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1.0 Training Overview

1.1. Training Purpose and Description

1.1.1. Purpose and Goals

The purpose of this training program is to provide a uniform training process for analysts in the Toxicology Section at the Vermont Forensic Laboratory (VFL). This program is designed to ensure and document that those individuals who will be working as analysts are knowledgeable and competent to perform their technical, analytical, and legal duties.

1.1.2. Scope

This training manual should be completed in conjunction with the TOX_P300_Intro to Toxicology Training Manual. Training will concentrate on blood alcohol analysis methods currently in use at the VFL and will culminate in a competency test(s). This program is designed for new employees or current employees without prior blood alcohol analysis experience. A trainee with previous experience in forensic or other alcohol analysis may not require all modules or steps; it is the responsibility of the Toxicology Section Supervisor to determine the duration and scope of the training program for a trainee with previous experience. Similarly, the module content may be tailored as applicable to anticipated job responsibilities.

1.1.3. Documentation

The trainee will compile all documentation associated with completed training work. These files may include, but are not limited to, worksheets, reports, and review sheets. The trainer will review these materials and document completion of required training components. Documentation of training will be maintained at the laboratory.

1.2. Trainee Responsibilities

1.2.1. Instructions for Trainee

The length of time needed to complete the training program will vary and is left to the discretion of the trainer and supervisor. The trainee will be provided access to any required or suggested readings and will be exposed to samples and situations expected to be encountered during routine work in the Toxicology Section. The trainee will keep records, where appropriate, of how training tasks were accomplished (e.g. who did the trainee observe testify in court, what additional papers not listed in Appendix I did the trainee reference, etc.). At the conclusion of training, the trainee

will evaluate the effectiveness of the training program and suggest any improvements to the section supervisor.

1.2.2. Required Training Modules

The trainee, trainer, and section supervisor shall discuss which portions of this training manual are to be completed by the trainee based on the trainee's anticipated job responsibilities and prior experience. This section may also be used to outline re-training requirements for current employees if needed. The requirements for the trainee are outlined below:

	Required?		Completed?	
	Yes	No	Date	Trainer
1. Training Overview				
2. Laboratory Introduction				
3. Sample and Evidence Control				
4. Fundamental Scientific Knowledge				
5. Applied Scientific Knowledge				
5.1 Gas Chromatography Theory				
5.2 Blood Alcohol Analysis				
5.3 Statistics and Data Analysis				
6. Laboratory Analysis				
6.1 Blood Alcohol Analysis				
6.2 Training Sample Processing				
7. Reports and Notifications				
7.1 Report Writing				
7.2 Review				
7.3 Mock Cases				
8. Legal Knowledge				
8.1 Expert Testimony				
8.2 Document Preparation				
9. Final Evaluation				
9.1 Competency Tests				
9.2 Mock Trial				
10. Authorization				

1.3. Trainer Responsibilities

The trainer is responsible for instructing the trainee in the operations of the laboratory and the processes and procedures that will ultimately comprise the trainee's job duties. The trainer will ensure that the trainee is exposed to all relevant topics within the training program. The trainer will provide sample sets for the trainee to analyze and will meet with the trainee periodically to monitor progress, review work, and provide feedback. The trainer will assist the trainee in preparing for any assessments, which include a competency test and a mock trial. At the conclusion of training, the trainer will evaluate the effectiveness of the training program and suggest any improvements to the section supervisor.

1.4. Acknowledgement of Training Plan

The signatures of the trainee, trainer(s), and section supervisor below indicate that the expected responsibilities and required training modules have been discussed and agreed upon.

Trainee: _____ Date: _____

Trainer(s): _____ Date: _____

Trainer(s): _____ Date: _____

Section Supervisor: _____ Date: _____

2.0 Laboratory Introduction

Refer to TOX_P300_Intro to Toxicology Training Manual.

3.0 Sample and Evidence Control

Refer to TOX_P300_Intro to Toxicology Training Manual.

4.0 Fundamental Scientific Knowledge

Refer to TOX_P300_Intro to Toxicology Training Manual.

5.0 Applied Scientific Knowledge

This training module will ensure that the trainee has received appropriate education and training to apply principles of gas chromatography to the analysis of forensic blood alcohol samples.

