ILLINOIS STATE POLICE

Division of Forensic Services

Forensic Sciences Command

TRAINING MANUALS

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DNA EVIDENCE TECHNICIANS

Introduction

APPENDICES

INTRODUCTION TO THE
DNA EVIDENCE TECHNICIAN TRAINING MANUAL

The DNA evidence technician training program has been designed to teach the DNA evidence technician the skills necessary to support the DNA analysis section/analysts. Good working habits, technical skills, and the theory andmethodology of the procedures and instrumentation will be covered. Also included in this training are quality assurance and DNA guidelines which provide the framework forensuring the high quality of DNA testing. Much of this training program has been modeled after the training program designed for DNA analysts. Only the number of exercises and the written requirements have been modified. It should be noted that several modules of the DNA Evidence Technician Training program are optional. Depending on the needs of the laboratory, the duties of the DNA Evidence Technicians can be limited in scope to the modules they have successfully completed. It is up to each laboratory to determine what modules they want their DNA Evidence Technician to complete and design their training program to include those modules.

Note: Only those modules successfully completed define the DNA Evidence Technician's scope of duties. Additionally, it is assumed that all evidence technicians entering this training program have been through a formal employee orientation program, covering the subjects of facility safety and security, blood borne pathogens and chemical hygiene, basic evidence handling and CALMS training.

For the DNA Evidence Technician, goals are set by position description. The DNA Evidence Technician training program is designed to train an SPET II to preparereagents, perform quality control on critical reagents for analyst's review and to perform non-interpretive analysis under direct analyst supervision. In general, training will include lecture and laboratory exercises with practical examinations. Training willbe provided by a certified DNA analyst.

In keeping with the educational goals of the training program, it is essential that each individual devote his or her full efforts to studies and assignments. Progress will be evaluated through assignments, student demonstration, practical tests, and proficiency samples. Training is divided into modules which will be covered in distinct blocks of time. The goals and objectives to be covered during each module will be listed at the beginning of each chapter. DNA Evidence Technicians who fail to maintainan acceptable level of academic progress will be appropriately counseled. DNA Evidence Technicians who fail to remedy their academic standing after counseling shall be recommended for elimination from the training program.

In order to evaluate progress, an evaluation of performance will be made at appropriate intervals using the performance evaluation document, CMS 201, if appropriate. For the individual in trainee status, monthly evaluations will be performed to ensure both the supervisor and the DNA Evidence Technician are aware of expectations, progress, and goals set for the DNA Evidence Technician.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: CLEAN TECHNIQUE

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Forensic Biology/DNA Procedures Manual Section FB-I-A, Appendix IV-A and Appendix IV-B

UNIT ESTIMATED TIME

1 Day

GOAL

Provide the evidence technician with the information necessary to understand the importance of and the practice of clean technique utilized during the biology/DNA procedures.

OBJECTIVES

1. The evidence technician will demonstrate competency in the use of clean technique. This module may be covered several times if the needs of the laboratory dictate that the modules on analytical techniques will be covered at a later time.

2. The evidence technician will demonstrate sufficient knowledge and skills required for proper clean technique during all phases of the training. Successful completion will be determined by instructor observation.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the evidence technician with the clean technique procedures.

Lectures: Clean Technique – Overview of Topics
Decontamination of the General Laboratory and Individual Work Areas
Cleaning and Sterilization Procedures of Laboratory Equipment
Forensic Biology/DNA Procedures Manual, FB-I-A Clean Technique Procedures, Initial Steps Prior to Starting Analysis
Policies for Amplification Set Up and Post PCR Product Processing Rooms
Use of Autoclave (if used by laboratory)

Exercise:
1. Read Forensic Biology/DNA Procedures Manual, FB-I-A Clean Technique; Forensic Biology/DNA Procedures Manual, FB-App IV-A - Forensic Biology Quality Assurance, Sample Handling and Facility Requirements; Forensic Biology/DNA Procedures Manual, FB-App IV-B - DNA Quality Assurance, Sample Handling and Facility Requirements; and the laboratory's facility operations manual policy on clean technique.
2. Review where gloves, sleeve covers, disposable lab coats, bleach,bleach bottles, etc. are stored. Set up individual work area withappropriate materials.

3. Decontaminate general laboratory and individual work areas under direct supervision. Review bleach log and make appropriate entries.
4. Review how to operate ultraviolet (UV) light in hoods and what must be exposed to UV light before and after use. Under direct supervision, set up tubes, Microcons and/or disposable beakers for 30 minute UV exposure.
5. Read operating manual for autoclave. Under direct supervision, run the autoclave through a dry cycle and a liquid cycle.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: QUALITY ASSURANCE

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PROCEDURAL REFERENCE

Forensic Biology/DNA Procedures Manual Appendix IV-A and Appendix IV-B

UNIT ESTIMATED TIME

3 to 5 Days

GOAL

Provide the information necessary for the evidence technician to understand and adhere to the Illinois State Police Command and Federal quality assurance standards.

OBJECTIVES

1. Participate in quality assurance procedures. The following are examples of quality assurance activities for which the evidence technician can be responsible: temperature recording for waterbaths, refrigerators and freezers; thermal cycler temperature verification and uniformity tests: quality control tests for reagents; chemical inventory tracking; and monitoring of facility bleaching. Successful completion will be determined by instructor observation.

   The lessons in this module may be covered several times, as determined by the needs of the laboratory.

LESSON 1

Estimated Time: 0.5 Day

Purpose: To familiarize the evidence technician with the quality assurance procedures.

Lectures: Quality Assurance – Overview of Topics
- Goals and Objectives
- Sample Handling and Facility Requirements – also reviewed in the Clean Technique Module
- Evidence Control
- Analytical Procedures – also reviewed in the Reagent Preparation Module
- Reagents/Chemicals – also reviewed in the Reagent Preparation Module
- Critical Reagents
- Annual System Verification with Standard Reference Material (SRM)
- Proficiency Testing
- Audits

Exercise:
1. Read the appropriate sections listed in the overview of topics in the Forensic Biology/DNA Procedures Manual.

LESSON 2

Estimated Time: 1 Day

Purpose: To familiarize the evidence technician with the procedures for equipment function checks and maintenance.

Lectures: Equipment Function Checks and Maintenance – Overview of Topics

Equipment Function Check Information: Procedure, Frequency, Results, and Course of Action
Balance and Oven Checks
Freezer/Refrigerator Temperature Checks
Waterbath Temperature Recording
Microscope Cleaning
Thermal Cycler Function Check – temperature verification and uniformity tests. Calibration kits tested yearly by outside source.
NIST and NIST Traceable Thermometer Function Checks

Exercises:

1. Read the sections listed in the overview of topics in the Forensic Biology/DNA Procedures Manual, FB-App IV-A and IV-B.
2. Review logbooks. Perform monthly quality assurance checks with instructor.

LESSON 3

Estimated Time: 1 to 3 Days – dependent on the number of critical reagents and control tests included in training.

Purpose: To familiarize the evidence technician with the procedure to prepare and run quality control tests on critical reagents.

Lectures: Quality Assurance – Overview of Topics

Quality Control Tests
Standards and Controls

Exercises:

1. Read appropriate analytical procedures section***s*** of the Forensic Biology/DNA Procedures Manual.
2. Prepare critical reagents and run quality control tests on the following critical reagents: DNA quantification kit, and/or STR amplification kits.
3. Prepare critical reagent documentation and review critical reagent logbook.
4. Identify standards and controls for DNA procedures.

LESSON 4

Estimated Time: 0.5 Day

Purpose: To familiarize the evidence technician with the Quality Assurance Standards for Forensic DNA Testing Laboratories and DNA Databasing Laboratories.

Exercise:

1. With the instructor, review the appropriate audit document and discuss how the laboratory satisfies each standard.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: REAGENT PREPARATION/CHEMICAL USE

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Director of Training

PROCEDURAL REFERENCE

Forensic Biology/DNA Procedures Manual Appendix IV-A and Appendix IV-B

UNIT ESTIMATED TIME

2 Days

GOAL

To learn how to properly prepare reagents for the Forensic Biology/DNA laboratory.

OBJECTIVES

1. The evidence technician will demonstrate sufficient knowledge and skill required for proper reagent preparation and tracking. Successful completion will be determined by instructor observation of reagent preparation on a pass/fail basis.

