

# *Idaho State Police*

## *Forensic Services*

### *Approval for Quality System Controlled Documents*



Discipline/Name of Document: Toxicology Training Manual  
Section One – Blood and Urine

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Quality Manager

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Date Signed

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**Section One**

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**Detection of Drugs in Blood and Urine Toxicology**

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- 1.1 Training Objectives
- 1.2 Administrative Issues
- 1.3 Evidence Handling
- 1.4 Balance Operation
- 1.5 Solution Preparation
- 1.6 Enzyme Immunoassay
- 1.7 Thin Layer Chromatography
- 1.8 Liquid-Liquid Extraction
- 1.9 Solid Phase Extraction
- 1.10 Gas Chromatography
- 1.11 Mass Spectrometry
- 1.12 Instrumentation
- 1.13 Casefile Preparation
- 1.14 Basic Pharmacology and Drug Metabolism
- 1.15 Preparation and Presentation of Courtroom Testimony
- 1.16 Mock Courtroom Testimony
- 1.17 Competency Testing
- 1.18 Performance of Analysis on Case Material
- 1.19 Analytical Method Sign-off

## Section One

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### Detection of Drugs in Blood and Urine

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#### 1.1 TRAINING OBJECTIVES

This section of the toxicology training plan is designed as a guide to provide a forensic Trainee with the background necessary to process blood and urine specimens to detect and confirm the presence of drug compounds other than ethanol. This plan addresses each of the various stages of sample processing, from the initial sample checkout to screening, confirmation and finally report generation. To properly 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.

The Required Reading cited, or equivalent, must be consulted if the Trainee is not familiar with the subject matter. Answers to questions may be provided verbally and/or in written form. Training for all Analytical Methods does not have to be pursued concurrently. In addition, it is not necessary to complete the entire training manual at one time, only the sections that apply to a particular Analytical Method. If a Trainee has been previously signed off on either blood or urine analysis, when training to include the other matrix is pursued, only a brief review of topics is necessary for sign-off.

#### 1.2 ADMINISTRATIVE ISSUES

- 1.2.1 The Trainee must be familiar with the Idaho State Police Policies Manual.
- 1.2.2 The Trainee must be knowledgeable of the content and application of the Forensic Services Quality Manual.
- 1.2.3 The Trainee must be well informed in the content and application of the Forensic Services Health and Safety Manual.
- 1.2.4 Required Reading  
Above referenced manuals.

#### 1.3 EVIDENCE HANDLING

- 1.3.1 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.
- 1.3.2 The Trainee must describe the barrier protection measures required when handling biological samples.
- 1.3.3 The Trainee must describe the types and applications of the toxicology collection kits distributed by ISP-FS.

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

1.3.5 Required Reading

1. Kippenberger, D.J. and Selavka, C.M. *Training in Specimen Handling*. pp. 33-54, in: California Association of Toxicologists (CAT) Manual for Analytical Toxicology, 1994.

**1.4 BALANCE OPERATION**

1.4.1 The trainee should be familiar with the operation of any analytical or top-loading balances used to prepare toxicology solutions and reference material.

1.4.2 Describe the basic steps involved in the weighing of a material.

1.4.3 Required Reading

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

**1.5 SOLUTION PREPARATION**

1.5.1 Basic Chemical Calculations and Nomenclature

Define the following terms and address the questions.

1.5.1.1 *Solute*

1.5.1.2 *Solvent*

1.5.1.3 *Mole*

1.5.1.4 *If you have the weight of a substance, how is the number of moles calculated?*

1.5.1.5 *Molarity (M)*

1.5.1.6 *How many moles per liter are in a 2M solution?*

1.5.1.7 *Normality (N)*

1.5.1.8 *How many equivalents in a 2N solution?*

1.5.1.9 *Weight per Volume Percent (%w/v)*

1.5.1.10 *Weight per Weight Percent (%w/w)*

1.5.2 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.

1.5.3 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.

