# TOXICOLOGY TRAINING MANUAL

# Table of Contents

# Revision History

| Revision # | Description of Changes |
|---|---|
| 1 | Original version transferred into Qualtrax |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

# 1.0 Introduction

## 1.1 Background and Theory

1.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed as a guide to provide a forensic analyst Trainee with the background necessary to process blood and urine specimens to detect and confirm the presence of impairing drug compounds other than ethanol and other volatiles. Ethanol and other volatiles training is addressed separately. The analyst is first tasked with review of the ISP Employee Handbook, ISP-FS ISO/IEC 17025:2005 Compliant Quality/Procedure Manual and the ISP-FS Health and Safety Manual. The analyst is then responsible to successfully complete the currently approved ethics course.

1.1.2 This plan addresses each of the various stages of sample processing, from initial sample checkout to the processes involved in screening, confirmation and report generation. To properly analyze and interpret the results of analysis, the Trainee must possess a working knowledge of drug metabolism and a fundamental understanding of the pharmacology of psychoactive compounds. In order to understand agency incident reports, the analyst must have an understanding of the tools used by law enforcement to detect impaired driving. For effective expert witness testimony, the analyst must have a working knowledge of our criminal justice system, including applicable Idaho Code. All of the covered topics are then applied for the proper preparation and presentation of courtroom testimony as demonstrated by mock courtroom testimony. In addition to discipline specific training, the new analyst must obtain a general knowledge of forensic science as a whole. When the Trainee has established competence by successfully completing training plan elements, supervised performance of analysis on case material completes the training process.

## 1.2 Objectives, Principles and Knowledge

1.2.1 In order to address the training plan questions: the Recommended Background Reading cited, or equivalent, must be consulted if the Trainee is not familiar with the subject matter.

1.2.2 For the background reading, the edition listed or a newer version should be consulted.

1.2.3 Both the education and work experience of the Trainee must be considered; however, at least a verbal review of material for the Trainer must be done to the satisfaction of the Trainer.

1.2.4 To establish the competency of the analyst, answers to training plan questions may be provided verbally and/or in written form. This choice is at the discretion of the Trainer. The Trainee must answer all of the questions 100% correct and if any part of the answer is incorrect, the Trainee must revisit the required reading until they can answer the question fully and correctly.

1.2.5 Training does not have to proceed in the order used in this training plan and the order and appropriate sections are at the discretion of the Trainer and/or Technical Lead.

1.2.6 It is not necessary to complete the entire training manual at one time, only the sections that apply to a particular Analytical Method.

1.2.7 Training for all Analytical Methods does not have to be pursued concurrently. Some Analytical Methods are utilized infrequently; therefore training can be completed prior to sign-off on all listed analytical methods. However, the Trainee must complete the training for a particular analytical method before that method can be used for casework by the Trainee.

1.2.8 Additional Training for Experienced/Signed-off Analyst

1.2.8.1 For training of an experienced analyst (Forensic Scientist II or III) in a new or updated technique or instrument, the training is to be commensurate with the magnitude of changes and with consideration of the analyst's existing background. The extent of training to be required will be agreed upon by the discipline leader and quality manager with input from the analyst.

1.3 Health and Safety Hazards

1.3.1 Precautions should be noted and appropriate use of PPE should be followed

1.3.2 Biohazards

1.3.3 Chemical Hazards

1.4 1.4 Reading and Practical Exercises

1.4.1 The new or experienced analyst is reminded that this training plan only addresses the core of training for toxicological analysis. After the completion of training, the analyst is responsible for keeping their knowledge current through continual literature review. This must include relevant journals, newsletters and textbooks.

# 2.0 Roles and Responsibilities

2.1 Supervisor

2.1.1 The Supervisor shall be apprised of the training schedule and estimated dates of completion for the individual modules. In addition, the Supervisor will evaluate mock court testimony.

2.2 Technical Lead

2.2.1 The Technical Lead shall assess any prior applicable training, review the current training plan, assign the appropriate modules and organize the training. The Technical Lead should regularly monitor the Trainee's progress and review their training record for completeness and accuracy, procure final competency tests and schedule mock courts. The Technical Lead shall provide input regarding mock court performance to the Supervisor and/or other members of management. At the completion of training plan or appropriate modules, the Technical Lead shall review all documentation regarding training to determine if the Trainee performed all required training and is competent to perform analysis. If the Trainee is competent to perform analysis, the Technical Lead shall forward all required documentation to the Quality Manager. The Technical Lead may act as the Trainer or designate an onsite Trainer.

2.3 Trainer

2.3.1 The Trainer shall provide a copy of the training plan to the Trainee with an anticipated timeline for completion. The Trainer is responsible for coordination of practical exercises, demonstrating techniques, reviewing answers to questions, providing feedback and administration of module tests. The Trainer should monitor for comprehension and competency in theoretical knowledge and basic practical skills. The Trainer shall communicate progress, delays, or the need for supplemental activities to the Technical Lead and/or Supervisor. Deficiencies should be openly discussed among the Trainee, Trainer, Technical Lead and/or Supervisor in an attempt to rectify them.

2.4 Trainee

2.4.1 The Trainee is responsible for completing the background reading for the modules on their own as well as providing written answers to any questions contained in the modules. The Trainee is expected to observe the Trainer whenever possible and take notes while doing so. If the Trainee cannot meet any of the anticipated timelines, the Trainee is responsible for notifying the Trainer. The Trainee should ask questions and ask for explanations whenever something is not clear.

# 3.0 Administrative Issues

3.1 Background and Theory

3.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary background information regarding employment with the Idaho State Police, other disciplines within the lab system, ethics, the procedures and quality requirements for the laboratory system as a whole, as well as the health and safety requirements for working in the laboratory

3.2 Objectives, Principles, and Knowledge

3.2.1 Complete the reading and practical exercises specified below.

3.3 Health and Safety Hazards

3.3.1 N/A

3.4 Reading and Practical Exercises

3.4.1 Reading

3.4.1.1 Idaho State Police Employee Handbook (http://intranet/ or equivalent)

3.4.1.2 Idaho State Police Forensic Services ISO/IEC 17025:2005 Compliant Quality/Procedure Manual (Documents Section of ILIMS)

3.4.1.3 Idaho State Police Forensic Services Health and Safety Manual. (Documents section of ILIMS)

3.4.2 Exercises

3.4.2.1 The Trainee must be familiar with relevant sections of the Idaho State Police Employee Handbook.

3.4.2.2 The Trainee must complete the Idaho State Police Forensic Services General Training plan. This core training plan covers the Idaho State Police Forensic Services ISO/IEC 17025:2005 Compliant Quality/Procedure Manual, the Idaho State Police Forensic Services Health and Safety Manual, the currently approved ethics course and basic training in other forensic science disciplines.

# 4.0 Evidence Handling

4.1 Background and Theory

4.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary background information regarding how evidence is packaged, received and tracked.