2. Learn the safety hazards and requirements of safe handling for Forensic Biology/DNA chemicals and reagents. Successful completion will be determined by instructor observation.

3. The evidence technician will demonstrate competency in the use of the laboratory pH meter and balances by completing a practical test for each instrument. Successful completion of the practical test will be determined by instructor observation on a pass/fail basis.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the evidence technician with the procedures to prepare and track Forensic Biology/DNA laboratory reagents.

Exercise:

1. Read the Analytical Procedures section of the Forensic Biology/DNA Quality Assurance Manual.
2. Identify and become familiar with hazardous chemicals found under safety considerations of each analytical technique in the Forensic Biology/DNA Procedures Manual.
3. Review how to properly label reagents using National Fire Protection Agency (NFPA) codes.
4, Review the location and use of Material Safety Data Sheets (MSDS), for the section and for the laboratory.
5. Review the reagent logbook, chemical logbook and individual logbook for Forensic Biology/DNA reagents.
6. Review the operating manual for the pH meter.
7. Practice the use of the pH meter.
8. Complete a practical test for the use of the pH meter. See Appendix B.
9. Review the operating manuals for laboratory balances.

10. Practice the use of balances.
11. Complete a practical test for the use of balances. See Appendix B.
12. Prepare and track reagents under the direct supervision of the instructor.
13. Complete a practical test for reagent preparation and tracking. See Appendix B.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: PREPARATION OF AMPLIFIED DNA SAMPLES

Reviewed by:

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Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Forensic Biology/DNA Procedures Manual, FB-IIIC-1

UNIT ESTIMATED TIME

0.5 - 1 Day

GOAL

To provide the necessary information for the evidence technician to successfully perform preparation of amplified samples of CE analysis using the Illinois State Police, ForensicSciences Command STR Analysis procedures.

OBJECTIVES

1. The evidence technician will demonstrate sufficient knowledge and skill in the Illinois State Police, Forensic Sciences Command procedures for amplified DNA sample preparation by completing practical exercises. A practical test consisting of unknown samples must be completed with the correct single source STR/DNA profile exhibited in each sample. This module may be completed in conjunction with the module on CE data analysis.

LESSON 1

Estimated Time: 0.5 – 1 Day

Purpose: To familiarize the evidence technician with sample preparation procedures for the capillary electrophoresis instrument (CE).

Demonstration: Sample Preparation

Exercises:

1. Read relevant portions of the Forensic Biology/DNA Procedures Manual, FB-IIIC-1.
2. Prepare a known sample set for CE analysis, under direct supervision. Each sample set should contain ten (10) samples which have been previously analyzed on the CE. All appropriate standards and controls must be included. After CE analysis, the instructor will compare the DNA profiles of the sample set against the known DNA profiles. The samples must exhibit the correct single source DNA profile and RFU values comparable to the known data.
3. Practice preparation of known sample sets, the number of sets to be determined by the instructor. Each sample set should contain ten (10) samples which have been previously analyzed on the CE. All appropriate standards and controls must be included. Evaluation of the exercise results will be done by the instructor as in Exercise 2.
4. Complete practical examination for preparation of amplified DNA samples. See Appendix B, Part A and Part B.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: AMPLIFICATION OF STRs USING THE POLYMERASE CHAIN REACTION (PCR)

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Approved by:

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PROCEDURAL REFERENCE

Forensic Biology/DNA Procedures Manual, FB-IIIC-1

UNIT ESTIMATED TIME

3 Days

GOAL

To provide the necessary information for the evidence technician to successfully perform amplification of STRs using the Illinois State Police, Forensic Sciences command PCR amplification procedures.

OBJECTIVES

1. The evidence technician will demonstrate competency in the Illinois State Police, Forensic Sciences Command PCR Amplification procedure by completing a practical exercise and a practical test. Successful completion will be determined by instructor evaluation on a pass/fail basis.

LESSON 1

Estimated Time: 3 Days

Purpose: To familiarize the evidence technician with the procedure for PCR amplification.

Lectures: Amplification of STRs – Overview of Topics
- ISP PCR amplification procedure for STRs – Forensic Biology/DNA Procedures Manual, FB-IIIC-1
- Amplification Kits
- Standards/Controls
- ISP Thermal Cycler Amplification Conditions
- Contamination Issues During PCR Amplification
- Documentation - Worksheets

Demonstration: PCR Amplification Procedure

Exercises:
1. Read the ISP PCR Amplification Procedure for STRs – Forensic Biology/DNA Procedures Manual, FB-IIIC-1.
2. Perform PCR amplification procedures on quantitated samples of known STR types, including all appropriate controls, under direct supervision. After analysis of the data, the instructor will compare the DNA profiles from the sample set to the known DNA profiles. Each DNA sample should exhibit the correct single source profile and RFU values comparable to the known data.

3. Practice PCR amplification procedures on quantitated samples, including all appropriate controls, minimum number of amplification sets determined by the instructor. Comparison results will be completed by the instructor as in Exercise 1.
4. Complete practical examination for amplification of STRs using the polymerase chain reaction. See Appendix B, Part A and Part B.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: CAPILLARY ELECTROPHORESIS UNIT MAINTENANCE

Reviewed by:

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Approved by:

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Director of Training

PROCEDURAL REFERENCE

Forensic Biology/DNA Procedures Manual Appendix IV-B
Relevant Capillary Electrophoresis Unit's User's Manual

UNIT ESTIMATED TIME

0.5 Day

GOAL

To provide the necessary information for the evidence technician to successfully perform capillary electrophoresis maintenance using the Illinois State Police, Forensic Sciences Command procedures.

OBJECTIVES

1. The evidence technician will demonstrate sufficient knowledge and skills in using the Illinois State Police, Forensic Sciences Command procedure for CE maintenance. The evidence technician may reference the Forensic Biology/DNA Procedures Manual or relevant instrumentation user's manual while performing maintenance procedures. Successful completion will be determined by instructor evaluation on a pass/fail basis.

LESSON 1

Estimated Time: 0.5 Day

Purpose: To familiarize the evidence technician with maintenance and set up procedures for the Genetic Analyzer (also termed the capillary electrophoresis instrument or CE).

Demonstration: CE Maintenance

Exercises:

1. Read relevant portions of the Forensic Biology/DNA Procedures Manual and Capillary Electrophoresis Unit's User's Manual.
2. Practice maintenance procedures.
3. Perform maintenance procedure under direct supervision of the instructor.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: CAPILLARY ELECTROPHORESIS MATRIX CREATION OR SPECTRAL AND SPATIAL RUNS

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PROCEDURAL REFERENCE

Forensic Biology/DNA Procedures Manual Appendix IV-B
Relevant Portions of the Capillary Electrophoresis Unit's User's Manual

UNIT ESTIMATED TIME

0.5 Day

GOAL

To provide the necessary information for the evidence technician to successfully perform matrix creation or to perform spectral and spatial runs using the Illinois State Police, Forensic Sciences Command procedures.

OBJECTIVES

1. The evidence technician will demonstrate sufficient knowledge and skills in using the Illinois State Police, Forensic Sciences Command procedure for matrix creation or for performing spectral and spatial runs by completing practical exercises. Successful completion will be determined by instructor evaluation on a pass/fail basis.

   Note: The DNA Evidence Technician will not be responsible for the interpretation of the matrix, spectral or spatial data. The duties under this module are restricted to the preparation of sample, and the creation of the matrix or performing a spectral or spatial run. Interpretation data will be the responsibility of a qualified DNA analyst.

LESSON 1

Estimated Time: 0.5 Day

Purpose: To familiarize the evidence technician with creating a matrix or for performing a spectral or spatial run for the CE. In addition, the evidence technician will gain familiarity with computer usage and CE set up.

Demonstration: Matrix, Spectral and Spatial Run Procedure

Exercises:

1. Read manufacturer's insert for the matrix standards.
2. Read relevant portions of the Capillary Electrophoresis Unit's User's Manual.
3. Perform matrix or spectral and spatial run exercise.
4. Provide data to instructor for evaluation.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: CAPILLARY ELECTROPHORESIS DATA ANALYSIS

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PROCEDURAL REFERENCE

Forensic Biology/DNA Procedures Manual Section IIIC-1
Relevant Portions of the Capillary Electrophoresis Unit's User's Manual

UNIT ESTIMATED TIME

0.5 Day

GOAL

To provide the necessary information for the evidence technician to successfully perform CE data analysis using the Illinois State Police, Forensic Sciences Command STR analysis procedures.

