



Idaho State Police Forensic Services

VOLATILES ANALYSIS
TRAINING MANUAL
BREATH

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Revision History

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1.0 Introduction

Evidence and instrumentation need to be handled and stored in order to preserve the integrity of the samples, and prolong the instruments condition. There are several factors that can contribute to the potential degradation of a sample or an instrument's condition. Recognizing these issues, their potential for harm, and the potential detrimental effect that they could have on the evidence and instrument are paramount to understanding the handling and preservation of the evidence and instrumentation. This training plan is normally taken after the completion of the blood analysis training within the Volatiles Analysis Discipline. Much of the background, history and physiology of alcohol are covered in the Blood training manual.

- 1.1 The Trainee should, upon completion of this section, understand the issues and hazards associated with the handling of evidence and instruments within the laboratory. This includes the potential long term storage concerns and the issues that may present themselves should the samples or instruments be subject to conditions that fall outside the prescribed guidelines.
- 1.2 The Discipline requires the handling of compressed, flammable gases. These gases should be stored in areas that are not subject to extreme temperatures. The cylinders should be stored in a manner so as to protect them from rupture.
- 1.3 The trainee should also follow the Health and Safety Manual when handling volatile, flammable, acidic or caustic substances as may be required within the discipline.
- 1.4 Maintaining a knowledge base within the discipline is an ongoing process. There is an appendix following this manual with suggested reading materials that cover the discipline as a whole, with many of the treatises covering multiple topics and sections. The discipline also maintains an ongoing and continually updated technical library. This will be referenced in the appendix as well. Refer to this for citations and references to support the answers to the exercises within this training manual.
- 1.5 Describe the procedures followed for the intake and transfer of instruments specifically submitted for calibration.
- 1.6 Describe the precautions taken for the storage and transport of compressed gas cylinders.

- 1.7 Describe the IDAPA 11.03.01 requirements for breath alcohol testing and calibration.

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2.0 Roles and Responsibilities

2.1 Supervisor

The supervisor in coordination with the Technical Lead, Trainer, and the Trainee will set up a schedule outlining expectations for the trainee and will then monitor the progress of the trainee.

2.2 Technical Lead

The Technical Lead (TL) will appoint a Trainer and monitor the trainee's progress. The TL will report to the supervisor any delays to the training schedule. The TL will be available to the trainer to answer any questions. The TL will review results from the exercises, arrange and grade competency tests, and mock courts

2.3 Trainer

The Trainer will provide the trainee with the materials necessary to complete training. Materials include but are not limited to samples, equipment and most importantly knowledge. They will keep the TL up to date on the progress of the trainee.

2.4 Trainee

In order to get the most out of this training it is important for trainees to realize that the information provided through this manual is only a portion of what will be needed in order to not only become proficient but also to become a productive member of the team. It is incumbent on the trainee to utilize not only the information presented but also knowledge learned in school and/or from previous work experience. The use of outside sources of information is encouraged as are questions.

3.0 Solution Preparation

3.1 Background and Theory

3.1.1 Preparing a solution of known concentration is perhaps the most common activity in any analytical lab. The method for measuring out the solute and solvent depend on the desired concentration unit and how exact the solution's concentration needs to be known. Pipets and volumetric flasks are used when a solution's concentration must be exact; graduated cylinders, beakers and reagent bottles suffice when concentrations need only be approximate.

3.2 Objectives, Principles, and Knowledge

3.2.1 Demonstrate an ability to prepare, and record the preparation of, solutions required in the analysis of alcohol and other volatiles. This includes how to operate the top-loading balance and pipetters.

3.2.2 As it pertains to the liquid simulator solutions used within the discipline, this module will not apply. The simulator solution authentication is covered solely within the Blood portion of the discipline training plan.

