1.0 Purpose

This procedure describes the training program for a laboratory technician.

2.0 Discussion

The laboratory technician will support the analysts with both administrative and technical duties. This training will include aspects from the technical training programs, the court testimony training, and additional administrative tasks. The training outlined below prepares the laboratory technician to receive and maintain evidence, perform administrative reviews, perform instrument maintenance and quality control checks, and assist analysts with casework.

3.0 Definitions

3.1 Court Testimony: Oral evidence offered by a competent witness under oath, which is used to establish some fact or set of facts.

3.2 Forensic Alcohol Analysis: Analyzing blood, breath, urine or other biological specimens and/or aqueous solutions for the presence and concentration of ethanol (alcohol).

3.3 Forensic Drug Analysis: Analyzing seized physical evidence suspected to be or to contain a controlled substance.

4.0 Procedure

4.1 The trainee should complete each section below under the guidance of a training mentor. The training mentor reviews all work performed and provides additional training where necessary. At successful completion of each section or sub-section the training mentor recommends authorization of the technician to perform specific duties to the Laboratory Manager.

4.2 Forensic Alcohol Analysis Training Phase 1

4.2.1 The tasks in this section will familiarize the trainee with laboratory procedures and housekeeping related to Forensic Alcohol Analysis (FAA). This section will prepare the trainee to receive evidence, perform maintenance and quality control checks on the balances and diluters, and to prepare, review, and distribute reports. This section should be completed within four weeks.

4.2.1 Activities:

1) Complete Sections 3.2 and 3.3 of the FAA SOP

2) Receive training on evidence entry into the laboratory database by training mentor (or designee)

3) Read the remainder of the FAA SOP

4) Perform the procedure outlined in 13.2.2.1

5) Complete Section 3.4.2 of FAA SOP

6) Review the operator manuals for the balances and diluters.

7) Observe training mentor perform the steps listed below:
   - Entry of a Results into Sample Information Log
   - Preparing, merging and printing reports
   - Administrative peer review
   - Notarizing reports
   - Distributing reports

8) Prepare a written report

9) Prepare a *Curriculum Vitae* (CV) for yourself. Use other analyst's CVs as a template/guide for yours.

10) Participate in a mock court exercise with training mentor

11) Observe analyst testify in court

4.3 Forensic Alcohol Analysis Phase 2

4.3.1 The tasks in this section will familiarize the trainee with methods related to Forensic Alcohol Analysis (FAA). This section will prepare the trainee to prepare standards, perform quality control checks on the gas chromatogram, and perform maintenance on the gas chromatogram. This section should be completed within six weeks.

4.3.2 Activities:

1) Review commonly prepared reagents and standards with training mentor.

2) Prepare a secondary alcohol standard within the range of 0.05 – 0.10 % (w/v).

3) Observe training mentor perform FAA analysis on the gas chromatogram to include the analyst review of the results.

4) Review maintenance performed on the gas chromatogram with training mentor.

5) Review operator manuals for the current instrument software, gas chromatographs, and headspace auto sampler.

6) Demonstrate how to perform the following under supervision of the training mentor (subject to maintenance schedule):
   - Check and change injection port septa and liner
   - Uninstall, cut, and reinstall the column
   - Clean the flame ionization detector
   - Check and clean the headspace needle
   - Replace a gas cylinder

7) On the GC, conduct two valid runs of analysis using methods and procedures from the Forensic Alcohol Analysis SOP and the requirements for an accuracy and precision run as detailed in section 13.1.3. More runs may be performed for practice before two final valid runs.

8) On the GC, establish the value of the secondary alcohol standard prepared in #2 above using validated secondary alcohol standards. The unknown standard prepared by the trainee shall be analyzed in two separate batches and contain 10 replicates for each batch. Each batch will also contain three replicates of a Cerilliant standard. The trainee will then determine the value of his or her prepared standard using laboratory procedures.

9) Read the references (as available) and answer the questions below.

4.3.3 References

A Full Evaporation Headspace Technique with Capillary GC and ITD, Schuberth et.al., 34 Journal of Chromatographic Science 314-319 (1996).

Chromatographic Methods for Blood Alcohol Determination, Tagliaro et.al., 580 Journal of Chromatography 161-190 (1992).