1.5.3 Required Reading

1. Shugar, J., Shugar, R.A. and Bauman, L. *Chemical Technicians' Ready Reference Handbook*. pp. 127-139 and 145-154, New York: McGraw-Hill, 1973.

2. 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.
3. Operation Manual for pH Meter.

## 1.6 ENZYME IMMUNOASSAY (EIA)

- 1.6.1 The trainee must demonstrate a working knowledge of theory of ELISA analysis as it relates to EIA.
- 1.6.2 The trainee must define the following terms as they related to EIA:
  - 1.6.2.1 *Enzyme*
  - 1.6.2.2 *Antigen*
  - 1.6.2.3 *Antibody*
  - 1.6.2.4 *Hapten*
  - 1.6.2.5 *Cross-reactivity*
  - 1.6.2.6 *Antigenic Determinant*
- 1.6.3 Required Reading
  1. Sections Covering *Immunoassay and ELISA* pp. 34-35, 117-137, 202-203, 236-239, 256-260, *in*: Principles of Forensic Toxicology. Second Edition, Levine, B. ed., AACC,2003.
  2. Analytical Method 10 Enzyme Immunoassay Screening for Drugs of Abuse
  3. Spiehler, V. *Immunoassays in Toxicology*. pp. 55-98, *in*: California Association of Toxicologists (CAT) Manual for Analytical Toxicology, 1994.
  4. 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.
  5. *Enzymatic Labeling and Detection* – Technical section providing by STC Technologies description of enzyme utilized for STC micro-plate assay.
  6. Perrigo, B.J. and Joynt, B.P. *Use of ELISA for the Detection of Common Drugs of Abuse in Forensic Whole Blood Samples*. Can. Soc. Forens. Sci. J., **28 (4)**:261-269,1995.
  7. Williamson, S.C. *Enzyme Immunoassay Techniques*. Graduate presentation for Biopharmaceutical Analysis II, September 1994.
  8. 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.

**1.7 THIN LAYER CHROMATOGRAPHY (TLC) (*Urine Only*)**

- 1.7.1 The trainee must be well versed in the theory of thin layer chromatography.
- 1.7.2 Define the following terms as they relate to TLC:
- 1.7.2.1 *Capillary Action*
  - 1.7.2.2 *Stationary and Mobile phases*
  - 1.7.2.3 *R<sub>f</sub>-Retardation/Retention Factor*
  - 1.7.2.4 *Elution/Developing Solvent*
  - 1.7.2.5 *Partition Coefficients (K<sub>a</sub>, K)*
  - 1.7.2.6 *Visualization Techniques*
- 1.7.3 Discuss the distribution of drug compounds between the stationary and mobile phases.
- 1.7.4 Describe factors which affect TLC separations.
- 1.7.5 Required Reading
1. Sections Covering *Thin Layer Chromatography*, pp. 90, 96-97, 237, 256. *in*: Principles of Forensic Toxicology. Second Ed., Levine, B. ed., AACC, 2003.
  2. Branum, G.D. *Thin Layer Chromatography*. pp. 99-124, *in*: California Association of Toxicologists (CAT) Manual for Analytical Toxicology Training, 1994.
  3. Poole, C.F. *Thin Layer Chromatography*. pp. 392-424, *in*: Clarke's Analysis of Drugs and Poisons. Third Ed. Moffat, A.C., Ed, London: The Pharmaceutical Press, 2004.
  4. Hearn, W.L. and Walls, H.C. Common Methods in Post-Mortem Toxicology. pp. 999-1000, *in*: Drug Abuse Handbook. Second Edition, Karch, S.B. ed., Boca Raton: CRC Press, 2007.
  5. Toxi-Lab<sup>®</sup> THC II Instruction Manual, ©1998.
  6. Toxi-Lab<sup>®</sup> THC II-PLUS Instruction Manual, ©1998.
  7. Toxi-Lab<sup>®</sup> TOXI-A Drug Detection System Instruction Manual, ©1989.
  8. Toxi-Lab<sup>®</sup> TOXI-B Drug Detection System Instruction Manual, ©1989.

