Idaho State Police
Forensic Services

Volatiles Analysis Training Plan

New Analyst Training

Ethanol and Other Volatiles – Revision 0

Analyst in Training: _____
Forensic Scientist ____

Trainer: _____
Forensic Scientist ____

Trainer: _____
Forensic Scientist ____

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1.0 TABLE OF CONTENTS

1.1 TRAINING OBJECTIVES

1.1.1 Introduction

This section is intended to serve as a guide for an Idaho State Police Forensic Services (ISP-FS) analyst training to perform quantitative ethanol and qualitative "other volatiles" analysis, in both biological and non-biological samples. The analysis of these samples is described in Volatiles Analytical Methods *1.0-Quantitative Analysis for Ethanol and Qualitative Analysis for Other Volatiles in Blood, Vitreous Humor and Urine by Dual Column Headspace Gas Chromatography* and *2.0-Analysis of Solutions Containing Ethanol and Common Volatiles.*

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 review and gain an understanding of the ASCLD/LAB Guiding Principles of Professional Responsibility for Crime Laboratories and Forensic Scientists and successfully complete the currently approved ethics course.

The subsections address the entire laboratory process including administrative issues, the submittal of the sample to the laboratory, collection kit requirements and documentation, instrumental analysis, preparation of laboratory notes, issuance of the analysis report and subsequent courtroom testimony. In order to address questions in court, the analyst must possess knowledge of the pharmacology of ethanol and related compounds, field testing to detect impairment, the organization of the criminal justice system and the associated Idaho Codes. The references cited and all pertinent literature must be consulted as necessary. In addition to discipline specific training, the new analyst must obtain general knowledge of various disciplines of forensic science.

1.1.2 Approach to Training

1.1.2.1 In order to address the training plan questions, the background reading cited must be consulted if the Analyst in Training is not familiar with the subject matter. For the background reading, the edition listed or a newer version should be consulted.

1.1.2.2 Answers to training plan questions may be provided verbally and/or in written form. This choice is at the discretion of the trainer. Both the education and work experience of the Analyst in Training will be considered; however, a verbal competency verification of material should be done to the satisfaction of the Trainer. When available, coursework syllabus should be placed into the training file to document relevant coursework.

1.1.2.3 Topics signed off during training for another discipline need not be repeated.

1.1.3 Training Order

Although all training does not have to proceed in the order used in this training plan, certain topics should be completed prior to others.

1.1.3.1 Section 1.2 should be signed-off prior to additional sections.

1.1.3.2 Sections 1.3 through 1.10 should be signed off prior to hands-on analysis of blood.

1.1.3.3 Sections 1.2 through 1.14 and 1.16 must be signed-off prior to competency testing.

1.1.4 Additional Training for Experienced/Signed-off Analyst

1.1.4.1 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 with consideration of the analyst's existing background. The extent of training will be agreed upon by the discipline leader and quality manager with input from the analyst.

1.1.4.2 If a separate training plan section has been created for the training topic and/or analytical method then it must be utilized, otherwise the appropriate portions of this training plan section must be used.

1.1.5 Continual Awareness of Relevant Literature

The new or experienced analyst is reminded that this training plan only addresses the core of training for volatiles 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 text books.

1.2 ADMINISTRATIVE ISSUES

1.2.1 The Analyst in Training must be familiar with relevant sections of the **Idaho State Police Employee Handbook**.

1.2.2 The Analyst in Training must be knowledgeable of the content and application of the **Idaho State Police Forensic Services ISO/IEC 17025:2005 Compliant Quality/Procedure Manual.** ISP Quality/Procedure Manual Exam must be successfully completed prior to pursuing additional training.

1.2.3 The Analyst in Training must be well informed in the content and application of the **Idaho State Police Forensic Services Health and Safety Manual**. The Health and Safety Manual Exam must be successfully completed prior to pursuing additional training.

1.2.4 The new analyst must review and understand the **ASCLD/LAB Guiding Principles of Professional Responsibility for Crime Laboratories and Forensic Scientists.**

1.2.5 The new analyst shall successfully complete the currently approved ethics course as described in the **Idaho State Police Forensic Services Quality/Procedure Manual**.

1.2.6 If the new analyst has not had coursework in other areas of forensic sciences, the analyst will be assigned general reading about other disciplines and may be assigned to work with analysts in other disciplines.

1.2.7 Background Reading

1. Idaho State Police Employee Handbook (http://intranet/.htm or equivalent)

2. Idaho State Police Forensic Services ISO/IEC 17025:2005 Compliant Quality/Procedure Manual (I:\International Management System)\

3. Idaho State Police Forensic Services Health and Safety Manual. (I:\International Management System)\

1.3 EVIDENCE HANDLING ISSUES

1.3.1 Describe the procedures followed for the intake and transfer of specimens submitted for alcohol and/or volatiles analysis.