OBJECTIVES

1. The evidence technician will demonstrate sufficient knowledge and skill in the Illinois State Police, Forensic Sciences Command procedures for CE data analysis by completing practical exercises. Successful completion will be determined by instructor evaluation.

   Note: The DNA Evidence Technician will not be responsible for the interpretation of the CE data. The duties under this module are restricted to the creation of sample sheets and injection lists or plate records and use of the appropriate software to analyze the data. Interpretation of the data will be the responsibility of a qualified DNA analyst.

LESSON 1

Estimated Time: 0.5 Day

Purpose: To familiarize the evidence technician with computer data analysis procedures for CE data.

Demonstration: Data Analysis

Exercises:

1. Read the following portion of the Forensic Biology/DNA Procedures Manual: Capillary Electrophoresis Data Collection.
2. Read relevant portions of the Capillary Electrophoresis Unit's User's Manual.
3. Practice data analysis procedures. The minimum number of data analyses to be performed will be determined by the instructor.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: DNA PRESERVATION

Reviewed by:

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Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Forensic Biology/DNA Procedures Manual Appendix IV-B – DNA Quality Assurance, Evidence Control

UNIT ESTIMATED TIME

1 Day

GOAL

To provide the necessary information for the evidence technician to successfully preserve DNA from forensic samples utilizing the Illinois State Police, Forensic Sciences Command policies for preserving DNA samples.

OBJECTIVES

1. The evidence technician will demonstrate sufficient knowledge and skill in the Illinois State Police, Forensic Sciences command procedures for DNA preservation by completing practical exercises. Successful completion will be determined by instructor evaluation on a pass/fail basis.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the evidence technician with the process of drying down extracted DNA for preservation purposes.

Demonstration: Use of Speed Vac to Dry Down DNA Samples

Exercises:
1. Read the laboratory's procedure for DNA sample dry down.
2. Perform dry down procedure on extracted DNA samples under direct supervision of instructor.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

MODULE: COURTROOM TRAINING

Reviewed by:

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Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

1 Day

GOAL

To achieve the necessary knowledge, skill, and ability to successfully perform courtroom testimony.

OBJECTIVES

1. Demonstrate effective DNA Evidence Technician expert witness testimony that is simple, concise, and accurate by participating in at least one mock trial. Successful completion will be determined by instructor observation on a pass/fail basis with the followingcriteria graded satisfactory: truthful, technically accurate, understandable, believable, evidence handling, and no defensive responses to questions.

2. Attend the one day session on courtroom performance training designed for evidence technicians.

LESSON 1

Estimated Time: 1 Day

Purpose: To learn how to be an effective DNA Evidence Technician expert witness.

Exercise:

1. Participate in Courtroom Demeanor Training for Evidence Technicians.

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

APPENDIX A: DNA EVIDENCE TECHNICIAN TRAINING CHECKLIST

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Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

DNA EVIDENCE TECHNICIAN
TRAINING CHECKLIST

Name: _____

Date Started: _____

Authorization for release from training:

Date Released: _____

Name/Signature: _____

Unit of Instruction		Date/Initials of Student	Date/Initials of Instructor
Clean Technique			
	Read and understand ISP procedures and appropriate equipment operating manuals.		
	Review location of PPE, bleach, etc. Set up individual work area with appropriate materials.		
	Under direct supervision, decontaminate work areas and make appropriate log entries.		
	Under direct supervision, practice UV decontamination.		
	Under direct supervision, practice proper operation of autoclave.		
Quality Assurance			
	Read and understand procedures.		
	Review logbooks (bleaching, critical reagent, temperature, equipment). Perform monthly checks with instructor.		
	Prepare and perform quality control checks on critical reagents (DNA quantification kit, STR amplification kits).		
	Prepare critical reagent documentation and review critical reagent logbook.		
	Identify DNA standards and controls.		
	With instructor, review appropriate audit document and discuss how the laboratory satisfies each standard.		
Reagent Preparation/Chemical Use			
	Read and understand procedures.		
	Identify hazardous chemicals used in Biology / DNA procedures.		

	Review NFPA codes and proper labelling requirements.		
	Review location and use of MSDS for the section.		
	Review section reagent, chemical and individual logbooks.		
	Review operation and use of the pH meter.		
	Practical Criterion Test – pH Meter		
	Review operation and use of balances.		
	Practical Criterion Test – Balances		
	Under direct supervision, properly prepare and track reagents.		
	Practical Criterion Test – Reagent Preparation and Tracking		
Preparation of Amplified DNA Samples			
	Read and understand procedures.		
	Under direct supervision, prepare a known sample set for CE analysis.		
	Practice independent preparation of known sample sets for CE analysis.		
	Practical Criterion Test – Preparation of Amplified DNA Samples		
Amplification of STRs Using the PCR			
	Read and understand procedures.		
	Under direct supervision, perform PCR on quantitated samples of known STR type.		
	Practice independent PCR amplification of quantitated samples of known STR type.		
	Practical Criterion Test – Amplification of STRs Using the PCR		
CE Unit Maintenance			
	Read and understand ISP procedures and appropriate CE unit user's manual.		
	Practice maintenance procedure.		
	Under direct supervision, demonstrate ability to perform proper maintenance procedures.		
CE Matrix Creation or Spectral and Spatial Runs			
	Read and understand ISP procedures, matrix standard insert, and appropriate CE unit user's manual.		
	Perform matrix or spectral and spatial runs.		
	Provide data from matrix or spectral and spatial runs to instructor for evaluation.		

STR Analysis / CE Data Analysis			
	Read and understand ISP procedures and appropriate CE unit user's manual.		
	Practice data analysis procedures. Minimum number of data sets to be determined by instructor.		
DNA Preservation			
	Read and understand laboratory's DNA sample dry down procedure.		
	Under direct supervision, perform DNA sample dry down procedure.		
Courtroom Training			
	Participate in Courtroom Demeanor Training for Evidence Technicians.		

ILLINOIS STATE POLICE

DNA EVIDENCE TECHNICIAN TRAINING MANUAL

APPENDIX B: DNA EVIDENCE TECHNICIAN TRAINING PRACTICAL EXAMINATIONS

Reviewed by:

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Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

pH Meter Practical Examination

The instructor should provide the evidence technician with a reagent of known pH which the student must demonstrate has the correct value through proper use of the pH meter.

Balance Practical Examination

The evidence technician is asked to weigh out two dry chemicals, one on each balance. One chemical should be weighed out in grams. The second chemical should be weighedout in milligrams.

Reagent Preparation Practical Examination

The evidence technician will prepare and track a reagent which requires using the balance and the pH meter (20X SSC, 1.0M Tris, pH 8.0, Citrate buffer, etc.) The instructor will confirm the pH of the reagent upon completion of the examination.

Preparation of Amplified DNA Samples Practical Examination

Part A – The instructor will provide the evidence technician with a set of serial dilutions (1ng, 0.5ng, 0.25ng, 0.125ng, 0.063ng) which have been previously analyzed. The evidence technician will prepare the serial dilution set for CE analysis, including all propercontrols. Upon completion of the CE run, the instructor will analyze the data and comparethe unknown serial dilution set to the known DNA profiles from the previous run. Each DNA sample must exhibit the correct single source profile and RFU values comparable to the known (previously analyzed data) for successful completion of the practical examination.

Part B – The instructor will provide the evidence technician with a set of ten (10)unknowns (previously analyzed amplified DNA samples). The evidence technician will prepare the unknowns for CE analysis, including all proper controls. Upon completion of the CE run, the instructor will analyze the data and compare the DNA profiles obtained from the unknown sample set to the known DNA profiles from the previous run. Each DNA sample must exhibit the correct single source DNA profile and RFU values comparable to the known (previously analyzed data) for successful completion of the practical examination.

> Note: If this module is administered with the module on CE data analysis, then the evidence technician will be responsible for analyzing the data from the CE run.