**1.8 LIQUID-LIQUID EXTRACTION**

- 1.8.1 The trainee must be well versed in the principles involved with liquid-liquid extraction.
- 1.8.2 Describe the properties that are involved in a solvent's ability to extract a particular analyte.
- 1.8.3 Describe the following processes as they relate to liquid-liquid extraction:
- 1.8.3.1 *Basic Extraction*
  - 1.8.3.2 *Acidic Extraction*
  - 1.8.3.3 *Buffering – Why are different pHs required for different methods?*
- 1.8.4 Required Reading
1. Sections Covering *Liquid-liquid Extraction*. pp. 71-76, 180, 184-185, 202, 217. *in: Principles of Forensic Toxicology*, Levine, B. ed., AACC, 2003.
  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.
  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.

**1.9 SOLID PHASE EXTRACTION (SPE)**

- 1.9.1 The trainee must be knowledgeable about the principles involved with solid phase extraction (SPE).
- 1.9.2 Describe the advantages of SPE over liquid-liquid extraction methods.
- 1.9.3 Discuss Van der Waal Forces as they relate to SPE.
- 1.9.4 Discuss the sorbent options for SPE columns in regards to the types available, their target compounds and the interactions which they participate in.
- 1.9.5 Discuss the six typical steps involved in a SPE procedure.
- 1.9.6 Discuss how to prepare the sample for optimum analyte retention on a particular SPE column.
- 1.9.7 Required Reading

1. Sections Covering *Solid Phase Extraction*. pp. 76-78, 180, 185, 202, 217. in: *Principles of Forensic Toxicology*. Second Edition, Levine, B. ed., AACC, 2003.
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.
3. Platoff, G.E. and Gere, J.A. *Solid Phase Extraction of Abused Drugs from Urine*. *Forensic Science Review*. **3(2)**:119-132. 1991.
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.
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.
6. Hearne, G.M and Hall, D.O. *Advances in Solid-Phase Extraction Technology*. American Laboratory, January 1993.
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.

## 1.10 GAS CHROMATOGRAPHY (GC)

- 1.10.1 The trainee must have comprehensive background in the principles of GC.
- 1.10.2 Describe how a FID and a NPD detector work.
- 1.10.3 Compare the sensitivities of the FID and the NPD.
- 1.10.4 Describe the influence carrier gas flow has on the efficiency of a GC.
- 1.10.5 Define the following terms as they relate to GC.
  - 1.10.4.1 *Resolution*
  - 1.10.4.2 *Area Under the Curve*
  - 1.10.4.3 *HETP*
  - 1.10.4.4 *Signal to Noise Ratio*
- 1.10.6 For Quantitative GC discuss the following:
  - 1.10.6.1 Limit of Detection (LOD)
  - 1.10.6.2 Limit of Quantitation (LOQ)



- 1.10.7 Discuss which GC parameters affect resolution. Describe how to approach a lack of resolution.
- 1.10.8 Discuss how to alleviate peak tailing.
- 1.10.9 The trainee must possess an understanding of the principles and application of quantitative analysis.
- 1.10.10 Describe the major advantages of using an internal standard.
- 1.10.11 Required Reading
1. Sections Covering *Gas Chromatography*. pp. refer to index, *in: Principles of Forensic Toxicology*. Levine, B. ed., AACC, 1998.
  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.
  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.
  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.

## 1.11 MASS SPECTROMETRY

- 1.11.1 The trainee must have a working knowledge of the theory of mass spectrometry and the application of a mass selective detector.
- 1.11.2 Describe the ionization process.
- 1.11.3 Discuss the differences between SIM and Full-scan acquisition of data.
- 1.11.4 Discuss the advantages of derivatizing drug compounds.
- 1.11.5 Evaluate an Autotune report.
- 1.11.6 Required Reading
1. Sections Covering *Mass Spectrometry*. pp. refer to index, *in: Principles of Forensic Toxicology*. Levine, B. ed., AACC, 2003.
  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.