Determination of Ethanol in Biological Samples by Head-Space Gas Chromatography, Molina et.al., 10 Journal of Pharmaceutical & Biomedical Analysis 1069-1071 (1992).

Evolution of Capillary Columns for Gas Chromatography, Ettre et.al., 19 Liquid Chromatography Gas Chromatography North America 48-59 (2001). (optional)

Flame Ionization Detectors, Hinshaw et.al., 8 Liquid Chromatography Gas Chromatography 104-111.

Method for Determination of Ethyl Alcohol for Medicolegal Purposes, Kozelka et.al., 13 Industrial and Engineering Chemistry 905-907 (1941).

Rapid Vapor Phase Method for Determining Ethanol in Blood and Urine by Gas Chromatography, Wallace et.al., 46 The American Journal of Clinical Pathology 152-154 (1966).

The Beginnings of Headspace Analysis, Ettre et.al., 20 Liquid Chromatography Gas Chromatography North America 1120-1129 (2002).

4.3.4 Questions

1. Define mobile phase, stationary phase, retention time, relative retention time, resolution, and sensitivity.

2. How is the calibration curve generated? What is the area ratio?

3. What is the difference between internal standard method and external standard? What are the advantages and disadvantages of these methods?

4. What's the purpose of He gas, H_2 gas and air used in our GC instruments?

5. Why is the method employed by our lab called headspace gas chromatography? Describe how a sample is introduced onto a column.

6. Define polarity of a chemical. Is ethanol polar?

7. Describe how a mixture of volatile substances can be separated into individual compounds in our GC columns.

8. Describe the principle behind the flame ionization detector (FID) for ethanol.

9. Is the GC/FID method specific for ethanol? Why or why not?

10. Is it necessary to know the concentration of N-propanol internal standard in our method? Why or why not?

11. What are the volumes of sample, standard and internal standard pipetted by a diluter in our method?

12. Our method currently uses secondary alcohol standards close to 0.01, 0.05, 0.10, 0.25 and 0.50 in concentration. Why do we select these levels?

13. How is the value of a secondary alcohol standard determined? How is it different from a QC's value determination?

14. Can the expected value of the QC change after it has been determined? Why or why not?

15. Do the calibrators need to be in any particular order or particular position in a run? Do the QC's, calibration check samples and water blank need to be in a particular position?

16. Why is the water blank right after the standard of highest alcohol concentration?

17. What is PCS an abbreviation of?

18. What's the purpose of a PCS mix in a run?

19. In our method what is the acceptable range of a QC? Of a secondary standard result?

20. Should analysts check chromatograms after a run? Why or Why not? What should be evaluated?

21. What's the detectable level of ethanol in our columns?

22. Calculate the % w/v of an unknown using the following information from the chromatograms:

Samples	Sample Peak Area	Internal Std Peak Area
0.199 STD	349831	873861
Unknown	188041	877955

23. A 10% stock solution of ethanol in water (10g/100mL) is prepared using 200 proof ethanol. You need to prepare 100 mL solutions each at 0.100% and 0.010%. How many mL of the original stock solution do you need to prepare the 0.100% solution? How many mL of the 0.100% solution do you need to prepare the 0.010% solution?

4.4 Forensic Drug Analysis Phase 1

4.4.1 The tasks in this section will familiarize the trainee with methods related to Forensic Drug Analysis (FDA). This section will prepare the trainee to receive forensic drug

evidence, prepare standards and reagents, and perform quality control checks with color test reagents. This section should be completed within four weeks.

4.4.2 Activities:

1) Read Forensic Drug Analysis SOP Sections 1.0 – 2.0, 4.0 – 6.0, and 10.0.

2) Observe training mentor receive a forensic drug sample into the sample information database.

3) Perform the procedure outlined in Forensic Drug Analysis SOP Section 10.5.2

4) Read Forensic Drug Analysis SOP Section 7.1.5

5) Read Color Test Working Instructions and Reagent Check SOP, QP102.1

6) Prepare color test reagents for the following: (1) Marquis, (2) Cobalt Thiocyanate, (3) Sodium Nitroprusside, (4) Duquenois-Levine

7) Perform the following color tests on all available drug standards (using secondary standards when possible) or as directed by the training mentor: (1) Marquis, (2) Cobalt Thiocyanate, (3) Sodium Nitroprusside, (4) Duquenois-Levine.

8) Review the references (as available) and answer the questions below.