5.1. Gas Chromatography Theory

The trainee will develop and demonstrate a working knowledge of the techniques in use at the VFL to analyze alcohol samples, including the use of headspace gas chromatography (GC) with dual flame ionization detectors for whole blood analysis.

Task	Trainee	Trainer	Date Completed
I have read and understand the required readings outlined for this section in Appendix I.			
I have reviewed batch and case files showing the use of gas chromatography for blood alcohol analysis.			
I have answered the questions outlined for this section in Appendix II and received feedback on my answers.			

5.2. Blood Alcohol Analysis

The trainee will develop and demonstrate an understanding of the instrumentation and procedures used for blood alcohol analysis.

Task	Trainee	Trainer	Date Completed
I have read and understand the required readings outlined for this section in Appendix I.			
I have answered the questions outlined for this section in Appendix II and received feedback on my answers.			

5.3. Statistics and Data Analysis

The trainee will develop and demonstrate a working knowledge of the quantitative reporting, statistical calculations, and measurement uncertainty factors applied to blood alcohol testing at the VFL.

Task	Trainee	Trainer	Date Completed
I have read and understand the required readings outlined for this section in Appendix I.			
I have reviewed the measurement uncertainty budgets for blood alcohol analysis.			
I have answered the questions outlined for this section in Appendix II and received feedback on my answers.			

6.0 Laboratory Analysis

The trainee will demonstrate the ability to apply knowledge of the currently validated methods and technologies to the analysis of training samples representing the range and type of samples routinely encountered in casework analysis.

6.1. Blood Alcohol Analysis

The trainee will develop and demonstrate a working knowledge of the instrumentation and procedures used for blood alcohol analysis, including reagent preparation, instrument operation, quality control and maintenance of the gas chromatograph and headspace autosampler. This section may be completed concurrently with TOX_P305. The trainee and trainer will document this by both initialing the boxes below.

Task/Procedure	Initials & Date Observed	Initials & Date Performed
Preparation of reagents for blood alcohol analysis (including use of the Alcohol Reagent Log)		
General use of the gas chromatograph and headspace autosampler		
Instrument maintenance and record keeping (Maintenance Log)		
I have read and understand the required readings outlined for this section in Appendix I.		
I have answered the questions outlined for this section in Appendix II and received feedback on my answers.		
I have been authorized to use the headspace GC-FID.		

6.2. Training Sample Processing

The trainee will apply knowledge of the protocols and procedures in use at the VFL to the analysis of training samples before being authorized to analyze casework samples. The trainer will provide a set of relevant, previously analyzed samples for the trainee to process. The trainee will document each analysis performed and provide the trainer with results from the analyses. The trainee will demonstrate an understanding of the limitations and sensitivity of the procedure and associated quality controls. The trainee and trainer will document this by both initialing the boxes below.

The number and type of samples processed by the trainee will be sufficient to demonstrate the trainee's ability to competently conduct alcohol analysis and produce reliable results. If the section supervisor determines that the sample number or type requirements for the trainee differ from those listed below, documentation of this deviation shall be kept with the training materials.

Prior to processing training samples, the trainee will observe a qualified analyst(s) perform the method. At minimum, the samples processed for training will include the following:

1. Analyzed under the general supervision of an experienced analyst, 10 samples, in two batches of five, from the pool of previously analyzed samples.
2. Analyzed independently, 5 samples from the pool of previously analyzed samples.
3. The trainee will demonstrate competency by analyzing at least two previously analyzed samples and preparing batch and case specific files which will undergo technical review and be approved by the Toxicology Section Supervisor. The acceptance criteria for these samples will be outlined by the section supervisor prior to analysis. Samples may be run in the same batch, but unique cases will be created in FA. Successful completion will be documented with a written authorization specifying that the trainee can now act as a technician for a qualified analyst.
3. Analyze 50 casework samples under the supervision of a qualified analyst reporting the results. (The trainee should initial case documents for work that that they performed under supervision. The reporting analyst needs to initial all pages of the examination documentation.)

Where appropriate, measurement uncertainty will be applied to the results of these analyses.

Task/Procedure	**Initials & Date Observed**	**Initials & Date Performed Under Supervision**	**Initials & Date Performed Independently**
Training Samples			
I have demonstrated technical competency and am authorized to act as a technician.			
As a technician, I have successfully analyzed at least 50 casework samples.			