3. Foltz, R.L. *Mass Spectrometry*. pp. 159-190, *in*: California Association of Toxicologists (CAT) Manual for Analytical Toxicology Training. 1994.
4. Smith, R.M. *Understanding Mass Spectra*. New York: John Wiley & Sons, Inc., 1998 (or newer version).
5. Watson, D. *Mass Spectrometry*. pp. 379-391, *in*: Clarke's Analysis of Drugs and Poisons. Third Ed. Moffat, A.C., Ed, London: The Pharmaceutical Press, 2004.
6. Hearn, W.L. and Walls, H.C. *Common Methods in Post-Mortem Toxicology*. pp. 1002-1003, *in*: Drug Abuse Handbook. Second Edition, Karch, S.B. ed., Boca Raton: CRC Press, 2007.
7. Hearn, W.L. and Druid, H. *Strategies for Post-mortem Toxicology Investigation*, pp. 1033-1042, *in*: Drug Abuse Handbook, Second Edition, Karch, S.B. ed., Boca Raton: CRC Press, 2007.

## 1.12 INSTRUMENTATION

### 1.12.1 Gas Chromatograph

#### 1.12.1.1 **Flame Ionization Detector**

The trainee must demonstrate their ability to operate and maintain a gas chromatograph (GC) equipped with a Flame Ionization Detector (FID). This includes a thorough understanding of the system's software, inlet and detector maintenance, column installation, and troubleshooting techniques.

#### 1.12.1.2 **Nitrogen Phosphorus Detector**

The trainee must demonstrate their ability to operate and maintain a GC equipped with a Nitrogen Phosphorus Detector (NPD). This includes a thorough understanding of the system's software, inlet and detector maintenance, column installation, and troubleshooting techniques.

#### 1.12.1.3 **Mass Selective Detector**

The trainee must demonstrate their ability to operate a GC equipped with a Mass Selective Detector. This includes a thorough understanding of the system's software and troubleshooting techniques. The maintenance that is to be performed on the GC/MSD including the injection port, ion source, vacuum pump, and column must be discussed in detail.

## 1.13 CASEFILE PREPARATION

- 1.13.1 The Trainee must describe which documents, data and completed worksheets are required to be included in an alcohol/other volatiles analysis casefile.

- 1.13.2 The Trainee must describe the worksheets and data that are to be compiled for a centrally stored QA file for each analysis run.
- 1.13.3 The Trainee must describe requirements for administrative and technical review of casefile and analysis report.

#### 1.14 BASIC PHARMACOLOGY AND DRUG METABOLISM

- 1.14.1 The trainee must possess a basic understanding of the principles of pharmacology as they relate to drugs-of-abuse and drug compounds, which impair driving ability.
- 1.14.2 Define the following terms:
  - 1.14.2.1 *Pharmacology*
  - 1.14.2.2 *Pharmacokinetics*
  - 1.14.2.3 *Pharmacodynamics*
- 1.14.3 Discuss the factors that influence the metabolism of drugs.
- 1.14.4 List the major metabolites for the following representative compounds. Indicate which metabolites are psychoactive.
  - 1.14.4.1 *Methamphetamine.*
  - 1.14.4.2 *Cocaine alone and in combination with alcohol.*
  - 1.14.4.3 *Diazepam*
  - 1.14.4.4 *Clonazepam*
  - 1.14.4.5 *Alprazolam*
  - 1.14.4.6 *Flunitrazepam*
  - 1.14.4.7 *Carisoprodol*
  - 1.14.4.8 *Heroin*
  - 1.14.4.9 *Codeine*
  - 1.14.4.10  *$\Delta^9$ -THC*
  - 1.14.4.11 *Imipramine*
  - 1.14.4.12 *Amitriptyline*
  - 1.14.4.13 *Propoxyphene*
  - 1.14.4.14 *Tramadol*
- 1.14.5 Characterize phase I and II drug metabolism.
- 1.14.6 The metabolism of 1,4-Benzodiazepine, Diazepam, yields several metabolites which in turn undergo biotransformation. Indicate which compounds result in each case:
  - 1.14.6.1 *N-dealkylation (P450 mediated)*
  - 1.14.6.2 *Hydroxylation (P450)*
  - 1.14.6.3 *Glucuronidation*
- 1.14.7 The metabolism of Codeine yields several metabolites. Indicate which compounds result in each case:
  - 1.14.7.1 *O-dealkylation (P450 mediated)*