4.4.3 References

National Institute of Justice. "Color Test Reagents/Kits for Preliminary Identification of Drugs of Abuse", *NIJ Standard – 0604.01*, U.S. Department of Justice, July 2000.

Moffat, Anthony C et al., editors. *Clarke's Analysis of Drugs and Poisons.* London: The Pharmaceutical Press, 2004, pp. 279-300.

4.4.4 Questions

1. What is a primary drug standard? What is a secondary drug standard? Who must observe the receipt of a primary drug standard or transfer of a secondary drug standard?

2. How is a laboratory report number assigned for forensic drug samples?

3. What should be done if a discrepancy is found with the request form during inventory of the forensic drug sample?

4. For each color test used in this section, list the formulation, types of compounds that react with each test, and state what reaction would be observed.

5. When and how often is the reliability of the color test reagents checked?

6. What is the approximate sensitivity of each color test you are using?

7. Describe the difference between the terms "sensitivity" and "selectivity" as they relate to color tests.

8. What color test reagents are light sensitive, or are subject to thermal or temporal deterioration?

9. Define "false positive". Give three examples of false positive color tests.

10. Define "false negative". Give three examples of false negative color tests.

11. Describe the use of blanks pertaining to spot tests.

12. What effect do mixtures have on spot test results?

13. What effect does time have on color test reagents?

4.5 Forensic Drug Analysis Phase 2

4.5.1 The tasks in this section will familiarize the trainee with methods related to Forensic Drug Analysis (FDA). This section will prepare the trainee to perform quality control checks on the GC/MS and FTIR and perform maintenance on the GC/MS and FTIR. This section should be completed within six weeks.

4.5.2 Activities:

1) Read Forensic Drug Analysis SOP Sections 7.1.7, 9.3, 10.7 and Maintenance Plan SOP, TP105.

2) Observe training mentor or designee conduct quality control checks and maintenance on the FTIR.

3) Conduct a system suitability check and analyze a quality control sample on the FTIR and provide training mentor with print outs for review.

4) Read Forensic Drug Analysis SOP Sections 7.1.6, 9.1-9.2, and 10.6.

5) Observe training mentor perform an autotune and maintenance tune, perform routine maintenance on the GC/MS, and analyze samples on the GC/MS.

6) Perform an autotune and maintenance tune, provide training mentor with print outs.

7) Perform the following on the GC/MS (subject to maintenance schedule):

- Change the liquid sampling needle
- Replace the injection port septa and liner
- Remove, clip, and re-install the column
- Remove, clean, and re-install the ion source

8) Analyze a drug standard using a manual injection.

9) Review the references (as available) and answer the questions below.

4.5.3 References

Drake, A. (2004). Infra-red Spectroscopy. In A.C. Moffat (Ed.), *Clarke's Analysis of Drugs and Poisons,* (p. 328-345), London: The Pharmaceutical Press.

PerkinElmer. (2005). Technical Note: FT-IR Spectroscopy Attenuated Total Reflectance (ATR). Shelton, Connecticut. Retrieved July 10, 2007 from http://las.perkinelmer.com/content/technicalinfo/tch_ftiratr.pdf

PerkinElmer. (2004). Technical Note: ATR Accessories An Overview. Shelton, Connecticut. Retrieved July 10, 2007 from http://las.perkinelmer.com/content/technicalinfo/tch_atraccessories.pdf

"Spectrum 100 User Guide" and "Spectrum Software User Guide." Perkin Elmer. (2010). Spectrum Manuals CD (L1050002-O).

"Universal ATR" Tutorial. Perkin Elmer. (2010). Spectrum Multimedia CD (L1050005-B).

Watson, D. (2004). Mass Spectrometry. In A.C. Moffat (Ed.), *Clarke's Analysis of Drugs and Poisons,* (p. 379-391), London: The Pharmaceutical Press.

Dawling, S. (2004). Gas Chromatography. In A.C. Moffat (Ed.), *Clarke's Analysis of Drugs and Poisons,* (p. 425-499), London: The Pharmaceutical Press.

Trace DSQII and XCalibur Software User Manuals. Electronic files located on GC/MS computer.