3.3 Health and Safety Hazards

3.3.1 This section is covered in section 1.3 of this training manual.

3.4 Reading and Practical Exercises

3.4.1 Maintaining a knowledge base within the discipline is an ongoing process. There is an appendix following this manual with suggested reading materials that cover the discipline as a whole, with many of the treatises covering multiple topics and sections. The discipline also maintains an ongoing and continually updated technical library. This will be referenced in the appendix as well. Refer to this for citations and references to support the answers to the exercises within this training manual.

3.4.2 Demonstrate an ability to prepare, and record the preparation of, solutions required in the analysis and calibration of breath alcohol instruments.

3.4.3 The trainee will be familiar with the documentation and authentication process of the simulator solutions used within the discipline. This does not pertain to the actual analysis, but to the process that the laboratory goes through to acquire and authenticate the solutions, produce the approvals, and document/propagate the approval of the solutions throughout the state.

4.0 Instrument Calibration

4.1 Background and Theory

- 4.1.1 Calibration in measurement technology and metrology is the comparison of measurement values delivered by a device under test with those of a calibration standard of known accuracy. Such a standard could be another measurement device of known accuracy, a device generating the quantity to be measured such as a voltage, or a physical artefact, such as a meter ruler.
- 4.1.2 The outcome of the comparison can result in no significant error being noted on the device under test, a significant error being noted but no adjustment made, or an adjustment made to correct the error to an acceptable level. Strictly, the term calibration means just the act of comparison, and does not include any subsequent adjustment.
- 4.1.3 The formal definition of calibration by the International Bureau of Weights and Measures (BIPM) is the following: "Operation that, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties (of the calibrated instrument or secondary standard) and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication."
- 4.1.4 This definition states that the calibration process is purely a comparison, but introduces the concept of measurement uncertainty (UM) in relating the accuracies of the device under test and the standard.
- 4.1.5 To improve the quality of the calibration and have the results accepted by outside organizations it is desirable for the calibration and subsequent measurements to be "traceable" to the internationally defined measurement units. Establishing traceability is accomplished by a formal comparison to a standard which is directly or indirectly related to national standards (such as NIST in the USA), international standards, or certified reference materials. This may be done by national standards laboratories operated by the government or by private firms offering metrology services
- 4.1.6 Instrument calibration is one of the primary processes used to maintain instrument accuracy.

4.2 Objectives, Principles, and Knowledge

- 4.2.1 The Analyst in Training must have a comprehensive background and knowledge in regard to the principles of instrument calibration.

4.3 Health and Safety Hazards

4.3.1 This section is covered in section 1.3 of this training manual.

4.4 Reading and Practical Exercises

4.4.1 Maintaining a knowledge base within the discipline is an ongoing process. There is an appendix following this manual with suggested reading materials that cover the discipline as a whole, with many of the treatises covering multiple topics and sections. The discipline also maintains an ongoing and continually updated technical library. This will be referenced in the appendix as well. Refer to this for citations and references to support the answers to the exercises within this training manual.

4.4.2 **Lifeloc FC20:**

4.4.3 The trainee must be familiar with the documentation provided on the ISP website, where to find manuals, manufacturer's manuals, and reference guides available to the public, as well as where to locate records for the FC20 instrument calibrations.

4.4.4 Analyst in Training must possess a working knowledge of the theory and inner workings of the Lifeloc FC20.

4.4.5 The trainee should be familiar with BRALC AM 2.0.

4.4.6 The Analyst in Training must demonstrate their ability to calibrate the Lifeloc FC20 series of instruments.

4.4.7 The Analyst in Training must demonstrate their ability to utilize the EASYCAL® dry gas system for calibration of Lifeloc FC20 series of instruments.

4.4.8 The Analyst in Training must demonstrate their ability to perform software updates and modifications to the FC20 software and programming parameters utilizing vendor provided software and tools.