7.0 Reports and Notifications

The trainee will be familiar with the creation of casework files and reports following the requirements of the Toxicology section.

7.1. Report Writing

The trainee will develop and demonstrate knowledge of procedures and documentation requirements for reporting analytical results in accordance with laboratory policy. Training will include, but is not limited to, report format, language used, and the use of the LIMS. The trainee and trainer will document this by both initialing the boxes below.

Task	Initials & Date Observed	Initials & Date Performed Under Supervision	Initials & Date Performed Independently
Generated a blood alcohol batch file			
Generated a blood alcohol case file			
I have answered the questions outlined for this section in Appendix II and received feedback on my answers.			

7.2. Review

The analyst trainee will become familiar with the policies, procedures, and forms for technical, administrative, and director review of case files. If the trainee has observed the director review of other toxicology case files, that observation may be used to sign off on the requirement for observing a director review of blood alcohol case files.

Task	Trainee	Trainer	Date Completed
I am familiar with the technical review requirements as outlined in the QA and Alcohol Analysis Manuals.			
I have observed the technical review of blood alcohol casework by an experienced analyst.			
I have performed “pre-review” technical review(s) of blood alcohol casework.			
I have observed the administrative review of blood alcohol case files.			

I have observed the director review of Toxicology case files.			

7.3. Mock Cases

The trainer will prepare at least two mock cases for the trainee using previously analyzed samples. The acceptance criteria for these samples will be outlined by the section supervisor prior to analysis. Samples may be run in the same batch, but unique cases will be created in FA. The trainee will analyze these samples, create case files, perform appropriate calculations, and write reports. The trainer(s) will perform reviews of these cases and the trainee will revise the case files as needed to meet review criteria.

Task	Trainee	Trainer	Date Completed
I have analyzed samples, prepared case files, and had those files reviewed for these mock cases. Case Numbers:			

8.0 Legal Knowledge

8.1. Expert Testimony

The trainee will develop and demonstrate knowledge of the responsibilities of expert witnesses and strategies for effective expert testimony.

Task	Trainee	Trainer	Date Completed
I have read and understand the required readings outlined for this section in Appendix I.			
I have answered the questions outlined for this section in Appendix II and received feedback on my answers.			
I have observed an experienced analyst testify in court as an expert witness regarding the analysis of blood alcohol samples, including the principle of GC/FID. Transcripts may be reviewed in lieu of live testimony.			

I have practiced direct and cross-examination with more than one qualified analyst and received feedback.			
I have practiced presenting a blood alcohol report as an exhibit.			

8.2. Document Preparation

The trainee will practice preparing documents that would be requested from an analyst preparing to appear in court.

Task	Trainee	Trainer	Date Completed
I am familiar with what is included in a blood alcohol discovery packet			
I have reviewed at least one blood alcohol discovery packet prepared by a qualified analyst or designee.			
I have prepared a practice blood alcohol discovery packet and had it reviewed by the Toxicology Section Supervisor.			

9.0 Final Evaluation

At the completion of this training program, the trainee's ability to perform the duties of an analyst will be assessed. The nature of final assessment and evaluation may differ based on the trainee's experience and anticipated job responsibilities. The section supervisor is responsible for determining what assessment and evaluation is necessary for the trainee and documenting this.

9.1. Competency Tests

The trainee will pass all applicable competency tests as determined and documented by the section supervisor prior to beginning work as an analyst. Competency testing includes a written exam as well as written reports for mock cases that will undergo technical, administrative, and director reviews. Satisfactory completion of a competency test is required for all analysts regardless of previous experience. The number and type of samples required for the competency test should be sufficient to cover the anticipated spectrum of assigned duties and to evaluate the individual's ability to perform proper testing methods.

Task	Trainee	Trainer	Date Completed
I have completed all competency tests pertaining to blood alcohol analysis.			

I have successfully completed a written examination pertaining to blood alcohol analysis and received feedback on my results.			

9.2. Mock Trial

The trainee will understand that each case or sample set examined has the potential to require them to testify as an expert witness. As such, the trainee will demonstrate their knowledge of alcohol testing methods and ability to testify as an expert witness by participating in a mock trial, including both direct and cross-examination. The trainee will be evaluated for aspects of performance to include testimony content, response to cross-examination, demeanor, and attire. The mock trial will take place prior to the trainee performing independent casework as a qualified analyst.