1.3.2 Describe the barrier protection measures required when handling biological samples and unknown liquids.

1.3.3 Describe the types of commonly available blood collection tubes and containers.

1.3.4 Describe the IDAPA 11.03.01 requirements for blood collection.

1.3.5 Discuss the preservative and anticoagulant required for IDAPA-compliant blood collection tubes/containers.

1.3.6 Discuss why the preservative and anticoagulant required for IDAPA-compliant blood collection tubes/containers are necessary.

1.3.7 Describe the types and applications of the toxicology collection kits distributed by ISP-FS.

1.3.8 Discuss how ISP-FS kits comply with the requirements set forth in IDAPA 11.03.01.

1.3.9 Describe the agencies served by their laboratory region and the programs involved.

1.3.10 Background Reading

1. IDAPA 11, Title 03, Chapter 01: Idaho State Forensic Laboratory Rules Governing Alcohol Testing.

1.4 STATISTICS FOR ANALYTICAL DATA

1.4.1 Reporting of Quantitative Data

The Analyst in Training must possess a working knowledge of statistics applied to analytical data.

1.4.2 Discuss the following terms as they relate to analytical data:

1.4.2.1 *Population Mean versus Sample Mean*

1.4.2.2 *Population Standard Deviation versus Sample Standard Deviation*

1.4.3 Discuss the following terms as they are applied to analytical data:

1.4.9.1 *Independent Variable*

1.4.9.2 *Linear Regression Analysis*

1.4.9.3 *Correlation Coefficient*

1.4.4 Describe how variance and standard deviation are related.

1.4.5 Discuss the following terms as they relate to analytical data:

1.4.5.1 *Normal Distribution*

1.4.5.2 *Confidence Interval*

1.4.6 Describe how the population mean and population standard deviation are used to define a Gaussian curve.

1.4.7 Define the following terms as they are applied to analytical data:

1.4.7.1 *Accuracy*

1.4.7.2 *Precision*

1.4.8 Answer the following questions:

1. Can sample data be precise but not accurate?
2. Can sample data be accurate but not precise?

1.4.9 Contrast Random and Systematic Error.

1.4.10 Discuss the concept of measurement uncertainty.

1.4.11 Discuss the top-down versus the bottom-up approach for estimating measurement uncertainty.

1.4.12 Describe how the difference between error and uncertainty would be explained to a jury and/or a judge.

1.4.13 Background Reading

1. Skoog, D.A., West, D.M., Holler, F.J., Errors in Chemical Analysis. *in:* Analytical Chemistry, pp. 52- 77, Saunders College Publishing, 1994 (6th edition).

2. Linnet, K. and Boyd, J.C., *Selection and Analytical Evaluation of Methods – With Statistical Techniques. in:* TIETZ Textbook of Clinical Chemistry and Molecular Diagnostics, pp. 353 – 407, Elsevier, 2006 (4th edition).

3. Kahn, S.E. and Jandreski, M.A., *Laboratory Statistics.* pp. 340 - 361. *in:* Clinical Chemistry: Theory, Analysis, Correlation, Mosby, 2003.

4. Gullberg, R.G., *Statistical Applications in Forensic Toxicology.* pp. 458 - 499, *in:* Medical-Legal Aspects of Alcohol, Fifth ed., edited by James C. Garriott, L & J, 2008 or more recent edition.

5. Prichard, E. and Barwick, V., Quality Assurance in Analytical Chemistry. Wiley, 2007.

1.5 SOLUTION PREPARATION

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

1.5.2 The Analyst in Training must explain the nomenclature and calculations involved in the determination of weight percent and volume percent solutions.

1.5.3 Background Reading

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

2. 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.

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

1.6 GAS CHROMATOGRAPHY (GC) THEORY AND OPERATION

1.6.1 The Analyst in Training must possess a comprehensive background in regard to the principles of GC.

1.6.2 Provide a brief explanation of GC in terms understandable to a layperson.

1.6.3 Describe the influence carrier gas flow has on the efficiency of a GC-FID.

1.6.4 Define the following terms as they relate to GC.

1.6.4.1 *Resolution*
1.6.4.2 *Area Under the Curve*
1.6.4.3 *HETP*

1.6.4.4 *Sensitivity versus Specificity*

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

1.6.6 Discuss measures to alleviate peak tailing.

1.6.7 Describe how amount ratios and response ratios are used to construct a calibration curve.

1.6.8 Discuss the major advantages of using an internal standard method.

1.6.9 Demonstrate their ability to operate a GC equipped with a flame ionization detector (FID) through both the system software and the instrument controller.