4.4.9 Suggested Reading (relevant pages from other editions of the following references may be substituted)

1. Lifeloc FC20 reference manual
2. EASYCAL® users guide and reference manual.

4.4.10 **Draeger 9510:**

4.4.11 Analyst in Training must possess a working knowledge of the theory and inner workings of the Draeger 9510.

4.4.12 The trainee should be familiar with BRALC AM 5.0.

4.4.13 The Analyst in Training must demonstrate their ability to calibrate the Draeger 9510 series of instruments.

4.4.14 Suggested Reading (relevant pages from other editions of the following references may be substituted)

1. Draeger 9510 reference manual

2. Draeger 9510 Users guide

4.4.15 **Hands of the Analyst:**

4.4.16 During training for each instrument, the trainee shall engage in “hands of the analyst” training for calibration.

4.4.17 This shall be documented via serial numbers of the instruments calibrated, and the number of instruments is at the discretion of the trainer (but can be not less than 5 Lifeloc FC20's or 1 Draeger 9510)

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5.0 Instrument Calibration – Competency Test

5.1 Background and Theory

- 5.1.1 Competency testing assesses the performance of an individual for performing analysis within a specific discipline, and measures their competency in the application of that knowledge to effectively perform their duties.
- 5.1.2 Competency testing is the process of analyzing an unknown sample provided to the trainee, and obtaining the correct results from analysis. The results are known by the trainer, who is responsible for providing the sample.
- 5.1.3 Competency is measured in a more abstract sense, in that it is a comprehensive testing of both the analytical capabilities of the analyst, but also the application of the knowledge base obtained through training to their interpretation and testimony about their analysis.

5.2 Objectives, Principles, and Knowledge

- 5.2.1 This module may begin upon the completion of modules 1-3.
- 5.2.2 The analyst is expected to complete a comprehensive competency test.
- 5.2.3 Passing is required with 100% accuracy.
- 5.2.4 If the initial attempt at completing the competency test is not successful, further training and attempts may be undertaken at the discretion of the Supervisor, Technical Lead, Trainer and Trainee, or a combination of the aforementioned individuals.

5.3 Health and Safety Hazards

- 5.3.1 This section is covered in section 1.3 of this training manual.

5.4 Reading and Practical Exercises

- 5.4.1 Maintaining a knowledge base within the discipline is an ongoing process. There is an appendix following this manual with suggested reading materials that cover the discipline as a whole, with many of the treatises covering multiple topics and sections. The discipline also maintains an ongoing and continually updated technical library. This will be referenced in the appendix as well. Refer to this for citations and references to support the answers to the exercises within this training manual.

- 5.4.2 The Analyst in Training must describe how instrument records are maintained.
 - 5.4.3 The trainee must be able to demonstrate what steps are to be taken if an instrument fails calibration and needs repair.
 - 5.4.4 At the discretion of the Trainer, trainee, supervisor and technical lead, the trainee will be provided with a competency test for each instrument they are being competency trained to calibrate.
 - 5.4.5 Upon completion and sign off for calibrations, the new analyst will begin a period of technical review training. This will consist of “pre-reviewing” calibration certificates from other analysts, documenting items that were found to be in non-compliance, and then forwarding the comments and cases onto technical review to another trained analyst.
 - 5.4.6 Technical review training will continue for no less than one month’s time, or 25 instruments reviewed, whichever comes first. Completion of technical review training is at the discretion of the technical lead, with input from the other analysts in which the trainee had reviewed.
 - 5.4.6.1 Technical review documentation shall consist of listing the serial numbers of the instruments that were reviewed.
- 5.5 Passing criteria
- 5.5.1 Passing will be indicated by the trainee successfully calibrating the given instrument to within the acceptable specifications without any mistakes. If there are mistakes made in procedure or documentation, then the trainee (at the discretion of the trainer) may be allowed to repair the mistakes without notice or direction of the nature of the mistake that was made. Only that there was a procedural or documentation mistake.
 - 5.5.2 Completion of the competency test is attained once a test is submitted without any mistakes and is 100% error free and within calibration specification.

6.0 Instrument Calibration - Mock Court

6.1 Background and Theory

6.1.1 A mock trial is an act or imitation trial. Mock trials simulate lower-court trials. Trainees use a mock to hone their testimony skills and delivery of complex scientific concepts to a jury of non-scientists.