4.2 Objectives, Principles, and Knowledge

4.2.1 Complete the required reading and exercises specified below.

4.3 Health and Safety Hazards

4.3.1 Gloves and lab coats should be worn when working with evidence.

4.4 Reading and Practical Exercises

4.4.1 Reading

4.4.1.1 Idaho State Police Forensic Services Health and Safety Manual (Documents section of ILIMS)

4.4.2 Exercises

4.4.2.1 The Trainee must describe the procedures followed for the intake of toxicology specimen collection kits, transfer of samples, required paperwork and subsequent specimen handling considerations.

4.4.2.2 The Trainee must describe the types and applications of the toxicology collection kits distributed by ISP-FS.

4.4.2.3 The Trainee must describe the agencies served by their laboratory and the programs involved.

4.4.2.4 The Trainee must describe the barrier protection measures required when handling biological samples.

# 5.0 Balance Operation

5.1 Background and Theory

5.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information and skills to properly operate an analytical balance.

5.2 Objectives, Principles, and Knowledge

5.2.1 Complete the reading and exercises specified below.

5.3 Health and Safety Hazards

5.3.1 Gloves and lab coats should be worn when working in the laboratory. In addition, if any powders are being weighed, safety glasses or goggles should be worn.

5.4 Reading and Practical Exercises

5.4.1 Reading

5.4.1.1 Manufacturer manual for all balances to be used by the Trainee.

5.4.1.2 Analytical Method #17

5.4.2 Exercises

5.4.2.1 The Trainee must be familiar with the operation of any analytical or top-loading balances used to prepare toxicology solutions and reference material.

5.4.2.2 The Trainee must be able to describe the basic steps involved in obtaining the weight of a material.

# 6.0 Pipette Intermediate Check: Theory and Operation

6.1 Background and Theory

6.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information and skills to properly operate a pipette as well as be able to perform intermediate checks on the pipettes.

6.2 Objectives, Principles, and Knowledge

6.2.1 Complete the reading and exercises specified below.

6.3 Health and Safety Hazards

6.3.1 Gloves and lab coats should be worn when working in the laboratory. In addition, if any chemicals are being used, safety glasses or goggles should be worn.

6.4 Reading and Practical Exercises

6.4.1 Reading

6.4.1.1 Analytical Method #16

6.4.1.2 Standard Operating Procedure for the PCS 2- Pipette Calibration System, Artel Document #310A2715A, April 1997.

6.4.1.3 PCS 2 Pipette Calibration System Procedure Guide, Artel Document # 15A2135, Version 5.1, 03-28-1997.

6.4.1.4 College Chemistry/Biochemistry Text, chapter(s) discussing Absorption Spectrophotometry.

6.4.1.5 Curtis, R.H., Performance Verification of Manual Action Pipets: Part I, Am. Clin. Lab. 12(7):8-9; 1994.

6.4.1.6 Curtis, R.H., Performance Verification of Manual Action Pipets: Part II, Am. Clin. Lab. 12(9):16-17; 1994.

6.4.1.7 ISO 8655-6:2002, Piston-operated volumetric apparatus - Part 6: Gravimetric method for the determination of measurement error.

6.4.2 Exercises

6.4.2.1 ARTEL PCS 2™ Pipette Calibration System

6.4.2.1.1 The Trainee must have a working knowledge of how to prepare the ARTEL PCS 2™ Pipette Calibration System to perform an intermediate check of the status of a POVA's (piston operated volumetric apparatus) calibration.

6.4.2.1.2 The Trainee must describe the operating principle of the PCS 2™ Pipette Calibration System.

6.4.2.1.3 The Trainee must explain the routine maintenance performed on the PCS 2™ Pipette Calibration System.

6.4.2.2 Gravimetric Pipette Intermediate Checks

6.4.2.2.1 The Trainee must describe the principle, equipment and calculations involved when using the gravimetric method to perform an intermediate check of a POVA.

6.4.2.2.2 The Trainee must demonstrate their ability to perform an intermediate check on a POVA.

# 7.0 Solution Preparation

7.1 Background and Theory

7.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information and skills to properly prepare any solutions that need to be made for analyzing toxicology samples.

7.2 Objectives, Principles, and Knowledge

7.2.1 Complete the reading and exercises specified below.

7.3 Health and Safety Hazards

7.3.1 Gloves lab coats and safety glasses or goggles should be worn when working in the laboratory.

7.4 Reading and Practical Exercises

7.4.1 Reading

7.4.1.1 Analytical Method #23

7.4.1.2 College Chemistry Text, chapter(s) discussing the properties of solutions.

7.4.1.3 Seamonds, B. and Byrne, E.A. Basic Laboratory Principles and Techniques pp. 3 - 43. in: Clinical Chemistry: Theory, Analysis, Correlation. Mosby, 2003.

7.4.1.4 Shugar, G.J., Shugar, R.A. and Bauman, L. Grades of Purity of Chemicals pp. 145-154, pH Measurement. pp. 232-234. in: Chemical Technicians' Ready Reference Handbook, McGraw Hill: New York, 1973.

7.4.1.5 Habben, K.H. Basic Analytical Reference – Chapter 19. pp. 1-9, in: Current Approaches in Forensic Toxicology. Presented by the Forensic Toxicologist Certification Board, Inc. at SOFT meeting, 1994.

7.4.1.6 Operation Manual for pH Meter.

7.4.2 Exercises

7.4.2.1 Basic Chemical Calculations and Nomenclature

7.4.2.2 The analyst must be able to address the questions and define the following terms:

7.4.2.2.1 Solvent

7.4.2.2.2 Molarity (M)

7.4.2.2.3 How moles per liter are in a 2M solution?

7.4.2.2.4 Normality (N)

7.4.2.2.5 How many equivalents in a 2N solution?

7.4.2.2.6 Weight per Volume Percent (%w/v)

7.4.2.2.7 Weight per Weight percent (%w/w)

7.4.2.3 The Trainee must be familiar with solution preparation and documentation. This must include the preparation of hydrolysis agents, buffers and extraction solvents used in all stages of specimen preparation for analysis.

7.4.2.4 The Trainee must have a working knowledge of pH meter operation and documentation. The Trainee must standardize a series of pH buffers and perform a pH check during the preparation of a buffer solution for the Trainer.

# 8.0 Principle: Enzyme Immunoassay

8.1 Background and Theory

8.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to explain what enzyme immunoassays are and how they work.

8.2 Objectives, Principles, and Knowledge

8.2.1 Complete the reading and exercises specified below.

8.3 Health and Safety Hazards

8.3.1 N/A

8.4 Reading and Practical Exercises

8.4.1 Reading

8.4.1.1 Analytical Methods #1 and #7

8.4.1.2 Thompson, S.G., Principles for Competitive Binding Assays. pp. 246 – 264. in: Clinical Chemistry: Theory, Analysis, Correlation. Mosby, 2003 or more recent version.

8.4.1.3 Sections Covering Immunoassay and EMIT. refer to index for pages, in: Principles of Forensic Toxicology, Second Edition, Levine, B. ed., AACC, 2003 or more recent version.

8.4.1.4 Analytical Methods #1 and #7: Enzyme Immunoassay Screening for Drugs of Abuse.

8.4.1.5 Spiehler, V., Immunoassays in Toxicology. pp. 55-98, in: California Association of Toxicologists (CAT) Manual for Analytical Toxicology, 1994.

