court testimony from training surroundings and/or court hearings as applicable.

The requirements of section 6.9 also apply when applicable to the job role.

The trainee is considered competent if:

- Sufficient knowledge is shown through the testimony of a range of case reports and questions about those cases are appropriately addressed.
- Effective communication skills are demonstrated.
- Demonstrates objectivity.

7. ASSESSMENT AND MAINTENANCE OF COMPETENCE

Relevant aspects of competencies in relation to the job role and current SOPs should be assessed periodically, to ensure staff competence as defined by the laboratory. Ways to assess competence are for example:

- internal or external audits;
- case review;
- internal or external proficiency tests;
- monitoring of quality controls.

Note 1:
For a laboratory-based technique the practical procedure and sample processing of the operator should be assessed. The assessor should check for the implementation of the correct, current technique in accordance to the latest operating document. The assessor can also randomly check on areas such as theoretical knowledge of relevance.

Note 2:
For software-based techniques the assessor should monitor the quality of the work done by the operator under assessment, ensuring all procedures have been adhered to and the quality of the results produced are not compromised in any way. Other areas such as theoretical knowledge of relevance can be randomly checked.

Minor changes to current methods may not require a full retraining process.

If any operator falls short of preset requirements, as defined by the laboratory, the operator will be required to attend retraining and reassessment until the required standard is reached.

The period of inactivity in a certain area, as defined by the laboratory, after which retraining and reassessment is necessary, should be defined and documented.

Whenever possible, staff members should take part in continued, relevant education and training to keep their knowledge in the field up to date.

8. REFERENCES

- [1] EN ISO/IEC 17025:2017, General requirements for the competence of testing and calibration laboratories.
- [2] ILAC-G19, Modules in a Forensic Process.
- [3] ENFSI Quality Assurance Programme for DNA laboratories.
- [4] ENFSI DNA Contamination Prevention Guidelines.

9. AMENDMENTS AGAINST PREVIOUS VERSION

This document replaces the document ‘Concept Training Document’ (Recommendations for the training of DNA Staff) of the ENFSI DNA Working group (November 2010).
The document has been amended as a whole to make it more practical with clearer guidance regarding training and maintenance of competence.

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