If the trainee has previous testimony experience or is expected to perform a limited scope of duties, this requirement may be modified at the discretion of the section supervisor. This modification will be documented. If a mock trial is not required, an alternate form of oral examination must be selected by the section supervisor.

The trainee will testify to a competency test case, a fabricated case, or a case which has been completed by a qualified analyst. The case selected will be agreed upon by the trainee and trainer and approved by the section supervisor.

The mock trial will include, but is not limited to, questions on qualifications, chain of custody, evidence handling, alcohol analysis methodology, measurement uncertainty, and technical aspects of the case at hand. Questioning by both the prosecutor and defense attorneys should be relevant and realistic. The atmosphere of the trial will be formal. It will be conducted in the same manner as a real courtroom. This will include conduct and protocol, and the trainee should present themselves accordingly. The outcome of the mock trial evaluation will be satisfactory or unsatisfactory. If it is determined that the trainee's performance was not satisfactory the section supervisor will determine what corrective action must be taken. The trainee will need to complete a mock trial with satisfactory performance before beginning work as a qualified analyst. Participants in the mock trial shall provide feedback for the trainee regardless of whether performance was satisfactory or unsatisfactory.

Task	Trainee	Trainer	Date Completed
A case has been chosen for mock court. Case Number:			

I have offered testimony in mock court, including both direct and cross-examination regarding the analysis of blood alcohol samples and the principle of headspace gas chromatography and flame ionization detection.			

10.0 Authorization

Completion of training modules will be documented in section 1.2.2. At the completion of training, the section supervisor shall provide written documentation authorizing the trainee to conduct independent casework as a qualified analyst.

Appendix I: Readings

A: Required Readings

The resources listed below are provided to give the trainee the necessary information to perform their duties. Depending on the trainee's education and experience, they may not need to complete every reading in its entirety. The location of various training tools such as readings, videos, or websites are included for convenience. If file locations change or links break, alternative training materials may be used. Supplemental documents are available through the laboratory's shared drive under the training folder, but are not required unless designated as such by the section supervisor. The trainee should be familiar with the readings provided in the TOX_P300 manual in order to assist them in answering the questions in Appendix II.

5.0 Applied Scientific Knowledge

5.1. Gas Chromatography Theory

- ☐ Tiscione, et al. "Ethanol Analysis by Headspace Gas Chromatography with Simultaneous Flame-Ionization and Mass Spectrometry Detection", Journal of Analytical Toxicology, Vol 35, 2011, pp. 501-511.
- ☐ Tipler, A.; "An Introduction to Headspace Sampling in Gas Chromatography – Fundamentals and Theory" Perkin Elmer reference guide.

5.2. Blood Alcohol Analysis

- ☐ VFL Alcohol Analysis Manual (TOX_P100) and all associated documents
- ☐ VFL Blood Alcohol Method Validation
- ☐ Analytical Methods portion of the VFL Toxicology Reference Library

5.3. Statistics and Data Analysis

- ☐ Blood alcohol data processing worksheet (TOX_F100_1)
- ☐ Current and historical blood alcohol MU budgets
- ☐ Blood alcohol fishbone step 2 and step 3
- ☐ Blood alcohol control charts

6.0 Laboratory Analysis

6.1. Blood Alcohol Analysis

- ☐ Alcohol reagent log
- ☐ GC/FID instrument maintenance log

8.0 Legal Knowledge

8.1. Expert Testimony

- ☐ Vermont DUI Laws: Title 23, Chapter 13, Sections 1201 and 1203
- ☐ Vermont Department of Public Safety Breath and Blood Alcohol Analysis Rule
  - ALCOHOL > LEGAL > DPS Rules and Regulations Effective 03292013
- ☐ Review various sample scripts of chemist questions for blood alcohol testimony

B: VFL Toxicology Reference Library

Analysts are expected to be familiar with the contents of the VFL Toxicology Reference Library and be alert for articles and/or references that can be added. Updated references should be added to the VFL Toxicology Reference Library during the review period, when they become available, or when new methodologies or technologies are incorporated into the laboratory protocols.