1.6.10 Demonstrate a working knowledge of the operating software for the gas chromatograph. This must include the ability to utilize the system software to develop an analysis method, set processing parameters to optimize peak detection and integration, prepare an analysis sequence, reprocess data, and modify the analysis report format.

1.6.11 Demonstrate their ability to maintain a GC equipped with a flame ionization detector (FID). This includes inlet and detector maintenance, column installation, troubleshooting techniques and the documentation thereof.

1.6.12 Background Reading

1. Stafford, D.T., *Chromatography. in:* Principles of Forensic Toxicology, edited by Barry Levine, pp. 91 - 98, 100 - 108, 114 - 118, AACC Press, 2003 (2nd edition). or more recent edition.

2. Levine, B. and Caplan, Y.H., *Alcohol. in:* Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, pp. 175 - 190, AACC Press, 2003 or more recent edition.

3. Dawling, S., *Gas Chromatography*. pp. 425 - 438, in: Clarke's Analysis of Drugs and Poisons, Third ed., edited by Moffat, Osselton, and Widdop, PhP, 2004 or more recent edition.

1.7 HEADSPACE THEORY AND OPERATION

1.7.1 Analyst in Training must possess a working knowledge of the theory and practice of headspace analysis.

1.7.2 The Analyst in Training must describe how *the proportionality* known as *Henry's Law*, is utilized in headspace analysis.

1.7.3 The Analyst in Training must demonstrate their ability to operate Headspace Analyzer.

1.7.4 The Analyst in Training must be acquainted with how the headspace method parameters in conjunction with GC cycle time must be optimized.

1.7.5 The Analyst in Training must demonstrate their understanding of the system software as it applies to the headspace analyzer including setting up the HS analysis method.

1.7.6 The Analyst in Training must discuss the maintenance of headspace analyzer including troubleshooting techniques and the documentation thereof.

1.7.7 Background Reading

1. Siek, T.J., *Specimen Preparation. in:* Principles of Forensic Toxicology, edited by Barry Levine, pp. 69 - 70, AACC Press, 2003 (2nd edition) or more recent edition.

2. Saker, E.G. Screening and Quantitation by Headspace Technique of Some of the Vapors Most Commonly Found in Forensic Toxicology, pp. 1-33, in: Current Approaches in Forensic Toxicology, Chapter 11, SOFT Meeting, 1994.

3. Goldberger, B.A., Caplan, Y.H. and Shaw, R.F., *Methods for Fluid Analysis*. pp. 255 - 268, *in:* Medical-Legal Aspects of Alcohol, Fifth ed., edited by James C. Garriott, L & J, 2008 or more recent edition.

1.8 PIPETTE INTERMEDIATE CHECK THEORY AND OPERATION

1.8.1 ARTEL PCS 2™ Pipette Calibration System

1.8.1.1 The Analyst in Training 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.

1.8.1.2 The Analyst in Training must describe the operating principle of the PCS 2™ Pipette Calibration System.

1.8.1.3 The Analyst in Training must demonstrate their ability to operate the PCS 2™ Pipette Calibration System through completing an intermediate check on the syringes for the sample dilutor.

1.8.1.4 The Analyst in Training must explain the routine maintenance performed on the PCS 2™ Pipette Calibration System.

1.8.1.5 Background Reading

1. Analytical Method for Volatiles 3.0, PCS 2 Pipette Calibration.

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

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

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

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

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

1.8.2 Gravimetric Pipette Intermediate Checks

1.8.2.1 The Analyst in Training must describe the principle, equipment and calculations involved when using the gravimetric method to perform an intermediate check of a POVA.

1.8.2.2 The Analyst in Training must demonstrate their ability to perform an intermediate check on the syringes for the sample dilutor.

1.8.2.3 Background Reading

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

2. Analytical Method for Volatiles 4.0, Gravimetric Pipette Intermediate Check

1.9 SAMPLE DILUTOR OPERATION

1.9.1 The Analyst in Training must have a working knowledge of the Hamilton MICROLAB® dilutor.

1.9.2 The Analyst in Training must demonstrate the operation of the Hamilton MICROLAB® dilutor.

1.9.3 The Analyst in Training must describe the routine maintenance performed on the Hamilton MICROLAB® dilutor.

1.9.4 Background Reading

1. Hamilton MICROLAB® User's Manual.

1.10 ANALYTICAL METHODS

1.10.1 Volatiles Analysis Analytical Method 1.0

1.10.1.1 The Analyst in Training must convey their understanding of the analysis protocol in Analytical Method 1.0.

1.10.1.2 Analyst in Training must describe the types of samples which qualify for analysis with Analytical Method 1.0.

1.10.1.3 Analyst in Training must detail their approach in determining if a blood tube/container is compliant with IDAPA 11.03.01.