- 1.14.7.2 *N-dealkylation (P450)*
- 1.14.7.3 *Glucuronidation*
- 1.14.8 The metabolism of Methamphetamine yields several metabolites. Indicate which compounds result in each case:
- 1.14.8.1 *N-dealkylation (P450)*
- 1.14.8.2 *Oxidative Deamination (P450)*
- 1.14.8.3 *Aromatic Hydroxylation (P450)*
- 1.14.9 List compounds that yield methamphetamine as a metabolite.
- 1.14.10 The metabolism of Cocaine yields several metabolites. Indicate which compounds result in each case:
- 1.14.10.1 *N-dealkylation (P450)*
- 1.14.10.2 *Transesterification with alcohol (Esterase)*
- 1.14.10.3 *Ester Hydrolysis mediated by Esterases (two compounds)*
- 1.14.10.4 *Aromatic Hydroxylation (P450)*
- 1.14.11 Define the following terms in regard to drug metabolism:
- 1.14.11.1 *First pass effect*
- 1.14.11.2 *Half-life*
- 1.14.11.3 *Zero and first-order reactions*
- 1.14.12 Give two examples of commonly encountered compounds that form glucuronide conjugates in phase II.
- 1.14.13 Describe the potential modes of excretion for drug compounds.
- 1.14.14 Describe how urinary pH will affect urinary methamphetamine concentration.
- 1.14.15 Required Reading
1. Spiehler, V. and Levine, B., *Pharmacokinetics and Pharmacodynamics*. pp. 46-66, *in: Principles of Forensic Toxicology*, edited by Barry Levin, AACC, 1999.
  2. Isenschmid, D.S. *Cocaine*. pp. 221-245, *in: Principles of Forensic Toxicology*, edited by Barry Levin, AACC, 1999.
  3. Huestis, M.A. *Marijuana*. pp. 246-264, *in: Principles of Forensic Toxicology*, edited by Barry Levin, AACC, 1999.
  4. Moore, Karla. *Amphetamine/Sympathomimetic Amines*. pp. 221-245, *in: Principles of Forensic Toxicology*, edited by Barry Levin, AACC, 1999.
  5. Kerrigan, S. and Goldberger, B.A. *Opioids*. pp. 202-220, *in: Principles of Forensic Toxicology*, edited by Barry Levin, AACC, 1999.

6. Clarke's Analysis of Drugs and Poisons. Third Edition. Moffat, A.C., Ed, London: The Pharmaceutical Press. 2004.
7. Julien,R.M., *Principles of Drug Action*. in: Primer of Drug Action, pp. 1-39, Freeman-New York, 1998.
8. Benet, L.Z., Kroetz, D.L. and Sheiner, L.B., *Pharmacokinetics: The Dynamics of Drug Absorption, Distribution and Elimination*. pp. 3-28, in: Goodman and Gilman's The Pharmacological Basis of Therapeutics, New York:McGraw-Hill, Most current edition available.
9. Baselt, R.C. *Disposition of Toxic Drugs and Chemicals in Man*. Seventh Edition. Foster City:Biomedical Publications, 2004.
10. Baselt, R.C. *Drug Effects on Psychomotor Performance*. Foster City:Biomedical Publications, 2001.