8.4.1.6 Liu, R.H., Evaluation of Commercial Immunoassay Kits for Effective Workplace Drug Testing. pp.67-130, in: Handbook of workplace Drug Testing. Liu, R.H. and Goldberger, B.A. eds., Washington D.C.:AACC Press, 1995.

8.4.1.7 Hearn, W.L. and Walls, H.C., Common Methods in Post-Mortem Toxicology. pp. 995-998, in: Drug Abuse Handbook, Second Edition, Karch, S.B. ed., Boca Raton: CRC Press, 2007 or more recent version.

8.4.2 Exercises

8.4.2.1 Describe the competitive binding process as it applies to immunoassay.

8.4.2.2 The Trainee must define and discuss the following terms as they relate to Enzyme Immunoassay (EIA):

8.4.2.2.1 Enzyme
8.4.2.2.2 Antigen
8.4.2.2.3 Antibody
8.4.2.2.4 Hapten
8.4.2.2.5 Cross-reactivity/analytical specificity
8.4.2.2.6 Antigenic Determinant
8.4.2.2.7 Cutoff
8.4.2.2.8 Drift effect

8.4.2.3 Discuss specificity versus sensitivity as it applies to EIA.

8.4.2.4 Discuss the major differences between homogeneous and heterogeneous enzyme immunoassays.

8.4.2.5 The Trainee must demonstrate a working knowledge of theory and application of enzyme-multiplied immunoassay technique (EMIT).

8.4.2.5.1 Describe the basic EMIT process.
8.4.2.5.2 Discuss the attributes and limitations of EMIT.
8.4.2.5.3 Describe the basic ELISA process.
8.4.2.5.4 Describe the attributes and limitations of ELISA.

# 9.0 Instrumentation: Viva Automatic Chemistry Analyzer and/or DSX Analyzer

9.1 Background and Theory

9.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to operate and maintain the Viva Automatic Chemistry Analyzer and/or the DSX Analyzer.

9.2 Objectives, Principles, and Knowledge

9.2.1 Complete the reading and exercises specified below.

9.3 Health and Safety Hazards

9.3.1 Gloves, lab coats and safety glasses should be worn when working in the laboratory. Universal precautions should be taken when dealing with biological specimens.

9.4 Reading and Practical Exercises

9.4.1 Reading

9.4.1.1 Analytical Methods #1 and #7

9.4.1.2 Viva-Jr Operator's Manual, Article No.: 6002-940-410, Version number: 01/04-06.

9.4.1.3 Viva-Jr System Operations Guide, T268, 6/25/07, D01373.

9.4.1.4 DSX Automated ELISA System User's Manual, REV.04-20-05, 2005

9.4.2 Exercises

9.4.2.1 Viva Automatic Chemistry Analyzer (if applicable)

9.4.2.1.1 The Trainee must demonstrate their ability to apply the Viva system software to operate the analyzer.

9.4.2.1.2 The Trainee must demonstrate a thorough understanding of the required periodic and as needed maintenance for the Viva analyzer.

9.4.2.1.3 The Trainee must demonstrate a thorough understanding of troubleshooting techniques for the Viva analyzer.

9.4.2.2 DSX Automatic Chemistry Analyzer (if applicable)

9.4.2.2.1 The Trainee must demonstrate their ability to apply the DSX system software to operate the analyzer.

9.4.2.2.2 The Trainee must demonstrate a thorough understanding of the required periodic and as needed maintenance for the DSX analyzer.

9.4.2.2.3 The Trainee must demonstrate a thorough understanding of troubleshooting techniques for the DSX analyzer.

# 10.0 Principle: Liquid-Liquid Extraction

10.1 Background and Theory

10.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and describe what a liquid-liquid extraction is and how it works.

10.2 Objectives, Principles, and Knowledge

10.2.1 Complete the reading and exercises specified below.

10.3 Health and Safety Hazards

10.3.1 Gloves, lab coats and safety glasses should be worn when working in the laboratory. Universal precautions should be taken when dealing with biological specimens.

10.4 Reading and Practical Exercises

10.4.1 Reading

10.4.1.1 Sections Covering Liquid-liquid Extraction. Refer to index for page numbers, in: Principles of Forensic Toxicology. Second Edition, Levine, B. ed., AACC, 2003 or more recent version.

10.4.1.2 Stafford, David T., Liquid/Liquid Extraction in Toxicology –Chapter 14. pp. 1-13, in: Current Approaches in Forensic Toxicology. Presented by the Forensic Toxicologist Certification Board, Inc. at SOFT meeting, 1994.

10.4.1.3 Hearn, W.L. and Walls, H.C., Common Methods in Post-Mortem Toxicology. pp. 1005-1007, in: Drug Abuse Handbook. Second Edition, Karch, S.B. ed., Boca Raton: CRC Press, 2007 or more recent version.

10.4.2 Exercises

10.4.2.1 The Trainee must be well versed in the principals involved with liquid-liquid extraction.

10.4.2.2 Describe the properties that are involved in a solvent's ability to extract a particular analyte.

10.4.2.3 Describe the following processes as they relate to liquid-liquid extraction:

10.4.2.3.1 Basic Extraction

10.4.2.3.2 Acidic Extraction

10.4.2.3.3 Back Extraction

10.4.2.3.4 Buffering – Why are different pHs required for different methods?

10.4.2.4 Explain how the Henderson-Hasselbach equation applies to liquid-liquid extraction.

# 11.0 Principle: Solid Phase Extraction (SPE)

11.1 Background and Theory

11.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and describe what a solid phase extraction is and how it works.

11.2 Objectives, Principles, and Knowledge

11.2.1 Complete the reading and exercises specified below.

11.3 Health and Safety Hazards

11.3.1 Gloves, lab coats and safety glasses should be worn when working in the laboratory. Universal precautions should be taken when dealing with biological specimens.

11.4 Reading and Practical Exercises

11.4.1 Reading

11.4.1.1 Sections Covering Solid Phase Extraction. Refer to index for page numbers, in: Principles of Forensic Toxicology. Second Edition, Levine, B. ed., AACC, 2003 or more recent version.

11.4.1.2 Sears, R.M., Liquid/Solid Extraction in Toxicology – Chapter 15. pp. 1-51, in: Current Approaches in Forensic Toxicology. Presented by the Forensic Toxicologist Certification Board, Inc. at SOFT meeting. 1994.

11.4.1.3 Platoff, G.E. and Gere, J.A., Solid Phase Extraction of Abused Drugs from Urine. Forensic Science Review. 3(2):119-132. 1991.

11.4.1.4 Chen, X.H., Franke, J.P. and Zeeuw, R.A., Principles of Solid-Phase Extraction. pp. 1-22, in: Handbook of Workplace Drug Testing. Washington, D.C.:AACC Press, 1995.

11.4.1.5 Gere, J.A. and Platoff, G.E., Solid-Phase Extraction of Abused Drugs in Urine. pp. 23-44, in: Handbook of Workplace Drug Testing. Washington, D.C.:AACC Press, 1995.