1.10.1.4 Analyst in Training must describe the proper storage of blood, urine and vitreous humor samples in the laboratory.

1.10.1.5 Analyst in Training must describe the quality assurance requirements described in Analytical Method 1.0.

1.10.1.6 Analyst in Training must describe the acceptance criteria for an analysis run.

1.10.1.7 Analyst in Training must describe how quality assurance data is monitored and where it must be stored.

1.10.1.8 Analyst in Training must describe how blood, urine and vitreous humor alcohol concentrations must be reported.

1.10.1.9 Analyst in Training must indicate when the qualifier statement must be placed on the analysis report when the blood collection tube(s) does not comply with IDAPA 11.03.01.

1.10.1.10 Analyst in Training must indicate the statement that must be placed on the analysis report when urine is analyzed for ethanol concentration.

1.10.1.11 Analyst in Training must describe how qualitative volatiles must be reported.

1.10.1.12 Background Reading

1. Volatiles Analysis Analytical Method 1.0.

2. Idaho Administration Code, IDAPA 11.03.01, Rules Governing Alcohol Testing.

3. Christmore, D.S., Kelly, R.C. and Doshier, L.A. *Improved Recovery and Stability of Ethanol in Automated Headspace Analysis*, J. Forensic Sci. 29(4): 1038-1044; 1984.

4. Restek Applications Note #59598, Dual-Column Confirmational GC Analysis of Blood Alcohols Using the Rtx®-BAC1 and Rtx®-BAC2 Columns, 1999.

5. Stafford, D.T., *Chromatography. in:* Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, pp. 91-98, 100-108, AACC Press, 2003 or more recent version.

6. Levine, B., *Alcohol. in:* Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, pp. 175 - 190, AACC Press, 2003 or more recent version.

7. Caplan, Y.H., *The Determination of Alcohol in Blood and Breath. in:* Forensic Science Handbook, Volume I, edited by Richard Saferstein, pp. 594-648, Prentice-Hall New Jersey, 1981.

8. Saker, E.G., *Screening and Quantitation by Head Space Technique of Some of the Vapors Most Commonly Found in Forensic Toxicology*, in: Current Approaches in Forensic Toxicology, Chapter 11, SOFT Meeting, 1994.

9. Klaassen, C.D., *Inhalants, in:* Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, pp. 373-380, AACC Press, 2003 or more recent version.

1.10.2 Volatiles Analytical Method 2.0

1.10.2.1 The Analyst in Training must convey their understanding of the analysis protocol in Volatiles Analytical Method 2.0.

1.10.2.2 Analyst in Training must describe the types of samples that Volatiles Analytical Method 2.0 is applied for.

1.10.2.3 Analyst in Training must describe the quality assurance requirements described in Volatiles Analytical Method 2.0.

1.10.2.4 Analyst in Training must describe the acceptance criteria for an analysis run.

1.10.2.5 Analyst in Training must describe how quality assurance data is monitored and where it must be stored.

1.10.2.6 Analyst in Training must describe the authentication process for both quantitative and qualitative ethanol and other volatiles standards and controls.

1.10.2.7 The Analyst in Training must discuss the different types of alcoholic beverages and their respective alcohol content.

1.10.2.8 Analyst in Training must describe how alcohol concentrations must be reported in alcoholic beverages, simulator solutions and unknown solutions.

1.10.2.9 Analyst in Training must describe how qualitative volatiles must be reported.

1.10.2.10 Background Reading
In addition to reading listed under 1.10.1.13:

1. Volatiles Analysis Analytical Method 2.0.

2. McAnalley, B.H., *Chemistry of Alcoholic Beverages.* pp. 1-27, *in:* Medicolegal Aspects of Alcohol, edited by James C. Garriott, Lawyers & Judges, 1996 or more recent edition.

1.10.3 Volatiles Analytical Methods 3.0 and 4.0

1.10.3.1 The Analyst in Training must convey their understanding of the Pipette Calibration verification options set forth in Volatiles Analysis Analytical Method 3.0, *PCS 2™ Pipette Calibration System* and Volatiles Analysis Analytical Method 4.0, *Gravimetric Intermediate Checks.*

1.10.3.2 The Analyst in Training must outline the requirements for pipette calibration in regards to frequency and acceptance criteria.

1.10.4 Volatiles Analytical Method 5.0

1.10.4.1 The Analyst in Training must convey their understanding of the balance calibration requirements set forth in Volatiles Analysis Analytical Method 5.0, *Balance Calibration and Intermediate Checks.*

1.10.4.2 The Analyst in Training must describe the intermediate check procedure for the balance(s) utilized for preparation of solutions for alcohol/volatiles analysis.