6.2 Objectives, Principles, and Knowledge

6.2.1 The trainee should be able to answer all of the discipline related questions posed to them about their calibration.

6.2.2 The trainee should also be able to recognize when the questioning approaches and/or goes into territory that is outside of the realm of their calibration duties.

6.3 Health and Safety Hazards

6.3.1 This section is covered in section 1.3 of this training manual.

6.4 Reading and Practical Exercises

6.4.1 The trainee should engage in mini-mock court sessions on a regular basis.

6.4.2 The trainer should schedule the mini-mock court on a regular basis upon completion modules 1-3, but they may start earlier upon discretion.

6.4.3 The mock court should cover a broad range of topics dealing with all aspects of the instrument calibration and certification process.

6.5 Passing criteria

6.5.1 Passing is indicated upon completion and discussion amongst the trainer and those within the discipline. If there were deficiencies in knowledge or areas of testimony that need significant improvement, then the trainee (at the discretion of the trainer and/or DL) will be allowed to retake their mock trial at a later date with a different scenario.

6.5.2 Completion of the mock court is attained once it is completed to the satisfaction of the trainer, the DL and the others within the discipline without significant objection with cause.

7.0 Breath Alcohol Analysis Standard Operating Procedure

7.1 Background and Theory

- 7.1.1 A standard operating procedure, or SOP, is a set of step-by-step instructions compiled by an organization to help workers carry out routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations.
- 7.1.2 The standardization of procedures is not a new or novel concept to the breath alcohol world, and dates back centuries. The National Safety Council has been issuing recommendations for the standardization of breath testing programs, and much of today's modern programs can trace their standard to these offerings.

7.2 Objectives, Principles, and Knowledge

- 7.2.1 The thorough understanding of the procedure and what each part of the SOP is for is crucial.
- 7.2.2 Violations of the SOP will necessitate interpretation of the scientific validity of the results.
- 7.2.3 Understanding every aspect of the procedure, and how they work in harmony with each other to produce reliable results is crucial to the discipline.

7.3 Health and Safety Hazards

- 7.3.1 This section is covered in section 1.3 of this training manual.

7.4 Reading and Practical Exercises

- 7.4.1 The Analyst in Training must convey their understanding of the analysis protocol in SOP 6.0 as well as the rules in IDAPA 11.03.01.
- 7.4.2 Analyst in Training must describe how operators and specialist obtain and maintain certification.
- 7.4.3 Analyst in Training must detail their approach in determining if a testing protocol is compliant with IDAPA 11.03.01.
- 7.4.4 Analyst in Training must describe the proper storage and transportation of instruments and standards.

- 7.4.5 Analyst in Training must describe the acceptance criteria for a performance verification and calibration.
- 7.4.6 Analyst in Training must describe how quality assurance data is monitored and where it must be stored.
- 7.4.7 Analyst in Training must describe how breath alcohol concentrations must be reported.
- 7.4.8 The Analyst in Training must discuss the different types of alcoholic beverages and their respective alcohol content.
- 7.4.9 The Analyst in Training must describe the intermediate check procedure for the instruments.
- 7.4.10 Suggested Reading
1. BRALC SOP 6.0.
 2. Idaho Administration Code, IDAPA 11.03.01, Rules Governing Alcohol Testing.
 3. National Safety Council – Historical Document

8.0 Case Record Preparation

8.1 Background and Theory

- 8.1.1 Documentation is one of the pillars of the scientific community as well as the forensic world.
- 8.1.2 The documentation requirements set forth in this discipline are derived from the international ISO 17025 standards, as well as the ISPFS quality manual.

8.2 Objectives, Principles, and Knowledge

- 8.2.1 The analyst must know that standards of documentation for case records as it pertains to all aspects of the discipline. From technical records, administrative records, authentication data, and batch analytical records, the analyst must understand the requirements and importance of each, as well as the potential for changes in their retention policies.
- 8.2.2 The analyst must be familiar with the electronic LIMS used within the laboratory and the methods of preserving the records within the discipline.