Amplification of STRs using PCR Practical Examination

Part A – The instructor will provide the evidence technician with a set of serial dilutions (1ng, 0.5ng, 0.25ng, 0.125ng, 0.063ng) which have been previously analyzed. The evidence technician will prepare the serial dilution set for amplification, including all proper controls. Upon completion of analysis on the CE, the instructor will analyze the data and compare the unknown serial dilution set to the known DNA profiles from the previous run. Each DNA sample must exhibit the correct single source profile and RFU values comparable to the known (previously analyzed data) for successful completion of the practical examination.

Part B – The instructor will provide the evidence technician with a set of ten (10)unknowns (previously analyzed DNA samples). The evidence technician will prepare the unknowns for amplification, including all proper controls. Upon completion of analysis on the CE, the instructor will analyze the data and compare the DNA profiles obtained from the unknown sample set to the known DNA profiles from the previous run. Each DNA sample must exhibit the correct single source DNA profile and RFU values comparable to the known (previously analyzed data) for successful completion of the practical examination.

> Note: If the evidence technician has been qualified in preparation of amplified DNA for CE analysis and/or CE data analysis, or this module is being administered in conjunction with those modules, then the evidence technician will be responsible for completing those steps.

TABLE OF CONTENTS
DRUG CHEMISTRY

INTRODUCTION TO THE DRUG CHEMISTRY TRAINING MANUAL

The drug chemistry training program has been designed to teach the forensic scientist the skills necessary for the analysis of cannabis and drugs. Good working habits, knowledge of the criminal justice system, technical skills, and the theory and methodology of the procedures and instrumentation necessary for the forensic chemist will be covered. Also included in this training are rules of the Forensic Sciences Command, the Illinois State Police and the State of Illinois which govern the work environment of the forensic scientist trainee.

For the drug chemistry trainee, goals are set by position description. This is a training level position under direct supervision for a period not to exceed one year in duration. The individual is trained in and performs beginning level duties in forensic analysis of cannabis and drugs.

The training modules have been divided into Core Training Modules (CTMs) and Ancillary Training Modules (ATMs). All CTM modules are expected to be covered during training, while ATMs will be covered as appropriate. Successful completion of all Core modules is required to complete training. In keeping with the educational goals of the training program, it is essential that each trainee devote his or her full efforts to studies and assignments. Core training modules will be covered as distinctive blocks of time. Ancillary modules will be assigned throughout the course of training as either a preface to a Core module or as an adjunct to training. Progress will be evaluated through proficiency samples, written and oral quizzes and tests, and practical assignments. Training is divided into modules which will be covered in distinctive blocks of time. The goals and objectives to be covered during each module will be listed at the beginning of each chapter. Trainees who fail to maintain an acceptable level of academic progress will be appropriately counseled. Trainees who fail to remedy their academic standing after counseling shall be recommended for elimination from the training program.

In order to evaluate progress, an evaluation of performance will be made at appropriate intervals using CMS 201. For the first six months of the training program, monthly evaluations will be performed to ensure both the supervisor and the trainee are aware of the expectations, progress, and goals set for the trainee. Good communication is essential to a successful training program; trainees are encouraged to offer input into their training program.

GENERAL OBJECTIVES

The general objectives include the following:

1. Teach the trainee the theories and techniques of the instrumentation used in Illinois State Police forensic drug chemistry section.

2. Teach the trainee to perform the proper procedures in the collection, preservation, receipt and examination of evidence, in accordance with Illinois State Police guidelines.

3. Teach the trainee the legal aspects of drug analysis, to include weight guidelines and scheduling.

4. Prepare the trainee for court testimony and introduce the trainee to the Criminal Justice System.

5. Teach the trainee to maintain quality controls in forensic drug chemistry.

6. Teach the trainee to generate written reports of examination results, to technically and administratively document all casework properly and to develop acceptable proofing skills to ensure all case files are properly maintained.

7. Teach the trainee the botanical and chemical analysis of cannabis.

8. Have the trainee review literature in order to develop and maintain expertise relative to cannabis and drug chemistry analyses as well as keep abreast of new techniques being developed in the field of drug chemistry.

9. Have the trainee develop and maintain good working relations with laboratory staff and outside agencies.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: COURTROOM TRAINING FOR DRUG CHEMISTRY

Reviewed by:

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Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

9 Days over the course of training

GOAL

To understand the terminology and definitions used in the criminal justice system and to achieve the necessary knowledge, skills and abilities to successfully perform courtroom testimony.

OBJECTIVES

1. To gain an understanding of the criminal justice system and the role of the forensic scientist.

2. The following fundamental aspects of courtroom training are to be covered in the Basic Courtroom Demeanor Training Course:
   * Courtroom Testimony
   * Courtroom Orientation (layout)
   * Qualifying Questions (instruction on Direct Testimony)
   * Expectations of Courtroom Testimony
   * Evidence Handling
   * Evaluation of Non-Technical Performance
     - ► Appearance
     - ► Presentation
     - ► Believability
     - ► Truthfulness
   * Improvements in general presentation of an opinion.

3. To participate in at least two drug chemistry mock trials during the training period.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the criminal justice system.

Lectures: Provided during orientation and throughout training.

Exercise: 1. To be determined by the presenter.

Required Reading: 1. As assigned.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the court system.

Lecture: Courtroom Demeanor Class

Exercises:
1. As assigned in courtroom demeanor class.
2. The trainee will pass a written criterion test on the class material.

Drug Chemistry Mock Trials

Preface: The following section specific courtroom training has been developed in conjunction with the standard courtroom demeanor course which all trainees have been required to attend. This section specific courtroom training assumes that each trainee has already covered the fundamental aspects of court testimony and that all trainees have a general knowledge of the courtroom setting and Command expectations in the testimony of their employees.

Some general procedures associated with court will be covered during each mock trial. These include qualifying questions, evidence handling procedures, and worksheet data.

At least 2 mock trials will be conducted during the training period. These will be given after a set of particular modules have been covered in the training and the direct questioning will be predominantly on that module(s) material. Any testing techniques not covered during one of the 2 designated mock trials will either be covered in additional mock trials or in a final oral exam to be administered prior to the release from training. Mock trials will be divided as follows and at a minimum will cover:
1. Cannabis (including macroscopic and microscopic examination, the Duquenois-Levine color test, and GCMS).
2. Controlled substances (including Color tests, GCMS or FTIR, any additional testing techniques utilized during analysis of the case in question).

LESSON 3

Estimated Time: 5 Days

Purpose: To prepare the trainee for court proceedings and presentations.

Lecture: None

Exercise:

1. Participate in a mock trial setting at least twice over the course of the training period.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: TECHNIQUES OF CANNABIS ANALYSIS

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedure in the Drug Chemistry Procedures Manual for the observation of Leafy Plant Material (DC-IIIA-1), the use of the Duquenois-Levine Test (DC-IIIA-2) Appendix I – Report Wording (DC-App I) and Appendix IV – Administrative Policies for Cannabis Analysis (DC-App-IV).

UNIT ESTIMATED TIME

23 Days

GOAL

To achieve the necessary knowledge, skill and abilities to analyze cannabis successfully, and to testify to the results.

OBJECTIVES

1. The trainee will demonstrate comprehension of the laws governing Cannabis analysis by passing a written criterion quiz with a score of no less than 80%.

2. The trainee will demonstrate practical knowledge of cannabis botany and both the macroscopic and microscopic visual examinations by successfully passing a practical criterion test with a score of no less than 100%.

3. The trainee will demonstrate practical knowledge of the Duquenois-Levine test by successfully passing a practical criterion test with a score of no less than 100%.

5. The trainee will demonstrate knowledge of the Cannabis Control Act, evidence handling procedures and report writing by correctly analyzing casework according to the Procedures Manual as determined by the training coordinator on a pass/fail basis.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the Cannabis Control Act and Federal laws concerning cannabis.

Lecture: Illinois Acts referencing Cannabis/Federal Statutes on Cannabis

Exercise:
1. Read the assigned materials.
2. Complete the Cannabis Study guide.
3. Successfully complete a written quiz with a score of no less than 80%.

Required Reading:
1. Ill. Compiled Stat. (most current issue) 720 ILCS 550/1-19 (Cannabis Control Act).