1.10.4.3 The Analyst in Training must outline the requirements for balance calibration and intermediate checks in regards to frequency and acceptance criteria.

1.10.5 Volatiles Analytical Method 6.0

1.10.5.1 The Analyst in Training must be aware of the requirements for volatiles analysis competency test and proficiency tests set forth in Volatiles Analysis Analytical Method 6.0, *Volatiles Analysis Toxicology Competency and Proficiency Tests.*

1.10.5.2 The Analyst in Training must describe how competency and proficiency tests are evaluated.

1.10.6 Volatiles Analytical Method 7.0

1.10.6.1 The Analyst in Training must be aware of the testing guidelines for volatiles analysis set forth in Volatiles Analysis Analytical Method 7.0, *Testing Guidelines for Volatiles Analysis.*

1.10.6.2 The Analyst in Training must describe the guidelines for using a breath alcohol test to determine if additional analysis is warranted.

1.10.6.3 The Analyst in Training must describe the guidelines for using a blood alcohol concentration to determine if additional analysis is warranted.

1.10.7 Volatiles Analytical Method 8.0

1.10.7.1 The Analyst in Training must be aware of the requirements for authentication set forth in Volatiles Analysis Analytical Method 8.0, *Authentication of Reference Material and Matrix Controls: Ethanol*

1.10.7.2 The Analyst in Training must describe the requirements for the authentication of ethanol reference materials.

1.10.7.3 The Analyst in Training must describe the requirements for the authentication of blood matrix controls.

1.10.8 Volatiles Analytical Method 9.0

1.10.8.1 The Analyst in Training must be aware of the requirements for authentication set forth in Volatiles Analysis Analytical Method 9.0, *Authentication of Reference Material and Matrix Controls: Other Volatiles*

1.10.8.2 The Analyst in Training must describe the requirements for the authentication of qualitative reference materials that have a *Certificate of Analysis* available.

1.10.8.3 The Analyst in Training must describe the requirements for the authentication of qualitative reference materials that do not have *Certificate of Analysis* available.

1.10.9 Volatiles Analytical Method 10.0

1.10.9.1 The Analyst in Training must be aware of the requirements for uncertainty of measurement reporting set forth in Volatiles Analysis Analytical Method 10.0, *Uncertainty of Measurement for Volatiles Analysis.*

1.10.9.2 The Analyst in Training must describe the current approach to uncertainty of measurement for quantitative ethanol reporting.

1.10.10 Volatiles Analytical Method 11.0

1.10.10.1 The Analyst in Training must be aware of the how alcohol testing sites are approved as set forth in Volatiles Analysis Analytical Method 11.0, *Criteria for Site Approval to Perform Legal Alcohol Determinations.*

1.10.10.2 The Analyst in Training must describe the procedure for testing site approval.

1.10.10.3 The Analyst in Training must describe how proficiency tests are evaluated for IDAPA approval.

1.11 CASEFILE PREPARATION

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

1.11.2 The Analyst in Training must describe the worksheets and data that are to be compiled for a centrally stored QA file for each analysis run.

1.11.3 The Analyst in Training must describe requirements for administrative and technical review of casefile and analysis report.

1.12 PHARMACOLOGY AND IMPAIRMENT DETECTION

1.12.1 The Analyst in Training must demonstrate a working knowledge of the pharmacology of alcohol and other commonly encountered volatiles. This must include an understanding of the factors affecting absorption, distribution and elimination.

1.12.2 The Analyst in Training must describe the situation when the alcohol content of arterial blood exceeds that of venous blood.

1.12.3 The Analyst in Training must be familiar with the metabolism of ethanol and other commonly encountered volatiles. This must include how metabolism relates to toxicity.

1.12.4 The Analyst in Training must describe their understanding of the effects of alcohol and other commonly encountered volatiles on the human body. This must include how it contributes to mortality and impairment observed in DUI cases.

1.12.5 The Analyst in Training must describe their understanding of postmortem changes and their effect on alcohol concentration.

1.12.6 The Analyst in Training must be comfortable with the development, performance and interpretation of Standardized Field Sobriety Tests (SFST) and a Drug Recognition Exam (DRE).

1.12.7 <u>Background Reading</u>

1. Levine, B., *Alcohol*. *in:* Principles of Forensic Toxicology, Second Edition, edited by Barry Levine, pp. 175 - 190, AACC Press, 2003 or more recent edition.