4.5.4 Questions

1. Describe how an FTIR spectrum is auto-saved and/or saved.
2. Describe how ATR analysis can be run on powders, liquids, and mixtures.
3. Describe the preventative maintenance schedule and the QA/QC procedures performed on the FTIR and GC/MS including the software.
4. Why does the general drug screen method not collect data before four minutes?
5. Describe the proper manual injection technique.
6. What type(s) of GC(s) (model, manufacturer, etc.) does the drug laboratory use? What type(s) of injection ports, carrier gases, flows, columns, and detectors does each GC incorporate?
7. What types of information are obtained from a GC/MS?
8. What is the sensitivity of a GC/MS?
9. What is the difference between spectrometry and spectroscopy?
10. What is mass spectrometry?
11. What is the most common mode of ionization?
12. What temperature must be maintained in the ion source?
13. Describe the importance of blanks on the GC/MS.

4.6 Forensic Drug Analysis Phase 3

4.6.1 The tasks in this section will familiarize the trainee with methods related to Forensic Drug Analysis (FDA). This section will prepare the trainee to assist an analyst with weighing of drug samples and to conduct analysis of suspected marijuana samples under the supervision of a chemist. The start and length of this section will depend on the background of the trainee and current needs of the laboratory.

4.6.2 Activities:

1) Read Sampling SOP, QP102.10.1 and Weighing SOP, QP102.10.2.

2) Observe training mentor weigh a forensic drug sample and determine an appropriate sample for analysis.

3) Complete Section 3.5 "Marijuana Identification Training" of the Forensic Drug Analysis SOP (any items already completed in previous sections can be signed off on by the training mentor).

4) Prepare a GC/MS sample of one of the marijuana training samples for training mentor.

5) Complete Section 3.11 "Reporting" of the Forensic Drug Analysis SOP.

6) Complete Section 3.12 "Courtroom Testimony" of the Forensic Drug Analysis SOP.

7) Read the following references (as available) and answer the following questions.

4.6.3 References

Drugs of Abuse, DEA Publication (available annually at www.justice.gov/dea)

North Carolina General Statues Ch. 90, Art. 5, "North Carolina Controlled Substances Act" (with emphasis on §90-87; §90-89 to §90-94)

Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) Recommendations. 3rd Edition, 2007 – 08 – 09.

4.6.4 Questions

1. What are the three general analytical schemes outlined in the Forensic Drug Analysis SOP?

2. The laboratory has received an item of evidence with seven visually homogeneous sub-items of a suspected controlled substance. Under the administrative sampling plan how many of the sub-items should be analyzed for charges of simple possession? For charges of possession with intent to distribute? If the District Attorney has requested additional analysis how many of the sub-items should be analyzed under the hypergeometric sampling plan?

3. How can residues be sampled? How should residue samples be returned to the evidence?

4. List the analytical techniques used in the laboratory and the corresponding category A, B, or C.

5. What are the minimum standards that must be met in order for an identification of a drug or chemical to be reported?

6. How could the category of an analytical technique be lowered? Give an example that could occur in the laboratory.

7. The analytical balance shows the weight of a sample in the packaging to be 15.279 g, how should that weight be reported? How should it be reported if the balance shows 6.243 g when the sample is weighed without the packaging?

8. The laboratory has received an item of evidence with seven visually homogeneous sub-items of a suspected controlled substance. Under the administrative sampling plan how will the sub-items be weighed for charges of simple possession? For charges of possession with intent? If the District Attorney has requested additional analysis how will the sub-items be weighed under the hypergeometric sampling plan?

5.0 Health and Safety

There are no specific health or safety requirements associated with this procedure. All health and safety requirements under individual SOPs are to be followed.

6.0 Records Management

The analyst performing the training and the training mentor are responsible to record the training tasks performed. The Quality Manager is responsible to ensure the proper storage, backup and retention of laboratory records.

7.0 References

7.1 Orange County (CA) Sheriff-Coroner Department, Controlled Substance Analyst Training (ASCLD/LAB Accredited)

7.2 Virginia Division of Forensic Science, Controlled Substances Training Manual, Controlled Substances (ASCLD/LAB Accredited)

8.0 Appendices

None.

9.0 Revision Table

Revision #	Effective date	Revised by	Description of Revisions
Original Issue	10/01/2014	A. Hutson	

Authorization

This Standard Operating Procedure, Original Issue, has been approved and authorized by:

Bethany P. Pridgen, MFS Forensic Lab Manager	Date
Ralph M. Evangelous Chief of Police	Date