#### 1.15 COURTROOM TESTIMONY

- 1.15.1 The Trainee must discuss proper demeanor and body language while testifying in court.
- 1.15.2 The Trainee must describe proper attire for court.
- 1.15.3 The Trainee must discuss ways to deal with nervousness while testifying.
- 1.15.4 The Trainee must describe how a casefile must be reviewed in preparation for testimony.
- 1.15.5 The Trainee must describe the typical sequence of questions pursued during direct and cross-examination.
- 1.15.6 The Trainee must discuss the implications of the following events:
  - 1.16.6.1 Stipulation
  - 1.16.6.2 Objection Over-ruled
  - 1.16.6.3 Objection Sustained
- 1.15.7 The Trainee must discuss sections of Idaho Code where the analysis of biological or unknown samples could be applied.
- 1.15.8 Required Reading
  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.

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

3. Idaho Code §18-8002, §18-8004, §18-8006, §23-1333. §37- 2732C, §33-210.

#### 1.16 **MOCK COURTROOM TESTIMONY**

As appropriate for the SOP(s) the Trainee is training for, conduct a mock court trial for the Trainee to provide testimony for a minimum of the following situations.

1. DUID case with pharmacology questions.
2. Probation violation case with drug detection time questions.

#### 1.17 **COMPETENCY TESTING FOR DRUG TOXICOLOGY**

Upon the completion of training, the trainee must complete a competency test consisting of  $\geq$ six (6) specimens. The specimens must contain representative commonly encountered parent drug and drug metabolites.

#### 1.18 **PERFORMANCE OF ANALYSIS ON CASE MATERIAL**

- 1.18.1 Upon successful completion of competency testing, the trainee is required to analyze casework under close supervision.
- 1.18.2 For the discipline of Toxicology, successful completion of competency testing is required prior to closely supervised analysis of case material.
- 1.18.3 Reports for supervised analysis will be cosigned by the trainer..
- 1.18.4 Upon completion of required number of case samples and associated paperwork, the trainee can begin unsupervised casework.
- 1.18.5 Supervised Analysis Case Sample Requirements
  - 1.18.5.1 **Urine Drug Toxicology**  
A minimum of 72 case samples.
  - 1.18.5.2 **Blood Drug Toxicology**  
A minimum of 50 case samples.

#### 1.19 **ANALYTICAL METHODS**

Refer to method sign-off section for specific analytical methods to be addressed for the following:

- 1.19.1 The trainee must fully describe the steps involved in the analysis procedure.
- 1.19.2 Trainee must describe the quality assurance requirements described in the Analytical Method.

- 1.19.3 Trainee must describe the acceptance criteria for an analysis run.
- 1.19.4 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.
- 1.19.5 Trainee must describe how quality assurance data is monitored and where it must be stored.
- 1.19.6 Trainee must describe the authentication process for reference material.

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**Training Plan Section One**

**Blood or Urine Toxicology**

**Topic Completion Sign-off**

**1.2 ADMINISTRATIVE ISSUES**

- Blood Toxicology
- Urine Toxicology

\_\_\_\_\_  
Date of Completion

\_\_\_\_\_  
Trainee

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Trainer

**1.3 EVIDENCE HANDLING ISSUES**

- Blood Toxicology
- Urine Toxicology

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Date of Completion

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Trainee

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Trainer

**1.4 BALANCE OPERATION**

- Blood Toxicology
- Urine Toxicology

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Date of Completion

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Trainee

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Trainer

**1.5 SOLUTION PREPARATION**

- Blood Toxicology
- Urine Toxicology

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Date of Completion

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Trainee

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Trainer

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**Training Plan Section One**