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

3. Caplan, Y.H., *The Determination of Alcohol in Blood and Breath.* pp. 594-648, *in:* Forensic Science Handbook, Volume I, edited by Richard Saferstein, New Jersey: Prentice-Hall, 1981.

4. Julien, R.M., *Central Nervous System Depressants: Alcohol and the Inhalants of Abuse*. pp. 64-92, *in:* Primer of Drug Action, New York: Freeman, 1998.

5. Perrine, D.M., *Depressants: Alcohol, Benzodiazepines, Barbiturates*, pp. 113-129, *in:* The Chemistry of Mind-Altering Drugs, ACS, Washington, DC, 1996.

6. Fleming, M.F., Mihic, S.J. and Harris, R.A., *Drugs Acting on the Central Nervous System - Ethanol. in:* Goodman and Gilman's The Pharmacological Basis of Therapeutics, 11th edition, 591 - 606, McGraw-Hill, 2006 or more recent edition.

7. Garriott, J.C. and Manno, J.E., *Pharmacology and Toxicology of Ethyl Alcohol.* pp. 26-45, *in:* Medicolegal Aspects of Alcohol, Fifth edition, edited by James C. Garriott, Lawyers & Judges, 2008 or more recent edition.

8. Jones, A.W., *Biochemical and Physiological Research on the Disposition and Fate of Ethanol in the Body.* pp. 47-156, *in:* Medicolegal Aspects of Alcohol, edited by James C. Garriott, Fifth edition, Lawyers & Judges, 2008 or more recent edition.

9. Jones, A.W., *Biomarkers of Acute and Chronic Alcohol Ingestion.* pp. 157 - 204, *in:* Medicolegal Aspects of Alcohol, Fifth edition, edited by James C. Garriott, Lawyers & Judges, 2008 or more recent edition.

10. Garriott, J.C., *Analysis for Alcohol in Postmortem Specimens.* pp. 217- 228, *in:* Medicolegal Aspects of Alcohol, edited by James C. Garriott, Fifth edition, Lawyers & Judges, 2008 or more recent edition.

11. Anderson, W.H., *Collection and Storage of Specimens for Alcohol Analysis.* pp. 275 - 283, *in:* Medicolegal Aspects of Alcohol, Fifth edition, edited by James C. Garriott, Lawyers & Judges, 2008 or more recent edition.

1.13 CRIMINAL JUSTICE SYSTEM FUNDAMENTALS

1.13.1 The Analyst in Training must possess a practical understanding of the major branches of US federal and state government.

1.13.2 The Analyst in Training 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.

1.13.3 The Analyst in Training must be aware of which branch of US government law enforcement falls under.

1.13.4 The Analyst in Training must possess a practical understanding of the organizational structure of the criminal justice system.

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

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

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

1.13.8 Describe the subpoena process. What is the purpose of a subpoena? What does the phrase "duces tecum" mean when added to the subpoena?

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

1.13.10 Define the following terms:
1. Plaintiff
2. Defendant
3. Counsel

1.13.11 Who has the burden of proof, the plaintiff or defendant?

1.13.12 Describe the role and functions of the following criminal justice system components:
1. Judge
2. Prosecutor
3. Defense Attorney
4. Expert Witness
5. Jury
6. Bailiff
7. Court Reporter

1.13.13 Discuss the following questions:
1. What is a deposition?
2. What are the key differences between a *court* versus a *jury* trial?

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

1.13.15 Discuss the difference between direct, cross and rebuttal testimony?

1.13.16 Answer the following questions:
1. What objections are made by attorneys during a trial?
2. What is the difference between an objection being sustained versus overruled?

1.13.17 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?

1.13.18 Describe possible outcomes of the trial process.

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

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

1.13.21 Recommended Background Reading

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

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

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.

4. Caplan, Y.H. and Goldberger, B.A., *Legal Proceedings and the Expert Witness.* pp. 423 - 436 - 885, *in:* Medical-Legal Aspects of Alcohol, Fifth ed., edited by James C. Garriott, L & J, 2008 or more recent edition.

1.14 PREPARATION AND PRESENTATION OF COURTROOM TESTIMONY

1.14.1 The Analyst in Training must discuss proper demeanor and body language while testifying in court.

1.14.2 The Analyst in Training must describe proper attire for court.

1.14.3 The Analyst in Training must discuss ways to deal with nervousness while testifying.

1.14.4 The analyst must describe how a casefile must be reviewed in preparation for testimony.

1.14.5 The Analyst in Training must describe the typical sequence of questions pursued during direct and cross-examination.