2. Ill. Compiled Stat. (most current issue) 410 ILCS 705 (Cannabis Regulation and Tax Act).

3. Ill. Compiled Stat. (most current issue) 505 ILCS 89 (Illinois Industrial Hemp Act).

4. Joint Committee on Administrative Rules Administrative Code (most current), Title 8/Part 1200 (Illinois Industrial Hemp Act)

5. Code of Federal Regulations, Food and Drugs, Chapter 21, Part 1300 to end (current issue on-line).

LESSON 2

Estimated Time: 4 Days

Purpose: To familiarize the trainee with the gross and microscopic characteristics of Cannabis.

Lectures: Gross Botanical Characteristics of Cannabis
Stereoscope Care and Use

Exercises
1. Read assigned materials.
2. Observe gross characteristics of Cannabis using the microscope.
3. Successfully pass a written quiz on gross botany of Cannabis with a score of no less than 80%.

Lecture: Life Cycle and Microscopic Characteristics of Cannabis

Exercises:
1. Observe the microscopic characteristics of Cannabis.
2. Observe and compare microscopic botanical characteristics of Cannabis and distributed plant materials.
3. Successfully pass a written quiz on microscopic botanical characteristics and stereoscope use with a score of no less than 80%.
4. Successfully pass a practical criterion test on microscopic botanical characteristics with a score of no less than 100%.

Required Reading:
1. Supplemental materials assigned by training coordinator.

2. Bouquet, R. S., Cannabis, Bulletin on Narcotics, Vol. 2, No. 4, 1950, pp. 14-30.

3. Maher, John T., Cannabis Sativa – A Lecture, 1975, pp. 1-37.

4. Joyce, G. R. B., and Curry, S. H. eds., The Botany and Chemistry of Cannabis, 1970, pp. 1-10.

5. Quimby, Maynard W., et al, Economic Botany, (1973) 27, pp. 117-127.

6. Notes on the Morphology of Marijuana from the Washington Marijuana Identification School.

7. Clarke, R., The Botany and Ecology of Cannabis, Podds Press, Ben Lomond, CA., 1977, pp. 1-57.

8. Fairbairn, J., Bulletin on Narcotics, Vol. 24, No. 4, 1972, pp. 29-33.

9. de Pasquale, A., Tumino, G., and de Pasquale, R., Bulletin on Narcotics, Vol. 24, No. 4, 1974, pp. 27-41.

10. Dayanandan, P., and Kaufman, Peter B., American Journal of Botany, (1976), 63(5), pp. 578-591.

11. Nakamura, George R., (1969), J.O.A.C., 52, No. 1, pp. 5-16.

12. American Academy of Forensic Sciences, Criminalistics Section Resolutions, Feb. 14, 1974, p. 1.

13. Fernald, M., Ed., Gray's Manual of Botany, 8th Ed., D. van Nostrand Co., New York, 1970, pp. 555-556.

14. Schultes, R., Botanical Museum Leaflets, Vol. 23, No. 9, (1974), pp. 337-367.

15. Small, E., The Forensic Taxonomic Debate on Cannabis: Semantic Hokum, J. For. Sci., Vol. 21, No. 2, April 1976, pp. 239-251.

16. Van Sickel F., Microgram, Vol. 2, No. 3, 1969, pp. 8-11.

17. Drug Enforcement Administration, Microgram, Vol. 7, No. 2, 1974, pp. 16-19.

18. 30 Ill. App 3d 127 People v. Rege.

19. Arizona Department of Safety – Information Bulletin, 85-01 1985.

20. Safety Data Sheets.

Supplemental References:

1. Fairbairn, J. W., et al, 1976, J. Pharm. Pharmac, 28, pp. 1-7.

2. Vogelmann, A. et al, 1987, Bot. Gaz., 148(3), pp. 468-474.

LESSON 3

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the chemistry of Cannabis and the Duquenois-Levine test.

Lectures: The Cannabinoids
The Chemistry of the Duquenois-Levine Test
Demonstration of the Duquenois-Levine Test

Exercises:

1. Read the assigned materials.
2. Perform and record the results of the Duquenois-Levine test on Cannabis.
3. Perform and record the results of the Duquenois-Levine test on distributed materials.
4. Successfully pass the written quiz on the chemistry of Cannabis with a score of no less than 80%.
5. Successfully pass a practical criterion test using the Duquenois-Levine test at a level of no less than 100%.

Required Reading:

1. Official Methods of AOAC, 14th Ed., AOAC, Washington, D.C., 1984, p. 774.
2. Butler, W., Journal of the AOAC, Vol. 45, No. 3, 1962, pp. 597-600.
3. Pitt, C., Hendron, R., and Hsia, R., Journal of Forensic Sciences, Vol. 17, No. 4, 1972, p. 693-700.
4. Bailey, Keith, Journal of Forensic Sciences, Vol. 24, No. 4, 1974, pp.817-841.
5. Hughes, R., and Warner, V., Journal of Forensic Sciences, Vol. 23, No. 2, 1978, pp. 304-310.
6. Lau-Cam, Cesar, Clinical Toxicology, 1978, 12 (5), pp. 535-541.
7. Kovar, K., Keck, M., and Krieger, Th., Microgram, Vol. 22 (7), 1989.
8. Forrester, Dale, E., The Duquenois Color Test for Marijuana: Spectroscopic and Chemical Studies, Doctoral Dissertation, UMI Dissertation Services, Ann Arbor, Michigan, Vol. 1, 1997, pp. III-21, 32-83, 217, 239-242, 390-391.
9. ST-NAR-40-Ebook(UNONDC).

Supplemental References:

1. Thornton, J. and Nakamura, G., (1972), Journal of Forensic Sciences, 12, pp. 461-519.

LESSON 4 (to be completed after Weights & Measurements and GCMS)

Estimated Time: 12 Days

Purpose: To familiarize the trainee with the proper method of Cannabis analysis.

Lectures:
Sampling Techniques
Balances
The Analysis of Cannabis, Evidence Handling and Report Wording

Exercises

1. Demonstrate the use and calibration of the balances.
2. Analyze mock or real cases applying the proper procedures.
3. Successfully pass a Cannabis mock trial.

Required Reading:

1. McCarthy, J., On Playing the Game of Expert Witness in a Two-Value Logic System, Journal of Forensic Sciences, Vol. 19, No. 1, 1974, pp. 130-135.

2. Starrs, J., The Ethical Obligations of the Forensic Scientist in the Criminal Justice System, Journal of the AOAC, Vol. 54, No. 4, 1971, pp. 906-914.

3. Cohen, S., The Role of the Forensic Expert in a Criminal Trial, Society of Forensic Sciences Journal, Vol. 12, No. 2, 1979, pp. 1-15.

4. Metzger, Michael H., Notes on Marijuana Identification in Criminal Cases, Clinical Toxicology 8 (4), 1975, pp. 65-473.

5. Key words an phrases discussed by the MAFS Report and Testimony Terminology Panel.

6. Hollien, Harry, The Expert Witness: Ethics and Responsibilities, Journal of Forensic Sciences, 35 (6), 1990, pp. 1414-1423.

7. Possible Questions for Testimony from the Washington Marijuana Identification School.

8. Nakamura, G. and Thornton, J., The Forensic Identification of Marijuana: Some Questions and Answers, J. of Police Science and Administration, Vol. 1, No. 1, 1973, pp. 102-112.

9. Travnikoff, Basil and Kvick, Robert, How to Examine a Chemist in Drug Abuse Cases, 1971, pp. 1-14, 29-36.

10. Fullerton, D., et al., The Identification and Misidentification of Marijuana, Contemporary Drug Problems, Fall 1974.

11. Kurzman, M. G., Fullerton, D. S., McGuire, M. O., Winning Strategies for Defense of Marijuana Cases: Chemical and Botanical Issues, J. Crim. Defense, Vol. 1, 1975, pp. 487-543.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: CONTROLLED SUBSTANCES ACT

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

4 Days

GOAL

To acquire a basic understanding of controlled substances and how they relate to the Controlled Substances Act.

OBJECTIVES

1. The trainee will demonstrate a comprehensive knowledge related to the classification of controlled substances by passing a written criterion test with a score of no less than 80%.

LESSON 1

Estimated Time: 4 Days

Purpose: To familiarize the trainee with state and federal controlled substances acts, and classification of controlled substances.

Lectures: The History of the State and Federal Controlled Substances Acts
Controlled Substances and Steroids

Exercises:

1. Read references.
2. Complete study guides.
3. Prepare oral presentation on controlled substances as directed by the training coordinator
4. Successfully complete a written criterion test with a score of no less than 80%.