**Blood or Urine Toxicology**

**Topic Completion Sign-off**

**1.6 ENZYME IMMUNOASSAY (EIA) THEORY AND APPLICATION**

- Blood Toxicology
- Urine Toxicology

\_\_\_\_\_  
Date of Completion

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Trainee

\_\_\_\_\_  
Trainer

**1.7 THIN LAYER CHROMATOGRAPHY**

- Blood Toxicology
- Urine Toxicology

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Date of Completion

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Trainee

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Trainer

**1.8 LIQUID-LIQUID EXTRACTION**

- Blood Toxicology
- Urine Toxicology

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Date of Completion

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Trainee

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Trainer

**1.9 SOLID PHASE EXTRACTION**

- Blood Toxicology
- Urine Toxicology

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Date of Completion

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Trainee

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Trainer

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**Training Plan Section One**

**Blood or Urine Toxicology**

**Topic Completion Sign-off**

**1.10 GAS CHROMATOGRAPHY**

Blood Toxicology

Urine Toxicology

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Date of Completion

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Trainee

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Trainer

**1.11 MASS SPECTROMETRY**

Blood Toxicology

Urine Toxicology

\_\_\_\_\_  
Date of Completion

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Trainee

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Trainer

**1.12 INSTRUMENTATION**

Blood Toxicology

Urine Toxicology

\_\_\_\_\_  
Date of Completion

\_\_\_\_\_  
Trainee

\_\_\_\_\_  
Trainer

**1.13 CASEFILE PREPARATION**

Blood Toxicology

Urine Toxicology

\_\_\_\_\_  
Date of Completion

\_\_\_\_\_  
Trainee

\_\_\_\_\_  
Trainer

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**Training Plan Section One**

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**Blood or Urine Toxicology**

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**Topic Completion Sign-off**

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**1.14 BASIC PHARMACOLOGY AND DRUG METABOLISM**

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- Blood Toxicology
- Urine Toxicology

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Date of Completion

\_\_\_\_\_  
Trainee

\_\_\_\_\_  
Trainer

**1.15 PREPARATION AND PRESENTATION OF COURTROOM TESTIMONY**

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- Blood Toxicology
- Urine Toxicology

\_\_\_\_\_  
Date of Completion

\_\_\_\_\_  
Trainee

\_\_\_\_\_  
Trainer

**1.16 MOCK COURTROOM TESTIMONY**

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- Blood Toxicology
- Urine Toxicology

\_\_\_\_\_  
Date of Completion

\_\_\_\_\_  
Trainee

\_\_\_\_\_  
Trainer

**1.17 COMPETENCY TESTING**

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- Blood Toxicology
- Urine Toxicology

\_\_\_\_\_  
Date of Completion

\_\_\_\_\_  
Trainee

\_\_\_\_\_  
Trainer

**Training Plan Section One**

**Blood or Urine Toxicology**

**Topic Completion Sign-off**

**1.18 PERFORMANCE OF ANALYSIS ON CASE MATERIAL**

- Blood Toxicology
- Urine Toxicology

Date of Completion \_\_\_\_\_

Trainee \_\_\_\_\_

Trainer \_\_\_\_\_

**1.19 ANALYTICAL METHOD SIGN-OFF**

Section	Analytical Method	Completion Date	Trainee	Trainer
1.0	<b>Enzyme Immunoassay – Blood and Urine</b>			
<b>Urine Toxicology</b>				
2.2	<b>Thin Layer Chromatography</b>			
2.2.1	TOXI-LAB TOXI-A Drug Detection System			
2.2.2	TOXI-LAB TOXI-B Drug Detection System			
2.2.3	TOXI-LAB Amine Differentiation			
2.2.4	TOXI-LAB Carboxy-THC Detection System			
2.3	<b>Solid Phase Extraction – Qualitative Urine</b>			
2.3.4	Benzodiazepines			
2.3.6	Cocaine and Cocaine Metabolite			
2.3.8	Opiates			