Appendix II: Training Questions

Questions listed below are intended to be answered by trainees. Headings are numbered in accordance with the section numbering in the body of this manual.

5.0 Applied Scientific Knowledge

5.1. Gas Chromatography Theory

1. Explain the principle and operation of headspace gas chromatography.
2. Explain the principle and operation of flame ionization detection.
3. What gases are used in GC-FID analysis and what are their purposes?
4. Explain the calibration process of the GC-FID.
5. Manually calculate a BAC based on response of ethanol, internal standard, and calibrators.
6. What is a surrogate? What is its role? What are the relevant QC criteria?
7. What is a timing mix? What is its role? What are the relevant QC criteria?

5.2. Blood Alcohol Analysis

1. How are evidentiary samples prepared for blood alcohol analysis by GC at the VFL?
2. What pipetting method is used to aliquot blood? Internal standard?
3. What is the internal standard used for blood alcohol analysis?
4. What are high and low aqueous controls? What are their roles? What are the relevant QC criteria?
5. What are whole blood controls? What are their roles? What are the relevant QC criteria?
6. Describe a typical run sequence for blood alcohol analysis.

5.3. Statistics and Data Analysis

Statistical Analysis

1. How many calibration points are required for the BAC curve based on the ASB guidelines?

Excel

1. How does Excel source the QC information from the raw data?
2. How does Excel determine if additional replicates are needed?
3. What can you edit in the Excel sheet?
4. How are BAC results rounded and truncated?
5. How are results reported?

Blood Alcohol Measurement Uncertainty

1. How is the measurement uncertainty of the blood alcohol analysis method estimated?
2. How often is the budget updated?
3. What is the timeframe of the data used in the budget?
4. What confidence interval is applied for blood alcohol?
5. What contributors are evaluated?
6. When would you pool the total %CV in the QC calculations?
7. Which uncertainty value do we input for the pipettes?

6.0 Laboratory Analysis

6.1. Blood Alcohol Analysis

1. What information should appear on the label of a reagent prepared in the laboratory?
2. How are reagents prepared in the laboratory QC checked? How are these QC checks documented?
3. What QC checks do purchased reagents require?
4. Who is responsible for ordering supplies for reagents prepared in-house? How does this process work?
5. What QC checks and maintenance does each of the following require?
    a. Perkin Elmer TurboMatrix 110 HS autosampler
    b. Currently validated GC-FID
    c. Gas tanks
    d. Hydrogen generator
    e. Hood

7.0 Reports and Notifications

7.1. Report Writing

1. What documents are included in blood alcohol batch and case files?
2. What is the VFL's reporting range for BAC? How is this communicated to our customers?
3. What information must be included on a blood alcohol report?

8.0 Legal Knowledge

8.1. Expert Testimony

1. What are the DPS rules and regulations for blood alcohol? Why are they important?
2. How does the VFL demonstrate compliance with the rules and regulations?
3. What is the per se legal limit for BAC in Vermont?
4. If a person's BAC is below 0.08 can they still get a DUI?
5. Define the following terms using language you would use when speaking to a jury.
    a. Gas chromatography including dual column technology
    b. Headspace
    c. Internal standard
    d. Calibration, as it applies to GC
    e. Quality control, as it applies to GC
    f. Timing mix
    g. Flame ionization detector

DOCUMENT HISTORY			
DATE	**VERSION**	**APPROVED BY**	**ACTIVITY OR REVISION**
2/2/2015	1	Lab Director	Replaces F-ALC 090; training program expanded to cover other Alcohol section functions
6/4/2015	2	Lab Director	Revised Sections 6, 9 and 10 to clearly define milestones, competency testing and authorizations; minor wording & formatting changes throughout document
9/8/2017	3	Lab Director	Revised sections 4 through 9 by separating into subsections for general knowledge, breath, blood, and certified reference materials; added section 4.2; clarified required DMT training in sections 5.2 & 6.2; added required reading for sections 2, 4, 5 & 8 to appendix I; additional training questions added in appendix II
7/18/2024	4	Lab Director	Toxicology Training Manual reconfigured from TOX_P301 to move general information to TOX_P300 and sub-discipline training to TOX_P306 and TOX_P307; TOX_P301 is now redefined to include only blood alcohol training materials