8.3 Health and Safety Hazards

- 8.3.1 This section is covered in section 1.3 of this training manual.

8.4 Reading and Practical Exercises

- 8.4.1 The Analyst in Training must describe which documents, data and completed information is required to be included in an instrument calibration case record.
- 8.4.2 The Analyst in Training must describe the worksheets and data that are to be compiled for a centrally stored QA file for each instrument calibration.
- 8.4.3 The Analyst in Training must describe requirements for administrative and technical review of calibration certificates.
- 8.4.4 The Analyst in Training should work closely with the training and perform pre-review duties while in training in order to familiarize themselves with the administrative and technical review documentation and review process.
- 8.4.5 Administrative and Technical review competency testing will be covered in a future section, and the sign off for 'technical review of casework' will occur later.

8.4.6 The Analyst in Training must describe the QA/QC data that is necessary to be centrally stored for instrument calibrations.

8.5 Supervised casework

8.5.1 Upon completion of instrument calibration training, passing a competency test and passing the instrument calibration mock trial, the trainee will assume casework in calibration of the instruments that they have been approved to calibrate.

8.5.2 During this period, the trainee will be under the direction of their trainee and will be doing “supervised casework”. This supervised casework will consist of “hand of the analyst” type of duties pertaining to the calibration of breath alcohol instruments.

8.5.3 The supervised casework will continue for no less than 25 portable instruments and/or 3 benchtop units.

8.5.4 Each instrument will be individually signed off, or mentioned separately in the same signoff document.

9.0 Breath Alcohol Testimony

9.1 Background and Theory

- 9.1.1 Documentation is one of the pillars of the scientific community as well as the forensic world.
- 9.1.2 The documentation requirements set forth in this discipline are derived from the international ISO 17025 standards, as well as the ISPFS quality manual.

9.2 Objectives, Principles, and Knowledge

- 9.2.1 The analyst must know that standards of documentation for care records as it pertains to all aspects of the discipline. From technical records, administrative records, authentication data, and batch analytical records, the analyst must understand the requirements and importance of each, as well as the potential for changes in their retention policies.

9.3 Health and Safety Hazards

- 9.3.1 This section is covered in section 1.3 of this training manual.

9.4 Reading and Practical Exercises

- 9.4.1 The Analyst in Training must demonstrate a working knowledge of the pharmacology of alcohol and other commonly encountered volatiles. This must include an understanding of the factors affecting absorption, distribution and elimination.
- 9.4.2 The Analyst in Training must describe the situation when the alcohol content of arterial blood exceeds that of venous blood.
- 9.4.3 The Analyst in Training must be familiar with the metabolism of ethanol and other commonly encountered volatiles. This must include how metabolism relates to toxicity.
- 9.4.4 The Analyst in Training must describe their understanding of the effects of alcohol and other commonly encountered volatiles on the human body. This must include how it contributes to mortality and impairment observed in DUI cases.
- 9.4.5 The Analyst in Training must describe the analytical capabilities and technologies employed by each testing instrument in use in Idaho.

- 9.4.6 The Analyst in Training must be comfortable with the development, performance and interpretation of Standardized Field Sobriety Tests (SFST) and a Drug Recognition Exam (DRE).
- 9.4.7 The Analyst in Training must describe the potential sources of uncertainty associated with a performance verification.
- 9.4.8 The Analyst in Training must describe the potential sources of mouth alcohol contamination. This section is to include sources associated with external as well as internal sources. Relevant reading and research is ongoing and continual.
- 9.4.9 The Analyst in Training must describe the potential sources of external interference.
- 9.4.10 The Analyst in Training must be well versed and competent in explaining the nuances of scientific defense challenges to a breath alcohol case.
- 8.4.10.1 Topics include, but are not limited to: Blood:Breath Ratios, Hlastala's paradigm, RFI, Rising BAC, Alveolar air v. Deep lung breath, Hypo- or Hyperthermia, Breathing patterns, Belching-Burping, GERD, Dentures and other dental work, Slope detectors, Specificity and interfering substances, Widmark calculations, Uncertainty of Measurement, and traceability.