1.14.6 The Analyst in Training must discuss the implications of the following events:
- 1.14.6.1 Stipulation
- 1.14.6.2 Objection Overruled
- 1.14.6.3 Objection Sustained

1.14.7 The analyst must be aware of what is required of them for the following:
- 1.14.7.1 Rebuttal Testimony
- 1.14.7.2 Witness Exclusion

1.14.8 The Analyst in Training must discuss sections of Idaho Code where the analysis of biological or unknown samples could be applied.

1.14.9 Background Reading

1. Anderson, M. F., *Prosecution of the Alcohol-Impaired Driving Case*. pp. 379 - 385, *in:* Medical-Legal Aspects of Alcohol, Fifth ed., edited by James C. Garriott, L & J, 2008 or more recent edition.

2. Nesci, J., *Defense of Driving Under the Influence Cases.* pp. 379 - 385, *in:* Medical-Legal Aspects of Alcohol, Fifth ed., edited by James C. Garriott, L & J, 2008 or more recent edition.

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

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

5. Idaho Code §18-8002, §18-8004, §18-8006, §23-1333.

1.15 MOCK COURTROOM TESTIMONY

A mock court trial must be conducted for the Analyst in Training to provide testimony for a minimum of the following situations.

1. DUI blood alcohol analysis with pharmacology questions.

2. "Open container violation" including questions about the alcohol concentration of various types of alcoholic beverages.

1.16 TRAINING SAMPLES: ANALYSIS OF CONTROLS, SOLUTIONS AND SPIKED SAMPLES

During the course of training, the Analyst in Training should apply the Analytical Methods to the analysis of control samples, non- biological solutions and/or spiked whole blood samples to develop their expertise.

1.17 COMPETENCY TESTING

Upon completion of training plan sections 1.2 through 1.14, the Analyst in Training will complete a competency test consisting of the following samples:

1. Whole blood specimens containing a wide range of appropriate alcohol concentrations and a minimum of one commonly encountered other volatile.

2. Non-biological solution(s) containing appropriate ethanol concentrations.

3. Refer to AM 6.0 for competency testing guidelines and evaluations.

1.18 PERFORMANCE OF ANALYSIS ON PRACTICE MATERIAL

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 may also 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 second sample is greater than ½ (½ meaning: ½ of the total sample of that type submitted, if two grey top blood tubes are submitted it would be half of the total blood in the two tubes, but if a purple and a grey top tube are submitted it would be the ½ of the volume of the blood in one of the tubes submitted). In addition the trainee may, under the direct observation of a competent analyst, handle case samples but 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. 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. During the course of their training, the Analyst in Training will be responsible for the analysis of no less than 30 samples under close supervision. The 30 samples must be divided into a minimum of at least two analysis runs. When both parties are comfortable with the trainee's proficiency and understanding of the methods, this section can be signed off. Appendix A provides general guidance for applying and evaluating this section.

1.19 COMPREHENSIVE COURSE ONALCOHOL TESTING

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

Topic Completion Sign-off

1.2 ADMINISTRATIVE ISSUES

1.2.1 Read and understood relevant sections of **Idaho State Police Employee Handbook**. This step is fulfilled with a verbal examination.

_____ _____
Date of Completion Analyst in Training

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Trainer

1.2.2 Read and understood the content and application of the **Idaho State Police Forensic Services ISO/IEC 17025:2005 Compliant Quality/Procedure Manual**. This step is fulfilled by the successful completion of written examination.

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Date of Completion Analyst in Training

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Trainer

1.2.3 Read and understood the content and application of the **Idaho State Police Forensic Services Health and Safety Manual**. This step is fulfilled by the successful completion of written examination.

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Date of Completion Analyst in Training

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Trainer

1.2.4 Read and understood the **ASCLD/LAB Guiding Principles of Professional Responsibility for Crime Laboratories and Forensic Scientists.** This step is fulfilled with a verbal examination.

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Date of Completion Analyst in Training

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Trainer

1.2.5 Completion of the currently approved ethics course as described in **Idaho State Police Forensic Services ISO/IEC 17025:2005 Compliant Quality/Procedure Manual**. This step is fulfilled by the successful completion of written examination.

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Date of Completion Analyst in Training

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Trainer

Topic Completion Sign-off

1.2 ADMINISTRATIVE ISSUES

1.2.6 General knowledge of forensic science disciplines other than toxicology. This step is fulfilled with a verbal examination.