11.4.1.6 Hearne, G.M and Hall, D.O., Advances in Solid-Phase Extraction Technology. American Laboratory, January 1993.

11.4.1.7 Hearn, W.L. and Walls, H.C., Common Methods in Post-Mortem Toxicology. pp. 1006-1007, in: Drug Abuse Handbook. Second Edition, Karch, S.B. ed., Boca Raton: CRC Press, 2007 or more recent version.

11.4.2 Exercises

11.4.2.1 The Trainee must be knowledgeable about the principles involved with solid phase extraction (SPE).

11.4.2.2 Describe the advantages of SPE over liquid-liquid extraction methods.

11.4.2.3 Discuss Van der Waal Forces as they relate to SPE.

11.4.2.4 Discuss the sorbent options for SPE columns in regards to the types available, their target compounds and the interactions which they participate in.

11.4.2.5 Discuss the six typical steps involved in a SPE procedure.

11.4.2.6 Discuss how to prepare the sample for optimum analyte retention on a particular SPE column.

# 12.0 Principle: SLE Extraction

12.1 Background and Theory

12.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and describe what a supported liquid extraction is and how it works.

12.2 Objectives, Principles, and Knowledge

12.2.1 Complete the reading and exercises specified below.

12.3 Health and Safety Hazards

12.3.1 Gloves, lab coats and safety glasses should be worn when working in the laboratory. Universal precautions should be taken when dealing with biological specimens.

12.4 Reading and Practical Exercises

12.4.1 Reading

12.4.1.1 Biotage® Isolute® SLE+ User Guide, 2016.

12.4.2 Exercises

12.4.2.1 The Trainee must demonstrate a working knowledge of theory and application of SLE extraction.

12.4.2.1.1 What does SLE stand for?

12.4.2.1.2 Describe the basic SLE process.

12.4.2.1.3 How is it similar to LLE and SPE and how does it differ?

12.4.2.1.4 What are some key factors affecting analyte partitioning?

12.4.2.1.5 How can pH be used to enhance extraction efficiency?

12.4.2.1.6 What types of solvents should be used for neutral analytes? What for polar analytes? What for non-polar analytes?

12.4.2.1.7 Why is it important to completely dry down the sample before reconstituting?

# 13.0 Principle: Gas Chromatography (GC)

13.1 Background and Theory

13.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and describe what gas chromatography is and how it works.

13.2 Objectives, Principles, and Knowledge

13.2.1 Complete the reading and exercises specified below.

13.3 Health and Safety Hazards

13.3.1 N/A

13.4 Reading and Practical Exercises

13.4.1 Reading

13.4.1.1 Sections Covering Gas Chromatography. Refer to index for page numbers, in: Principles of Forensic Toxicology. Second Edition, Levine, B. ed., AACC, 2003 or more recent version.

13.4.1.2 Stafford, David T. Introduction to Chromatography – Chapter 2. pp. 1-39, in: Current Approaches in Forensic Toxicology. Presented by the Forensic Toxicologist Certification Board, Inc. at SOFT meeting, 1994.

13.4.1.3 Dawling, S. Gas Chromatography. pp. 425-499, in: Clarke's Analysis of Drugs and Poisons. Third Ed. Moffat, A.C., Ed, London: The Pharmaceutical Press, 2004 or more recent version.

13.4.1.4 Hearn, W.L. and Walls, H.C. Common Methods in Post-Mortem Toxicology. pp. 1000-1001, in: Drug Abuse Handbook. Second Edition, Karch, S.B. ed., Boca Raton: CRC Press, 2007 or more recent version.

13.4.2 Exercises

13.4.2.1 The Trainee must have comprehensive background in the principles of GC.

13.4.2.2 Describe the influence carrier gas flow has on the efficiency of a GC.

13.4.2.3 Define the following terms as they relate to GC.

13.4.2.3.1 Resolution

13.4.2.3.2 Area under the curve

13.4.2.3.3 HETP

13.4.2.3.4 Signal to noise ratio

13.4.2.4 Discuss which GC parameters affect resolution. Describe how to approach a lack of resolution.

13.4.2.5 Discuss how to alleviate peak tailing.

13.4.2.6 The Trainee must possess an understanding of the principles and application of quantitative analysis.

13.4.2.7 Describe the major advantages of using an internal standard.

# 14.0 Principle: Mass Selective Detector (MSD)

14.1 Background and Theory

14.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and describe what a mass selective detector is and how it works.

14.2 Objectives, Principles, and Knowledge

14.2.1 Complete the reading and exercises specified below.

14.3 Health and Safety Hazards

14.3.1 N/A

14.4 Reading and Practical Exercises

14.4.1 Reading

14.4.1.1 Sections Covering Mass Spectrometry. Refer to index for page numbers, in: Principles of Forensic Toxicology. Second Edition, Levine, B. ed., AACC, 2003 or more recent version.

14.4.1.2 Stafford, David T. Introduction to Chromatography – Chapter 2. pp. 1-39, in: Current Approaches in Forensic Toxicology. Presented by the Forensic Toxicologist Certification Board, Inc. at SOFT meeting. 1994.

14.4.1.3 Foltz, R.L. Mass Spectrometry. pp. 159-190, in: California Association of Toxicologists (CAT) Manual for Analytical Toxicology Training. 1994.

14.4.2 Exercises

14.4.2.1 The Trainee must have a working knowledge of the theory of mass spectrometry and the application of a mass selective detector.

14.4.2.2 Describe the ionization process.

14.4.2.3 Discuss the differences between SIM and Full-scan acquisition of data.

14.4.2.4 Discuss the advantages of derivatizing drug compounds.

14.4.2.5 Evaluate an Autotune report.

# 15.0 Instrumentation: Gas Chromatograph equipped with a Mass Selective Detector

15.1 Background and Theory

15.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information and skills to be able to operate, maintain and troubleshoot a GC/MS.

15.2 Objectives, Principles, and Knowledge

15.2.1 Complete the reading and exercises specified below.

15.3 Health and Safety Hazards

15.3.1 Gloves, lab coats and safety goggles or classes should be worn when working with chemicals. Gloves should be worn when working with the GC/MS.

15.3.2 Care should be taken when working with the GC/MS as there are parts that are very hot as well as a potential to get shocked if proper care is not taken.

15.4 Reading and Practical Exercises

15.4.1 Reading

15.4.1.1 Current instrument manuals (hardcopy and/or electronic) for each GC-MSD in use.

15.4.2 Exercises

15.4.2.1 Sections Covering Mass Spectrometry. Refer to index for page numbers, in: Principles of Forensic Toxicology. Second Edition, Levine, B. ed., AACC, 2003 or more recent version.

15.4.2.2 Stafford, David T. Introduction to Chromatography – Chapter 2. pp. 1-39, in: Current Approaches in Forensic Toxicology. Presented by the Forensic Toxicologist Certification Board, Inc. at SOFT meeting. 1994.

15.4.2.3 Foltz, R.L. Mass Spectrometry. pp. 159-190, in: California Association of Toxicologists (CAT) Manual for Analytical Toxicology Training. 1994.

# 16.0 Principle: LCMS-QQQ

16.1 Background and Theory

16.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to describe what an LCMS-QQQ is and how it works.