10.0 Core Training

10.1 Background and Theory

10.1.1 Core training is essential for the new trainee to understand how the different disciplines work together in the analysis of a case.

10.1.2 Understanding the basic functionality of the forensic lab system is good general knowledge.

10.2 Objectives, Principles, and Knowledge

10.2.1 The objective of the core training is to attain an overall understanding of the different arms of the forensic laboratory system and how they all work in unison to process evidence through the system, provide timely results, and maintain transparency to the public and court system.

10.3 Health and Safety Hazards

10.3.1 This section is covered in section 1.3 of this training manual.

10.4 Reading and Practical Exercises

10.4.1 The trainee should complete the core training as described within the quality manual during their training.

10.4.2 It is not an absolute requirement that the core training be completed prior to the assumption of casework, but it is recommended to avoid any delays in the full completion and sign off on the training plan with the discipline

11.0 Mock Court Testimony

11.1 Background and Theory

11.1.1 A mock trial is an act or imitation trial. Mock trials simulate lower-court trials. Trainees use a mock to hone their testimony skills and delivery of complex scientific concepts to a jury of non-scientists.

11.2 Objectives, Principles, and Knowledge

11.2.1 The trainee should be able to answer all of the discipline related questions posed to them about their calibration.

11.2.2 The trainee should also be able to recognize when the questioning approaches and/or goes into territory that it outside of the realm of their calibration duties.

11.3 Health and Safety Hazards

11.3.1 This section is covered in section 1.3 of this training manual.

11.4 Reading and Practical Exercises

11.4.1 The trainee should engage in mini-mock court sessions on a regular basis.

11.4.2 The trainer should schedule the mini-mock court on a regular basis upon completion modules 1-3, but they may start earlier upon discretion.

11.4.3 The mock court should cover a broad range of topics dealing with all aspects of the instrument calibration and certification process.

11.5 Passing criteria

11.5.1 Passing is indicated upon completion and discussion amongst the trainer and those within the discipline. If there were deficiencies in knowledge or areas of testimony that need significant improvement, then the trainee (at the discretion of the trainer and/or DL) will be allowed to retake their mock trial at a later date with a different scenario.

11.5.2 Completion of the mock court is attained once it is completed to the satisfaction of the trainer, the DL and the others within the discipline without significant objection with cause.

12.0 Comprehensive Course on Alcohol Testing

12.1 Background and Theory

- 12.1.1 The volatiles analysis discipline is much like many of the other disciplines within forensics, in that it is highly technical, and specialized.
- 12.1.2 The discipline is also historically one of the most litigious and contentious in court.
- 12.1.3 The ever changing environment as it pertains to the testing of volatile impairing substances requires the discipline to remain diligent in its acquisition of current and applicable knowledge and not stagnate.
- 12.1.4 By sending all new trainees to a national comprehensive course on alcohol testing, the acquisition of new knowledge pertinent to the discipline can be assured.

12.2 Objectives, Principles, and Knowledge

- 12.2.1 The trainee should attend and pass a nationally recognized comprehensive course on alcohol testing.
- 12.2.2 Upon return from the course, it is the trainee's responsibility to disseminate any newly acquired knowledge or novel concepts throughout the discipline.
- 12.2.3 Through this regular practice, the trainee and the discipline in general can remain current in the knowledge of any new trends that may be occurring outside the borders of our state, but still of importance to our state.

12.3 Health and Safety Hazards

- 12.3.1 This section is covered in section 1.3 of this training manual.

12.4 Reading and Practical Exercises

- 12.4.1 Within one-year of starting training in volatiles analysis, or prior to starting training, the trainee must attend and successfully complete a nationally recognized course on alcohol testing and related medico-legal matters.