Required Reading:

1. Ill. Compiled Statutes (most current year) 720 ILCS 570/100-215.
2. Ill. Compiled Statutes (most current year) 720 ILCS 570/401-409
3. Ill. Compiled Statutes (most current year) 720 ILCS 646/1-110.
4. Ill. Compiled Statues (most current year) 720-ILCS-647/1-999.

5. Joint Committee on Administrative Rules Administrative Code (most current)

6. Clarke, E. G. C., Isolation and Identification of Drugs, Pharmaceutical Press, London, 2nd Edition or newer edition, 1986.

Supplemental References:

1. Orcia, M. et al., Vocabulary of Organic Chemistry, John Wiley & Sons, New York, 1980.

2. Morrison, R. and Boyd, R., Organic Chemistry, 5th Edition, Allyn & Bacon, Inc., Boston, 1987.

3. Butler, W. P., Methods of Analysis, (A. P. Mathers, ed.), Internal Revenue Service, U. S. Government Printing Office 0-410-684, 1970.

4. Stewart, C. P. and Stolman, A., Toxicology: Mechanisms and Analytical Methods, Vol. II, 3rd Ed., Academic Press, N. Y., 1972.

5. Sobol, S. P., and Moore, R. A., Analytical Manual, (J. W. Gunn, Ed.), Command of Narcotics and Dangerous Drugs, U. S. Government Printing Office 0-506-836, 1970.

6. Gilman, A. and Goodman, L., Pharmacological Basis of Therapeutics, 7th Edition, Macmillan Publishing, N. Y., 1985, pp. 1366-1371 and 1440-1455.

7. Shulgin, Alexander, et al., Pihkal: A chemical Love Story, Transform Press, Berkeley, CA, 1991.

8. Shulgin, Alexander, et al., Tihkal: The Continuation, Transform Press, Berekeley, CA, 1997.

9. Code of Federal Regulations, April 1, 2003, Part 1308 to end.

10. Drug Identification Bible, (most current edition) Amera-Chem, Inc., Grand Junction, CO.

11. Supplemental handouts.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: COLOR TESTS

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedure in the Drug Chemistry Procedures Manual for Color Tests (DC-B-1).

UNIT ESTIMATED TIME

5 Days

GOAL

To achieve the necessary knowledge, skills and abilities to perform and interpret color tests used in the analysis of drug substances.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the knowledge of the theory and interpretation of drug tests by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a practical knowledge of how to perform and interpret color test results by passing a practical criterion test with a score of 100%.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the theory and interpretation of color tests.

Lecture: Theory of Color Tests and the Interpretation of Results

Exercises:

1. Read assigned material.
2. Complete the assignment on the mechanism of color tests.
3. Complete study guide.
4. Present oral presentation on the results of the mechanism research.

Required Reading:

1. Cotton, F., Albert and Wilkinson, G., Advanced Inorganic Chemistry, 5th Ed., John Wiley & Sons, N.Y., 1988, pp. 320, 482, 719.

2. Bell, C. F. and Lott, K. A. K., Modern Approach to Inorganic Chemistry, Butterworths, London, 1964, pp. 133-141, 149-168.

3. CAC Newsletter. (Handout –January 1989 Name Reactions and Drug Testing.)

4. Feigl, F., Spot Tests in Organic Analysis, 7th Ed., Elsevier Publishing, N. Y., 1966, pp. 251, 137-139, 381-382.

5. Morrison, R. and Boyd, R., Organic Chemistry, 5th Edition, Allyn & Bacon, Inc., Boston, 1987, pp 1071-1073.

6. John, S. H., Wist, A. A., and Najam, A. R., Spot Tests: A Color Chart Reference for Forensic Chemists, Journal of Forensic Sciences, Vol. 24, #3, July 1979, pp. 631-649.

Supplemental References:

1. March, Jerry, Advanced Organic Chemistry, 3rd Ed., John Wiley & Sons, N. Y., 1985.

2. Butler, W. P., Methods of Analysis, (A. P. Mathers, ed.), Internal Revenue Service, U. S. Government Printing Office 0-410-684, 1970, pp. 106 and 136-137.

3. Sobol, S. P., and Moore, R. A., Analytical Manual, (J. W. Gunn, Ed.), Command of Narcotics and Dangerous Drugs, U. S. Government Printing Office 0-506-836, 1970.

4. Gonzalez, T., et al., Legal Medicine Pathology and Toxicology, 2nd Ed., Appleton Century Crafts, Inc., New York, 1954.

5. Jungreis, E. and Bender, L., Organic Spot Test Analysis, Wilson and Wilson's Comprehensive Analytical Chemistry, Vol. 10, New York, 1980.

6. Stewart, C. P. and Stolman, A., Toxicology: Mechanisms and Analytical Methods, Vol. II, 3rd Edition, Academic Press, New York, 1972.

7. Clarke, E. G. C., Clarke's Analysis of Drugs and Poisons, 3rd Edition, Vol. 1, edited by Anthony Moffat et al., Pharmaceutical Press, London, pp. 279-300.

8. Morris, Jeremiah, Extraction of GHB for FTIR Analysis and a New Color Test for Gamma-Butryolactone (GBL), Microgram, Vol. 32, No. 8, August 1999, pp. 215-221.

9. O'Neal, Carol, Crouch, Dennis J., Fatah, Alim A. Validation of twelve chemical spot tests for the detection of drugs of abuse, Forensic Science International, Vol. 109, (2000), pp. 189-201.

LESSON 2

Estimated Time: 4 Days

Purpose: To familiarize the trainee with preparing and using color test reagents in the analysis of drug samples.

Lecture/ Demonstration:	How to Perform and Interpret Color Tests
Exercises:	1. The trainee will prepare stock solutions of assigned color test reagents and appropriately log reagents in LIMS. 2. The trainee will test drug standards with color test reagents and prepare a chart of the results. 3. The trainee will perform a practical exercise and display an adequate level of competency in the evaluation of the results. The training coordinator will grade this on a pass/fail basis. 4. The trainee must pass a written criterion test on color tests with a score of no less than 80%.
Required Reading:	None
Supplemental Reading:	As assigned by the Training Coordinator.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: THIN LAYER CHROMATOGRAPHY

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedures in the Drug Chemistry Procedures Manual for Thin Layer Chromatography (DC-C-1).

UNIT ESTIMATED TIME

5 Days

GOAL

To achieve the necessary knowledge, skills and abilities to use thin layer chromatography (TLC) in the analysis of controlled substances.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the knowledge of the theory and interpretation of drug tests by passing written criterion test with a score of no less than 80%.

2. The trainee will learn the proper procedures for report wording and the application of this preliminary test which will be evaluated by the training coordinator on a pass/fail basis.

3. The trainee will demonstrate practical skills of thin layer chromatography by completing a series of exercises which will be evaluated by the training coordinator on a pass/fail basis.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the theory of thin layer chromatography.

Lecture: Thin Layer Chromatography

Exercises:

1. Read assigned material.
2. Complete study guide.
3. Successfully pass a written criterion test with a score of no less than 80%.

Required Reading:

1. Bobbitt, J., Schwarting, A., and Gritter, R., Introduction to Chromatography, Reinhold Co., New York, N. Y., 1968, pp. 1-30.

2. Geiss, Friedrich, Fundamentals of Thin Layer Chromatography, Huthig Publishers, Heidelberg, Germany, 1987, pp. 185-188, 225-250.

3. Touchstone, J. and Dobbins, M., Practice of Thin Layer Chromatography, 2nd Ed., John Wiley & Sons, New York, NY 1983, pp. 1-15, 103-136.

Supplemental References

1. Hamilton, Richard, and Hamilton, Shiela, Analytical Chemistry for Open learning: Thin Layer Chromatography, John Wiley & Sons, New York, N.Y., 1987.

2. Bobbitt, J., Thin Layer Chromatography, Reinhold Co., New York, N. Y., 1968, pp. 1-27.

LESSON 2

Estimated Time: 1 Day

Purpose: To allow the trainee to become familiar with the preparation of common solutions used in thin layer chromatography.

Lecture: None

Exercises:

1. Read assigned materials.
2. Locate chemicals for assigned systems and reagents.
3. Prepare assigned solvent systems.
4. Prepare assigned visualizing reagents.