16.2 Objectives, Principles, and Knowledge

16.2.1 Complete the reading and exercises specified below.

16.3 Health and Safety Hazards

16.3.1 N/A

16.4 Reading and Practical Exercises

16.4.1 Reading

16.4.1.1 Agilent 6400 Series QQQ LC/MS Techniques and Operation, Course Number R1893A Volume 1 Student Manual, Agilent 2010

16.4.1.2 Agilent 6400 Series QQQ LC/MS Techniques and Operation, Course Number R1893A Volume 2 Student Manual, Agilent 2010

16.4.1.3 Agilent 1260 Infinity Binary LC Optimization Guide

16.4.2 Exercises

16.4.2.1 Explain how the following terms define or affect the performance of the instrument.

16.4.2.1.1 Resolution

16.4.2.1.2 Eddy diffusion

16.4.2.1.3 Capacity

16.4.2.2 Determine what type of column is currently installed on the LCMS QQQ in your laboratory.

16.4.2.2.1 What is the column packing material?

16.4.2.2.2 What is the total particle size of the packing material?

16.4.2.2.3 What is the inner diameter of the column?

16.4.2.2.4 What is the length of the column?

16.4.2.2.5 What pH range can this column accommodate?

16.4.2.2.6 What is the maximum operating pressure for this column?

16.4.2.3 Describe the difference between a gradient and an isocratic elution.

16.4.2.4 Discuss ways to reduce carryover.

16.4.2.5 What does the term data rate mean and how can that affect resolution and capacity?

16.4.2.6 Describe the difference between electrospray ionization and atmospheric pressure chemical ionization. What are the pros and cons of each ionization technique?

16.4.2.7 What is ion suppression? How is it evaluated and what can be done to reduce it?

16.4.2.8 What occurs in the first quadruple of the instrument, the hexapole, and the final quadrupole?

16.4.2.9 Give a basic explanation of the following acquisition parameters:

- 16.4.2.9.1 ms2scan
- 16.4.2.9.2 ms2sim
- 16.4.2.9.3 MRM
- 16.4.2.9.4 Dynamic MRM
- 16.4.2.9.5 Product ion
- 16.4.2.9.6 Neutral loss
- 16.4.2.9.7 Neutral gain

16.4.2.10 Evaluate a checktune and an autotune report.

# 17.0 Instrumentation: LCMS-QQQ

17.1 Background and Theory

17.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information and skills to be able to operate, maintain and troubleshoot an LCMS-QQQ.

17.2 Objectives, Principles, and Knowledge

17.2.1 Complete the reading and exercises specified below.

17.3 Health and Safety Hazards

17.3.1 Gloves, lab coats and safety goggles or classes should be worn when working with chemicals.

17.3.2 Care should be taken when working with the LCMS-QQQ so as to avoid shock.

17.4 Reading and Practical Exercises

17.4.1 Reading

17.4.1.1 http://www.chem.agilent.com/en-US/Technical-Support/Instruments-Systems/Mass-Spectrometry/6400-Series-Triple-Quadrupole-LC-MS/Pages/default.aspx

17.4.1.2 http://www.chem.agilent.com/en-US/Technical-Support/Instruments-Systems/Liquid-Chromatography/1260-Infinity-Binary-LC/Pages/default.aspx

17.4.2 Exercises

17.4.2.1 The Trainee must demonstrate their ability to operate an LC equipped with a triple quadrupole Mass Selective Detector.

17.4.2.2 The Trainee must demonstrate an understanding of the system's software, troubleshooting techniques and the maintenance that is to be performed on the LCMS/QQQ.

17.4.3 The Trainee must demonstrate to the Trainer the ability to pull up the instrument manuals online.

# 18.0 Content and Application of Analytical Methods

18.1 Background and Theory

18.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand, describe and perform the methods used in the toxicology discipline.

18.2 Objectives, Principles, and Knowledge

18.2.1 Complete the exercises specified below.

18.3 Health and Safety Hazards

18.3.1 Gloves, lab coats and safety glasses or goggles should be worn while working in the laboratory.

18.3.2 Universal precautions should be taken when working with biological samples.

18.4 Reading and Practical Exercises

18.4.1 Exercises

18.4.1.1 To assess the understanding of each method, each of the following must be addressed:

18.4.1.1.1 The Trainee must fully describe the steps involved in each analysis procedure.

18.4.1.1.2 Trainee must describe the quality assurance requirements described in each Analytical Method.

18.4.1.1.3 Trainee must describe the acceptance criteria for an analysis run.

18.4.1.1.4 The Trainee must possess a thorough understanding of the criteria used for the qualitative identification and/or quantitative level of a compound(s) of interest by each analytical method.

18.4.1.1.5 Trainee must describe how quality assurance data is monitored and where it must be stored.

18.4.1.1.6 Trainee must describe the authentication process for reference material.

# 19.0 Case File Preparation

19.1 Background and Theory

19.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and describe what needs to be included in case files and central files.

19.2 Objectives, Principles, and Knowledge

19.2.1 Complete the exercises specified below.

19.3 Health and Safety Hazards

19.3.1 N/A

19.4 Reading and Practical Exercises

19.4.1 Exercises

19.4.1.1 The Trainee must describe which documents and data are required to be included in urine or blood toxicology analysis casefile/notes packets.

19.4.1.2 The Trainee must describe what is to be included in the centrally stored QA file for each analysis run.

19.4.1.3 The Trainee must describe requirements for administrative and technical review of casefile/notes packets and analysis reports.

# 20.0 Basic Pharmacology and Drug Metabolism

20.1 Background and Theory

20.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and explain basic pharmacology and drug metabolism principles.

20.2 Objectives, Principles, and Knowledge

20.2.1 Complete the reading and exercises specified below.

20.3 Health and Safety Hazards

20.3.1 N/A

20.4 Reading and Practical Exercises

20.4.1 Reading

20.4.1.1 Spiehler, V. and Levine, B., Pharmacokinetics and Pharmacodynamics. Refer to index for page numbers, in: Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, AACC, 2003 or more recent version.

20.4.1.2 Isenschmid, D.S. Cocaine. Refer to index for page numbers, in: Principles of Forensic Toxicology, Second Edition, Levine, B. ed., AACC, 2003 or more recent version.

20.4.1.3 Huestis, M.A. Marijuana. Refer to index for page numbers, in: Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, AACC, 2003 or more recent version.

20.4.1.4 Moore, Karla. Amphetamine/Sympathomimetic Amines. Refer to index for page numbers, in: Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, AACC, 2003 or more recent version.

20.4.1.5 Kerrigan, S. and Goldberger, B.A. Opioids. Refer to index for page numbers, in: Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, AACC, 2003 or more recent version.

20.4.1.6 Clarke's Analysis of Drugs and Poisons. Third Edition. Moffat, A.C., Ed, London: The Pharmaceutical Press. 2004 or more recent version.

20.4.1.7 Julien,R.M., Principles of Drug Action in: Primer of Drug Action, pp. 1-39, Freeman-New York, 1998 or more recent version.