Urine Toxicology				
Section	Analytical Method	Completion Date	Trainee	Trainer
<b>2.4</b>	<b>Liquid-liquid Extraction – Qualitative Urine</b>			
2.4.1	TOXI-A and TOXI-B			
2.4.2	GHB			
2.4.3	Benzodiazepines			
2.4.4	Carboxy-THC			
<b>2.5</b>	<b>Identification of Compounds in Urine</b>			
2.5.2	Criteria for Identification of Compounds			
<b>2.7</b>	<b>Solid Phase Extraction – Quantitative Urine</b>			
2.7.1	6-Monoacetylmorphine			
2.7.2	Codeine and Morphine			
<b>2.8</b>	<b>Liquid-liquid Extraction – Quantitative Urine</b>			
2.8.1	Carboxy-THC			
2.8.2	GHB			

<b>Blood Toxicology</b>				
Section	Analytical Method	Completion Date	Trainee	Trainer
<b>3.3</b>	<b>Gas Chromatographic Blood Screening</b>			
3.3.1	Basic and Neutral Drug Compounds			
3.3.2	Strongly Basic Drug Compounds			
3.3.3	Acidic and Neutral Drug Compounds			
<b>3.4</b>	<b>Solid Phase Extraction Methods for Qualitative GC/MSD</b>			
3.4.2	Selected Benzodiazepine Class Compounds			
<b>3.6</b>	<b>Liquid-liquid Extraction Methods for Qualitative GC/MSD</b>			
3.6.1	Basic and Neutral Drugs			
3.6.2	Acidic and Neutral Drugs			
3.6.7	High pKa Drugs			
<b>3.9</b>	<b>Liquid-liquid Extraction Methods for Quantitative GC</b>			
3.9.1	$\Delta^9$ -Tetrahydrocannabinol and 11-Nor- $\Delta^9$ -THC-COOH (GC-MSD)			
3.9.2	High pKa Drugs (GC-MSD and GC-NPD)			
3.9.3	Basic and Neutral Drugs (GC-MSD and GC-NPD)			
3.9.4	Acidic and Neutral Drugs (GC-MSD or GC-NPD)			

<b>Blood Toxicology</b>				
Section	Analytical Method	Completion Date	Trainee	Trainer
<b>3.10</b>	<b>Solid Phase Extraction Methods for Quantitative GC/MSD Confirmation</b>			
3.10.1	THC and Carboxy-THC			
3.10.2	Methamphetamine and Amphetamine			
3.10.3	Free (Unbound) Codeine and Morphine			
3.10.4	Cocaine and Cocaine Metabolites			
3.10.5	GHB and GHB Metabolites			
<b>Ethanol and Common Volatiles</b>				
4.1	Quantitative Analysis for Ethanol and Qualitative Analysis for Other Volatiles in Blood, Vitreous Humor and Urine by Dual Column Headspace Gas Chromatography			
4.2	Analysis of Solutions Containing Ethanol and Common Volatiles			
<b>Quality Assurance</b>				
<b>5.1</b>	<b>POVA Intermediate Checks</b>			
5.1.1	Artel Pipette Calibration System for Intermediate Checks			
5.1.2	Gravimetric Pipette Intermediate Checks			
<b>5.2</b>	<b>Verification of Balance Calibration</b>			

<b>Quality Assurance</b>				
<b>Section</b>	<b>Analytical Method</b>	<b>Completion Date</b>	<b>Trainee</b>	<b>Trainer</b>
5.7	Review of Toxicology Proficiency and Competency Tests			
5.8	Quality Assurance Measures – Urine and Blood Toxicology			
5.9	Testing Guidelines			
5.10	Authentication of Reference Materials – Urine and Blood Toxicology			
5.11	Key Ions for Commonly Encountered Compounds			
5.12	Solution Preparation			

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# *Revision History*

## Section One

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### Detection of Drugs in Blood and Urine

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Revision #	Issue Date	History
0	12-31-1999	Original Issue
1	05-30-2000	Reformatted
2	05-24-2007	Updated nomenclature, additional Analytical Methods added, Check-off format added.

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