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Date of Completion Analyst in Training

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Trainer

1.3 EVIDENCE HANDLING ISSUES

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

1.4 STATISTICS FOR ANALYTICAL DATA

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

1.5 SOLUTION PREPARATION

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

1.6 GAS CHROMATOGRAPHY (GC) THEORY AND OPERATION

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

Topic Completion Sign-off

1.7 HEADSPACE THEORY AND OPERATION

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

1.8 PIPETTE INTERMEDIATE CHECK THEORY AND OPERATION

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

1.9 SAMPLE DILUTOR OPERATION

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

1.10 ANALYTICAL METHODS

1.0 Quantitative Analysis for Ethanol and Qualitative Analysis for Other Volatiles in Blood, Vitreous Humor and Urine by Dual Column Headspace Gas Chromatography

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

2.0 Analysis of Solutions Containing Ethanol and Common Volatiles

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

Topic Completion Sign-off

1.10 ANALYTICAL METHODS

3.0 PCS 2™ Pipette Calibration System for Intermediate Check

Competency Verified by: ❒Written Examination ❒Verbal Examination

_____ _____
Date of Completion Analyst in Training

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Trainer

4.0 Gravimetric Pipette Intermediate Check

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

5.0 Balance Calibration and Intermediate Checks (Revision 0)

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

6.0 Review of Volatiles Proficiency and Competency Tests

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

7.0 Testing Guidelines for Volatiles Analysis

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

Topic Completion Sign-off

1.10 ANALYTICAL METHODS

8.0 Authentication of Reference Materials – Ethanol

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

9.0 Authentication of Reference Materials – Other Volatiles

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

10.0 Uncertainty of Measurement for Volatiles Analysis

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

11.0 Criteria for Site Approval to Perform Legal Alcohol Determinations

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

1.11 CASEFILE PREPARATION

Competency Verified by: ❒Written Examination ❒Verbal Examination

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Date of Completion Analyst in Training

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Trainer

Topic Completion Sign-off

1.12 PHARMACOLOGY AND IMPAIRMENT DETECTION

Competency Verified by: ❒Written Examination ❒Verbal Examination

_____ _____
Date of Completion Analyst in Training

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Trainer

1.13 CRIMINAL JUSTICE SYSTEM FUNDAMENTALS

Competency Verified by: ❒Written Examination ❒Verbal Examination

_____ _____
Date of Completion Analyst in Training

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Trainer

1.14 PREPARATION AND PRESENTATION OF COURTROOM TESTIMONY

Competency Verified by: ❒Written Examination ❒Verbal Examination

_____ _____
Date of Completion Analyst in Training

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Trainer

1.15 MOCK COURTROOM TESTIMONY

Competency Verified by: Successful Completion

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Date of Completion Analyst in Training

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Trainer

1.16 TRAINING SAMPLES: ANALYSIS OF CONTROLS, SOLUTIONS AND SPIKED SAMPLES

Competency Verified by: ❒Examination of Data ❒Verbal Examination

_____ _____
Date of Completion Analyst in Training

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Trainer

Topic Completion Sign-off

1.17 COMPETENCY TESTING

Competency Verified by: Successful Completion

_____ _____
Date of Completion Analyst in Training

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Trainer

1.18 SUPERVISED CASEWORK: PERFORMANCE OF ANALYSIS ON CASE MATERIAL

Competency Verified by: Successful Completion

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Date of Completion Analyst in Training

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Trainer

1.19 COMPREHENSIVE COURSE ON ALCOHOL TESTING

Competency Verified by: Successful Completion. Refer to Training Certificate.

_____ _____
Date of Completion Analyst in Training

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Trainer

APPENDIX A

Guide for evaluating completion of practice casework

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.

We anticipate the trainees will practice each analysis method on controls, old proficiency tests and aliquots taken from casework, when feasible.

The trainee will generally practice with samples to learn the analysis process and then the trainee will do practice runs that consist of multiple samples.

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 and demonstrate that they are checking the names on the sample container(s) to make sure they match the submittal form, and correctly labeling the container(s), and understand how to document the condition of the evidence and how to describe it in note, 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.

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

Revision #	Issue Date	History
0	05-30-2000	Original Issue
1	12-16-2002	Updated to comply with Quality Manual
2	08-18-2004	Updated, refined, and reformatted
3	02-01-2005	Additional emphasis on IDAPA 11.03.01 requirements and QA
4	05-24-2007	Updated language, incorporated table of contents
5	02-05-2009	Added training mandates, including *hands of trainer* is not allowed for this training plan and toxicology training order requirements. Updated references. Added Statistics for Analytical Data section. Reformatting.
0	03-21-2011	Original issue for Volatiles Analysis Discipline with associated formatting changes. Added new quality requirements which require that each training plan include sections on ethics and general knowledge of "other" areas of forensic science and on the fundamental concepts of criminal justice. Formatting changes made for clarity. Updated background material references.
1	8-23-11	General grammatical changes and streamlining was performed on the document. Changes were made to the approach to the training program. "Hands of the trainer" is now allowed during training. The relationship between methods diagram was removed. The training using case materials requirements have been changed. Appendix A was added.