20.4.1.8 Benet, L.Z., Kroetz, D.L. and Sheiner, L.B.., Pharmacokinetics: The Dynamics of Drug Absorption, Distribution and Elimination. pp. refer to index, in: Goodman and Gilman's The Pharmacological Basis of Therapeutics, New York:McGraw-Hill, Most current edition available.

20.4.1.9 Baselt, R.C., Disposition of Toxic Drugs and Chemicals in Man. Seventh Edition. Foster City:Biomedical Publications, 2004 or more recent version.

20.4.1.10 Baselt, R.C., Drug Effects on Psychomotor Performance. Foster City:Biomedical Publications, 2001 or more recent version.

20.4.2 Exercises

20.4.2.1 Define the following terms:

20.4.2.1.1 Pharmacology

20.4.2.1.2 Pharmacokinetics

20.4.2.1.3 Pharmacodynamics

20.4.2.2 Discuss the factors that influence the metabolism of drugs.

20.4.2.3 List the major metabolites for the following representative compounds. Indicate which metabolites are psychoactive.

20.4.2.3.1 Methamphetamine.

20.4.2.3.2 Cocaine alone and in combination with alcohol.

20.4.2.3.3 Diazepam

20.4.2.3.4 Clonazepam

20.4.2.3.5 Alprazolam

20.4.2.3.6 Flunitrazepam

20.4.2.3.7 Carisoprodol

20.4.2.3.8 Heroin

20.4.2.3.9 Codeine

20.4.2.3.10 Delta-9-THC

20.4.2.3.11 Imipramine

20.4.2.3.12 Amitriptyline

20.4.2.3.13 Propoxyphene

20.4.2.3.14 Tramadol

20.4.2.4 Characterize phase I and II drug metabolism.

20.4.2.5 The metabolism of the 1,4-Benzodiazepine, Diazepam, yields several metabolites which in turn undergo biotransformation. Indicate which compounds result in each case:

20.4.2.5.1 N-dealkylation (P450 mediated)

20.4.2.5.2 Hydroxylation (P450)

20.4.2.5.3 Glucuronidation

20.4.2.6 The metabolism of codeine yields several metabolites. Indicate which compounds result in each case:

20.4.2.6.1 O-dealkylation (P450 mediated)

20.4.2.6.2 N-dealkylation (P450)

20.4.2.6.3 Glucuronidation

20.4.2.7 The metabolism of methamphetamine yields several metabolites. Indicate which compounds result in each case:

20.4.2.7.1 N-dealkylation (P450)

20.4.2.7.2 Oxidative deamination (P450)

20.4.2.7.3 Aromatic hydroxylation (P450)

20.4.2.8 List compounds that yield methamphetamine as a metabolite.

20.4.2.9 The metabolism of cocaine yields several metabolites. Indicate which compounds result in each case:

20.4.2.9.1 N-dealkylation (P450)

20.4.2.9.2 Transesterification with alcohol (Esterase)

20.4.2.9.3 Ester hydrolysis mediated by esterases (two compounds)

20.4.2.9.4 Aromatic hydroxylation (P450)

20.4.2.10 Define the following terms in regard to drug metabolism:

20.4.2.10.1 First pass effect

20.4.2.10.2 Half-life

20.4.2.10.3 Zero and first order reactions

20.4.2.11 Give two examples of commonly encountered compounds that form glucuronide conjugates in phase II.

20.4.2.12 Describe the potential modes of excretion for drug compounds.

20.4.2.13 Describe how urinary pH will affect urinary methamphetamine concentration.

# 21.0 Fundamentals of Criminal Justice

21.1 Background and Theory

21.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and explain the principles of the criminal justice system and court proceedings and our role in them.

21.2 Objectives, Principles, and Knowledge

21.2.1 Complete the reading and exercises specified below.

21.3 Health and Safety Hazards

21.3.1 N/A

21.4 Reading and Practical Exercises

21.4.1 Reading

21.4.1.1 Schmalleger, F.J., Criminal Justice: A Brief Introduction. Ninth Edition, Prentice Hall:New Jersey, 2011 (paperback).

21.4.1.2 Matson, J.V., Effective Expert Witnessing. Second Edition, Lewis Publishers:Boca Raton, 1994.

21.4.1.3 Kurmack, N.T., Legal Aspects of Forensic Science – Chapter 1, pp. 1-27. in: Forensic Science Handbook, Volume I, Saferstein, R. ed, Prentice-Hall:New Jersey, 1982.

21.4.1.4 Freckelton, I., Legal Aspects of Forensic Science. pp. 1099 – 1102. in: Encyclopedia of Forensic Sciences, Volume 4, Siegel, J.A., Saukko, P.J. and Knupfer, G.C. editors, Academic Press: San Diego, 2000.

21.4.2 Exercises

21.4.2.1 The Trainee must possess a practical understanding of the major branches of US federal and state government.

21.4.2.2 The Trainee must describe which two branches of the US government have the authority to define what a crime is. Describe how the processes for each branch differ.

21.4.2.3 The Trainee must be aware of which branch of US government law enforcement falls under.

21.4.2.4 The Trainee must possess a practical understanding of the organizational structure of the criminal justice system.

21.4.2.5 Describe the difference between being charged with an infraction, misdemeanor, or felony type offense.

21.4.2.6 Describe the differences between criminal and civil proceedings, including how the evidence is evaluated.

21.4.2.7 What are the three ways that a person can be charged with a criminal offense? Discuss the differences.

21.4.2.8 Describe the subpoena process. What is the purpose of a subpoena? What do the words "duces tecum" mean when added to the subpoena?

21.4.2.9 Describe the Discovery Process. What does the Discovery Process hope to prevent?

21.4.2.10 Define the following terms:

- 21.4.2.10.1 Plaintiff
- 21.4.2.10.2 Defendant
- 21.4.2.10.3 Counsel

21.4.2.11 Discuss who has the burden of proof: the plaintiff or defendant.

21.4.2.12 Describe the role and functions of the following criminal justice system components:

- 21.4.2.12.1 Judge
- 21.4.2.12.2 Prosecutor
- 21.4.2.12.3 Defense Attorney
- 21.4.2.12.4 Expert Witness
- 21.4.2.12.5 Jury
- 21.4.2.12.6 Bailiff
- 21.4.2.12.7 Court Reporter

21.4.2.13 Discuss the following questions:

- 21.4.2.13.1 What is a deposition?
- 21.4.2.13.2 What are the key differences between a bench trial versus a jury trial?

21.4.2.14 Describe the steps or events that take place in the course of a trial.

21.4.2.15 Discuss the difference between direct, cross and rebuttal testimony.

21.4.2.16 Answer the following questions:

- 21.4.2.16.1 What does it mean when the analyst's qualifications are stipulated to?
- 21.4.2.16.2 What objections are made by attorneys during a trial?
- 21.4.2.16.3 What is the difference between an objection being sustained versus overruled?

21.4.2.16.4 Describe how an analyst is qualified to testify as an expert witness. What is voir dire as it relates to the testimony of an expert witness?

21.4.2.16.5 Describe possible outcomes of the trial process.

21.4.2.16.6 Discuss the ramifications of Daubert v. Merrell Dow Pharmaceutical and Frye v. United States.

21.4.2.16.7 List the factors that help assure a scientific testing procedure is established as reliable.

# 22.0 Drugged Driving Laws in Idaho

22.1 Background and Theory

22.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and explain the principles of the Idaho codes regarding impaired driving.