Required Reading:

1. Supplemental handouts.

2. Clarke, E. G. C., Clarke's Analysis of Drugs and Poisons, 3rd Edition, Vol. 1, edited by Anthony Moffat et al. Pharmaceutical Press, London, pp. 392-424.

Supplemental References:

1. Zweig, G., Sherma, J., CRC Handbook Series in Chromatography, CRC Press, Inc., West Palm Beach, FL, Drugs Vol. I, II, 1981.

2. Butler, W. P., Methods of Analysis, A. P. Mathers, Ed., Internal Revenue Service, U. S. Government Printing Office 0-410-684, 1970.

3. Sobol, S. P., and Moore, R. A., Analytical Manual, J. W. Gunn, Ed., Bureau of Narcotics and Dangerous Drugs, U. S. Government Printing Office 0-506-836.

4. Mills, T., et al., Instrumental Data for Drug Analysis, Vol. 1-7, 1993.

5. Saferstein, Ph.D., Richard, Forensic Science Handbook, Vol. 1, 2, 3, Regents/Prentice Hall, Englewood Cliffs, New Jersey, 1982, 1988, 1993.

LESSON 3

Estimated Time: 3 Days

Purpose: To allow the trainee to develop and demonstrate the necessary skills in performing thin layer chromatography.

Lecture/
Demonstration: The Preparation/Development of TLC

Exercises:

1. Complete assigned exercises.
2. Successfully demonstrate the practical use of thin layer chromatography using a series of unknowns provided by your training coordinator.

Required
Reading:

1. Bobbitt, J., Schwarting, A., and Gritter, R. , Introduction to Chromatography, Reinhold Co., New York, N. Y., 1968, pp. 1-30.

2. Bobbitt, J., Thin Layer Chromatography, Reinhold Co., New York, N. Y., 1968, pp. 1-27.

3. Geiss, Friedrich, Fundamentals of Thin Layer Chromatography, Huthig Publishers, Heidelberg, Germany, 1987, pp. 185-188, 225-250.

4. Touchstone, J. and Dobbins, M., Practice of Thin Layer Chromatography, 2nd Ed., John Wiley & Sons, New York, NY 1983, pp. 1-15, 103-136.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: SEPARATIONS AND EXTRACTIONS

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedures in the Drug Chemistry Procedures Manual for Extractions, Separations and Derivatization Methods (DC-Appendix III).

UNIT ESTIMATED TIME

14 Days

GOAL

To achieve the necessary knowledge, skills, and abilities to isolate drug substances for further analysis.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the theory of separations by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a practical knowledge of how to perform separations by extracting substances from a series of unknowns. These exercises will be evaluated by the training coordinator on a pass/fail basis.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the theory and applications of extractions with respect to drugs and related substances.

Lecture: Theory of Extractions and Separations

Exercises:
1. Read assigned material.
2. Complete study guides.
3. Successfully pass a written criterion test with a score of no less than 80%.

Required Reading:
1. Connors, K. A., A Textbook of Pharmaceutical Analysis, 3rd Edition, John Wiley, New York, 1982, pp. 341-350.

2. Bell, Suzanne, "Chapter 4, Sample Preparation, Thin Layer Chromatography and Immunoassay," in Forensic Chemistry, Upper Saddle River, New Jersey: Pearson Education Inc., Pearson Prentice Hall, 2006, pp. 85-115.

3. Schirmer, Roger E., Modern Methods of Pharmaceutical Analysis, Vol. 1, CRC Press, Boca Raton, Florida, 1982, pp. 1-29.

Supplemental References:

1. Landgrebe, J., Theory and Practice in the Organic Laboratory, 3rd Edition, D. C. Heath & Co., Lexington, Massachusetts, 1982, pp. 78-86.

2. Clarke, E.G.C., Clarke's Analysis of Drug and Poisons, 3rd Edition, The Pharmaceutical Press, London, England, 2004, pp. 440-442 or the equivalent in a newer edition.

LESSON 2

Estimated Time: 12 Days

Purpose: The trainee will acquire the various skills necessary to successfully extract drugs from various matrices.

Lecture/ Demonstration: How to Perform Various Extraction Methods for Isolating Drug Substances

Exercises:

1. The trainee will perform a series of standard extraction methods on samples provided by the training coordinator.
2. The trainee will perform a series of specialized extraction procedures on samples provided by the training coordinator.
3. Extraction exercises will be evaluated by the Training Coordinator and graded on a pass/fail basis.

Supplemental References:

1. Reynolds, James, E. F., Ed., Martindale The Extra Pharmacopoeia, 29th Ed., The Pharmaceutical Press, London, 1989.

2. Budavari, Susan, Ed., The Merck Index, 12th Ed., Merck and Co., Inc., 1996 or later edition.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: GAS CHROMATOGRAPHY AND QUANTITATION BY GAS CHROMATOGRAPHY

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedure in the Drug Chemistry Procedures Manual for Gas Chromatography (DC-D-1) and Quantitation by Gas Chromatography (DC-IIA-3).

UNIT ESTIMATED TIME

Up to 25 Days

GOAL

To achieve the necessary knowledge, skills and abilities for use of gas chromatography in the identification of controlled substances.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the theory of gas chromatography by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a practical knowledge and skills in the operation of the gas chromatograph by successfully performing a variety of practical exercises. These demonstrations will include the following:
   A. A working knowledge of the gas chromatography software by generating a complete and accurate method of the analysis of a controlled substance to be evaluated by the training coordinator on a pass/fail basis.
   B. The ability to identify substances using the gas chromatography technique by correctly identifying a series of unknowns to be evaluated by the training coordinator on a pass/fail basis.

ANCILLARY

   C. The ability to quantitate using the gas chromatography technique by correctly quantitating an unknown with a practical criterion test score of pass/fail.

LESSON 1

Estimated Time: 4 Days

Purpose: To familiarize the trainee with the theory of gas chromatography.

Lecture: Theory of Gas Chromatography

Exercises:
1. Read the assigned materials on the theory of gas chromatography.
2. Complete the gas chromatography study guide.
3. Successfully pass a written criterion test on gas chromatography with a score of no less than 80%.

Required Reading:

1. Willard, Hobard H., Merritt, Lynne L., Dean, John L., Settle, Frank A., Instrumental Methods of Analysis, 7th Edition, Wadsworth Publishing Co., Belmont, California, 1988, pp. 513-529, 540-574. (pp. 530-539 for Quantitation.)

2. Buffington, R. and Wilson, M., Detectors for Gas Chromatography – A Practical Primer, Hewlett-Packard Co., 1987, pp. 1-10.

3. Poole, Colin, and Schuette, Sheila, Contemporary Practice of Chromatography, Elsevier Press, New York, N. Y., 1984, pp. 151-159.

4. Troubleshooting Guide, Supelco, Inc., Bellefonts, Pennsylvania, 1980

5. Grob, R., Modern Practice of Gas Chromatography, 2nd Edition, John Wiley and Sons, New York, 1985, pp. 159-176.

6. Hyver, K. J., and P. Sandra, High Resolution Gas Chromatography, 3rd Edition, Hewlett-Packard Co., 1989, Chapters 1 and 2.

7. Saferstein, Ph.D., Richard, Forensic Science Handbook, Vol 2, Regents/Prentice Hall, Englewood Cliffs, New Jersey, 1988, pp. 38-67.

LESSON 2

Estimated Time: 3 Days

Purpose: The trainee will successfully demonstrate a working knowledge of the hardware of the current gas chromatograph.

Lecture: Gas Chromatography Hardware

Exercises:

1. The training coordinator will demonstrate to the trainee the various parts and functions of the gas chromatograph (to include but not be limited to: the injectors, detectors, columns, pressure regulators, and flow measurements).
2. As a practical criterion test, the trainee will demonstrate to the training coordinator a working knowledge of the parts and function of the gas chromatograph and how to “set-up” the instrument. This will be on a pass/fail basis.

Required Reading:

1. The instrument instruction manuals where applicable.

LESSON 3

Estimated Time: 2 Days

Purpose: The trainee will successfully demonstrate a working knowledge of the software of the current gas chromatograph.