22.2 Objectives, Principles, and Knowledge

22.2.1 Complete the reading and exercises specified below.

22.3 Health and Safety Hazards

22.3.1 N/A

22.4 Reading and Practical Exercises

22.4.1 Reading

22.4.1.1 Idaho Code §18-8002, §18-8004 and §18-8006.

22.4.2 Exercises

22.4.2.1 For Idaho Code §18-8002A, Define the following terms and answer the question:

22.4.2.1.1 "Actual physical control"

22.4.2.1.2 "Administrative hearing"

22.4.2.1.3 "Evidentiary testing"

22.4.2.1.4 What happens if evidentiary testing is refused or not properly completed?

22.4.2.1.5 What is the role of the administrative hearing officer?

22.4.2.2 For Idaho Code §18-8004, answer the following:

22.4.2.2.1 Describe what the code defines as unlawful.

22.4.2.2.2 What additional information does the code allow to be considered when a person's ethanol concentration is less than 0.08 (g/100cc blood, g/210L breath or 67mL urine).

22.4.2.3 For Idaho Code §18-8006, what does it describe as "aggravated driving while under the influence of alcohol, drugs or any other intoxicating substances"?

# 23.0 Fundamentals of Standardized Field Sobriety Tests (SFST's)

23.1 Background and Theory

23.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and explain what SFST's are, which tests are administered and what the results of the testing mean.

23.2 Objectives, Principles, and Knowledge

23.2.1 Complete the exercises specified below.

23.3 Health and Safety Hazards

23.3.1 N/A

23.4 Reading and Practical Exercises

23.4.1 Exercises

23.4.1.1 Describe the origins of the Standardized Field Sobriety Testing (SFSTs).

23.4.1.2 What are the phases of Standardized Field Sobriety Tests? What information does each phase provide? Describe what driving behaviors may indicate impaired driving.

23.4.1.3 Describe the process for administering the last phase of SFSTs.

# 24.0 Fundamentals of Drug Evaluation and Classification (DEC) Program

24.1 Background and Theory

24.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand and explain what the DEC program is, who administers the evaluations and what the results of those evaluations can indicate.

24.2 Objectives, Principles, and Knowledge

24.2.1 Complete the reading and exercises specified below.

24.3 Health and Safety Hazards

24.3.1 N/A

24.4 Reading and Practical Exercises

24.4.1 Reading

24.4.1.1 Kunsman, G.W. Human Performance Toxicology. pp. 15 - 30, in: Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, AACC, 2003 or more recent version.

24.4.1.2 Page, T.E., The Classification of Drugs by Category. pp. 1 - 12, in: Medical-Legal Aspects of Drugs, Second Edition, Burns, M. ed., Tucson: Lawyers & Judges Publishing Co., Inc., 2007.

24.4.2 Exercises

24.4.2.1 Describe the origins of the Drug Evaluation and Classification (DEC) Program.

24.4.2.2 Describe each step of the physiological and psychomotor test protocols that an officer trained in the DEC program administers to a person suspected of driving impaired. What is this officer referred to as?

24.4.2.3 Describe each of the DEC program drug categories. What is the basis of these categories?

24.4.2.4 Provide examples of the major types of drugs that fall under each of the DEC program categories.

24.4.2.5 Describe the physiological responses consistent with each of the drug categories.

24.4.2.6 Describe the psychomotor test performance consistent with each of the drug categories.

24.4.2.7 Can the DEC Program differentiate between methamphetamine and cocaine use? Do methamphetamine and marijuana abuse share any physiological indicators?

24.4.2.8 What is a "Medical Rule Out"? What does it hope to prevent?

24.4.2.9 Describe the four types of poly-drug use considered by the DEC Program.

24.4.2.10 What are the three "S's" used by the DEC program to illustrate how effects of a particular drug category can vary? Describe the factors that influence each "S."

# 25.0 General Preparation and Presentation of Courtroom Testimony

25.1 Background and Theory

25.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to provide a forensic analyst Trainee with the necessary information to be able to understand the proper attire and demeanor for testifying in a courtroom.

25.2 Objectives, Principles, and Knowledge

25.2.1 Complete the reading and exercises specified below.

25.3 Health and Safety Hazards

25.3.1 N/A

25.4 Reading and Practical Exercises

25.4.1 Reading

25.4.1.1 Weingarten, H. The Expert Witness: the Toxicologist in Court. pp. 225- 242, in: California Association of Toxicologists (CAT) Manual for Analytical Toxicology Training, 1994.

25.4.1.2 Sannito, T. Nonverbal Communication in the Courtroom. Champion, Sept.-Oct., 1985.

25.4.2 Exercises

25.4.2.1 The Trainee must discuss proper demeanor and body language while testifying in court.

25.4.2.2 The Trainee must describe proper attire for court.

25.4.2.3 The Trainee must discuss ways to deal with nervousness while testifying.

25.4.2.4 The Trainee must describe how a casefile must be reviewed in preparation for testimony.

# 26.0 Mock Courtroom Testimony Requirements

26.1 Background and Theory

26.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to allow the Trainee to demonstrate their ability to testify in a court proceeding.

26.2 Objectives, Principles, and Knowledge

26.2.1 Complete the exercises specified below.

26.3 Health and Safety Hazards

26.3.1 N/A

26.4 Reading and Practical Exercises

26.4.1 Exercises

26.4.1.1 A mock court must be conducted to provide testimony for a minimum of one DUID case with pharmacology questions.

26.4.1.2 During the mock court, the Trainee may be asked how they would explain the following to a jury (note: not all topics may be covered as some will not pertain):

26.4.1.2.1 Our laboratory accreditation
26.4.1.2.2 How a sample is received
26.4.1.2.3 How the sample is initially examined
26.4.1.2.4 EIA Screen
26.4.1.2.5 Sample Preparation
26.4.1.2.6 Instrumentation used for confirmatory testing
26.4.1.2.7 The review process
26.4.1.2.8 Quantitation and the uncertainty associated with the values
26.4.1.2.9 The intended use of the drug(s) detected
26.4.1.2.10 The side effects of the drug(s) detected
26.4.1.2.11 DEC/DRE categories and Indicators
26.4.1.2.12 Neurotransmission
26.4.1.2.13 Pharmacology
26.4.1.2.14 Pharmacodynamics
26.4.1.2.15 Pharmacokinetics
26.4.1.2.16 Half-life

26.4.1.2.17 Onset of action
26.4.1.2.18 Duration of action
26.4.1.2.19 Types of Tolerance

# 27.0 Analysis of Practice Samples

27.1 Background and Theory

27.1.1 This section of the Idaho State Police Forensic Services (ISP-FS) toxicology training plan is designed to allow the Trainee to demonstrate their ability to perform the analytical methods, data analysis and/or reporting of compounds.

27.2 Objectives, Principles, and Knowledge

27.2.1 The Trainee will demonstrate the ability to do the necessary tasks for the methods they are to be performing.

27.3 Health and Safety Hazards

27.3.1 Gloves, lab coats and safety glasses or goggles should be worn while working in the laboratory.

27.3.2 Universal precautions should be taken when working with biological samples.

27.4 Reading and Practical Exercises

27.4.1 To develop their expertise in using analytical methods, the Trainee will apply them to the analysis of control samples, old proficiency test samples and/or training samples. These training samples may be obtained in the following way: A forensic scientist assigned to a case may take an additional sample from casework that the Trainee may analyze for training purposes. The sample may only be taken if the reserve after removing the training sample is greater than ½ (½ meaning: ½ of the total sample of that type submitted. For example, if two grey top blood tubes are submitted it would be half of the total blood in the two tubes. If a purple and a grey top tube are submitted, it would be the ½ of the volume of the blood in each of the tube types submitted). In addition the Trainee may, under the direct observation of a competent analyst, handle case samples. The Trainer will make all conclusions and must be present and observe all aspects of the work (the Trainee works as the "hands of the Trainer"). All evidence in the "hands of the Trainer" process will be checked out by the Trainer and the chain of custody shall be maintained in the name of the Trainer/trained analyst. Examination reports shall be based solely on examinations

performed by or directly observed by approved analysts. The report will be issued by the Trainer/trained analyst. If any evaluations or interpretations for casework are done by the Trainee, the Trainee must initial the examination record for the work performed and the Trainer/trained analyst must confirm observations and conclusions by initialing or signing each page of the examination records. The number and type of practice samples will be at the discretion of the Trainer and the Trainee. When both parties are comfortable with the Trainee's proficiency and understanding of the methods, this section can be signed off.

27.4.2 For the purposes of this training module, data may also be considered practice samples.

# 28.0 Competency Testing

28.1 Background and Theory

28.1.1 Upon the completion of training plan sections, the Trainee must complete a competency test consisting of 6 or more specimens. The number of samples will be decided by the Trainer and Technical Lead. The specimens must contain representative commonly encountered parent drug and drug metabolites. The competency test samples will be logged in and handled like regular evidence. Reports and restitution requests will be prepared just as a regular case would be handled. Competency tests logged into ILIMS will be handled like a regular case, administrative and technical review will be completed. The Trainer will evaluate all aspects of how the case is handled and reported, not only that the appropriated answers were obtained.

28.2 Objectives, Principles, and Knowledge

28.2.1 The Trainee will demonstrate that they are able to perform all the duties associated with processing case samples.

28.3 Health and Safety Hazards

28.3.1 Gloves, lab coats and safety glasses or goggles should be worn while working in the laboratory.

28.3.2 Universal precautions should be taken when working with biological samples.

28.4 Reading and Practical Exercises

28.4.1 To demonstrate that the Trainee is ready to perform supervised casework, they must complete a competency test. In order for the test to be evaluated as passing, the Trainee must get a 100%, meaning that they correctly identify all of the compounds that are present and not report any compounds that are not. The Trainer and/or Technical Lead will evaluate the test to determine if the results obtained are appropriate. If a drug is not confirmed but is noted and a reason for not confirming given, it will be up to the individual grading the test to determine if the analyst's assessment was correct.

# 29.0 Technical and Administrative Review

29.1 Background and Theory

29.1.1 Upon completion of supervised casework, the analyst will have the opportunity to begin performing case reviews on the methods they are approved in.

29.2 Objectives, Principles, and Knowledge

29.2.1 Complete the exercises below.

29.3 Health and Safety Hazards

29.3.1 N/A

29.4 Reading and Practical Exercises

29.4.1 After the analyst has completed training in blood or urine toxicology they may begin training for technical and administrative review sign off in the appropriate discipline.

29.4.2 The Trainer will demonstrate for the Trainee how the technical and administrative review is done and what documents must be reviewed. It is recommended that the Trainee develop a checklist to use when first starting technical and administrative review.

29.4.3 The Trainee will perform technical and administrative review on a minimum of 50 cases. All aspects of the review (chain of custody, central files, data review, etc.) will be completed. Any errors caught will be recorded and reported to the Trainer. The Trainee will not sign off on the cases but instead the cases will then be reviewed by an approved reviewer.

# 30.0 Supervised Casework

30.1 Background and Theory

30.1.1 After completing the appropriate training modules (including competency testing and mock court) the Trainee will be permitted to do supervised casework.

30.2 Objectives, Principles, and Knowledge

30.2.1 The Trainee will demonstrate that they are able to perform all the duties associated with processing case samples.

30.3 Health and Safety Hazards

30.3.1 Gloves, lab coats and safety glasses or goggles should be worn while working in the laboratory.

30.3.2 Universal precautions should be taken when working with biological samples.

30.4 Reading and Practical Exercises

30.4.1 The number of supervised cases will be determined by the Trainer and Technical Leader on a case by case basis. After the completion of the stated number of supervised cases, the Trainer and/or Technical Lead will decide if more cases are necessary before the Trainee is signed off to do independent casework.

# APPENDIX A

It is expected that analysts will progress at different rates based on past experience; education and that people learn and retain skills differently. The following are general guidelines for the Trainer to consider when assigning, evaluating and signing off on the practice casework section of the toxicology training manual.

The Trainee will practice each extraction method on controls, old proficiency tests and aliquots taken from casework, when feasible.

The Trainee will generally practice with samples to learn the extraction process and then the Trainee will do practice runs that consist of multiple extraction processes. The Trainee will most likely need to run between 50 and 100 samples to demonstrate competence. In addition, the Trainee should perform data analysis on past runs that are still stored on the computers.

The Trainer should observe the Trainee preparing multiple runs. During this observation the Trainer will confirm that the Trainee is:

-Handling the samples with care and in a way that ensures the samples don't get placed in the wrong tube at any time during the examination process.
-Using appropriate techniques to prevent contamination.

The Trainee should act as the hands of the analyst for at least one run and demonstrate that: they are checking the names on the sample container(s) to make sure they match the name entered into the ILIMS system, they are correctly labeling the container(s), they understand how to document the condition of the evidence and describe it in notes, store evidence during the examination process and seal it after analysis.

The Trainee will demonstrate that they store and handle controls and standards appropriately.

The Trainee will be able to perform the routine maintenance and perform and evaluate the quality checks that are required for all of the instrumentation he or she is approved to use.

The Trainee will demonstrate that he or she is comfortable operating the instrumentation and can do basic trouble shooting.

If appropriate for the method(s), the Trainee will demonstrate a solid understanding and comfort level determining when a weak analyte meets the criteria for identification.

The Trainee will demonstrate performance on multiple runs with no need for assistance from the Trainer and with expected efficiencies on the extractions.

If appropriate for the method(s), the Trainee will demonstrate the understanding and the ability to hydrolyze samples, what may prevent this process from working and how to determine this part of the analysis worked.

If appropriate for the method(s), the Trainee will demonstrate the ability to derivatize samples, understand what problems may occur and how to evaluate that in an analysis run.

The Trainee will demonstrate the understanding of which extraction process to run first on samples and which detected analytes should be confirmed.

The Trainee will demonstrate the understanding of when the officer or prosecutor should be consulted on casework decisions.