Lecture/Demonstration(s): Gas Chromatography Software and Kovats Qualitative GC Analysis

Exercises:

1. The training coordinator will demonstrate the gas chromatography software.
2. The trainee will complete the tutorial on gas chromatography.
3. The trainee will develop a method for obtaining a drug screening method and analyze a series of unknowns provided by the training coordinator on a pass/fail basis.
4. The trainee will demonstrate to the training coordinator a working knowledge of the software of the current gas chromatographs.

Required Reading:

1. The instrument software manual and computer tutorial as needed.

LESSON 4 - ANCILLARY

Estimated Time: 11 Days

Purpose: The trainee will successfully demonstrate the ability to quantitate controlled substances by gas chromatography.

Lecture: Quantitation by Gas Chromatography; Sampling Procedures; Calculations

Exercises:

1. Read assigned materials on gas chromatography
2. quantitation.
3. Complete problem set on quantitation calculations.
4. The trainee will develop methods to quantitate a controlled substances sample using all of the gas chromatography
5. quantitation procedures provided in the Drug Chemistry Procedures Manual.
6. The trainee will perform a quantitation using the autosampler.
   The trainee will correctly quantitate an unknown sample within Quality Assurance guidelines. This is a pass/fail criterion test.
   The trainee will successfully pass a written criterion test on quantitation with a score of no less than 80%.

Required Reading:

1. Gas Chromatography instrument manuals.

2. Quantitation Seminar, presented by personnel of the Drug Enforcement Administrations North Central Laboratory at the Midwestern Association of Forensic Scientists Meeting, 1981.

3. Skoog, Douglas, and West, Donald, Fundamentals of Analytical Chemistry, 4th Ed., 1982, Saunders Publishing, New York, N.Y., pp. 128-130, 144, 534-537, 662-666.

4. Moffatt, A. C., Senior Consulting Editor: Clarke's Isolation and Identification of Drugs, 2nd Ed. (or newer edition), 1986, The Pharmaceutical press, London, England, pp. 230-231.

5. Grob, R. L., Modern Practice of Gas Chromatography, 2nd Edition, John Wiley & sons, N. Y., N. Y., 1985, pp. 390-397, 409-412.

Supplemental References:

1. Hinshaw, J. and Ettre, L. S., Basic Relationship of Gas Chromatography, Advanstar Data, Cleveland, Ohio, 1993.

2. Hinshaw, J. and Ettre, L. S., Introduction to Open Tubular Column, Advanstar Communications, Cleveland, Ohio, 1994.

3. Taylor, J. K., Quality Assurance of Chemical Measurements, Lewis Publisher, Chelsea, Michigan, 1987, pp. 7-40.

4. Strobel, Howard and Heineman, William, Chemical Instrumentation: A Systematic Approach, 3rd Ed., 1989, John Wiley & Sons, pp. 381-391, 574-577.

5. Ettre, L. S., Practical Gas Chromatography, Perkin-Elmer Co., Norwalk, Connecticut, 1973, Chapters 1 and 2.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIR)

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedure from the Drug Chemistry Procedures Manual on Infrared Spectroscopy (DC-F-1 and DC-F-2).

UNIT ESTIMATED TIME

Up to 13 Days

GOAL

To achieve the necessary knowledge, skills and abilities for use of infrared spectrometry in the identification of controlled substances.

OBJECTIVES

1. The trainee will demonstrate a comprehensive knowledge of infrared spectrometry by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate practical skills and abilities in the operation of the infrared spectrometry by successfully passing a practical criterion test with a score of no less than 100%.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the theory of infrared radiation.

Lecture: The Electromagnetic Spectrum

Exercises:
1. Read assigned materials.
2. Begin study guide.

Lecture: Infrared Spectroscopy

Exercises:
1. Read assigned materials.
2. Continue to work on study guide.

Lecture: Sampling Techniques

Exercises:
1. Read assigned materials.
2. Continue to work on study guide.

Required Reading:
1. Silverstein, R. M., Bassler, G., Morrill, Terence C., Spectrometric Identification of Organic Compounds, 5th Ed., John Wiley & Sons, New York, New York, 1991, pp. 91-132.

2. Supplemental handouts.

3. Clarke, E. G. C., Clarke's Analysis of Drugs and Poisons, 3rd Ed., Vol. 1, 2004, pp. 328-345.

4. Smith, A. Lee, Applied Infrared Spectroscopy, Vol. 54, John Wiley & Sons, N. Y., N. Y., pp. 31, 73-97, 123-149, 176-186.

Supplemental Reference:

1. Saferstein, R., Forensic Science Handbook, Vol. 3, Regents/ Prentice Hall, Englewood Cliffs, New Jersey, 1993, pp. 71-102.

2. Smith, Brian C., Fundamentals of FTIR, CRC Press, New York, N. Y., 1996.

3. Stuart, Barbara, Analytical Chemistry by Open Learning: Modern Infrared Spectroscopy, John Wiley & Sons, New York, N. Y., 1996.

LESSON 2

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the theory of infrared spectrometers.

Lecture: The Theory of Fourier Transform Infrared Spectrometry

Exercises:
1. Read assigned materials.
2. Continue to work on study guide.

Required Reading:

1. Beckman Instruments, FTIR Primer, Beckman Instruments Co., Irvine, CA, 1983.

2. Supplemental handouts.

3. Nicolet Instruments, FITR Primer, Nicolet Instruments Co., Madison, Wisconsin, 1986.

4. Willard, Hobart H., Merritt, Lynne L., Dean, John L., Settle, Jr., Frank A., Instrument Methods of Analysis, 7th Ed., Wadsworth Publishing Co., Belmont, CA, 1988, pp. 287-316.

LESSON 3

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the software used on the infrared spectrometer.

Lecture/
Demonstration: FTIR Software

Exercises:
1. Read the assigned materials.
2. Run a Polystyrene standard calibration.

Required
Reading:
1. Instrumental Manual and on-line tutorial where applicable.

2. Supplemental handouts.

LESSON 4

Estimated Time: 10 Days

Purpose: To allow the trainee to gain experience in the use and operation of the infrared spectrometer and the theory and use of Attenuated Total Reflection (ATR).

Lecture/
Demonstration: Preparation of a KBr Pellet

Exercise:
1. Perform the assigned practical exercises to the satisfaction of the trainer.

Lecture/
Demonstration: Preparation of Samples for Infrared Analysis

Exercises:
1. Prepare and run infrared spectra on assigned standards.
2. Successfully pass a practical criterion test by using infrared spectrometry with a score of pass/fail.

Lecture/
Demonstration: Theory of ATR

Exercises:
1. Read assigned materials.
2. Successfully pass a quiz on the theory of ATR.

Required
Reading:
1. Koulis, Cynthia V., Reffner, John A., Bibby, Arran M., Comparison of Transmission and Internal Reflection Infrared Spectra of Cocaine, J. Forensic Sci 2001, 46(4):822-829.

2. Bartick, Edward G., Tungol, Mary W., Reffner, John A., A New Approach to Forensic Analysis with Infrared Microscopy: Internal Reflection Spectroscopy, Analytical Chimirca Acta, 208 (1994): pp.35.42.

3. Supplemental handouts.

Supplemental

References:

1. Mills, T. et al., Instrumental Data for Drug Analysis, Vol. 1-7, 1993.
2. Supplemental handouts.

LESSON 5 – ANCILLARY

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the interpretation of infrared spectra

Lecture: The Interpretation of Infrared Spectra

Exercises:

1. Read the assigned materials.
2. Complete the assignments on interpretation.
3. Successfully pass a comprehensive written criterion test on infrared spectroscopy with a score of no less than 80%.

Required Reading:

1. Silverstein, R. M., Bassler, G., Morrill, Terence C., Spectrometric Identification of Organic Compounds, 5th Ed., John Wiley & Sons, new York, New York, 1991, pp. 9-132.
2. Supplemental handouts.

Supplemental References:

1. Clarke, E. G. C., Isolation and Identification of Drugs, 2nd Edition, Pharmaceutical Press, London.
2. Saferstein, R., Forensic Science Handbook, Vol. 3, Regents/Prentice Hall, Englewood Cliffs, New Jersey, 1993, pp. 130-141.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: MASS SPECTROMETRY

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedure in the Drug Chemistry Procedures Manual for Mass Spectrometry (DC-G-1) and Quantitation in Mass Spectrometry by Selected Ion Monitoring (SIM) DC-IIA-6).

UNIT ESTIMATED TIME

Up to 25 Days

GOAL

To achieve the necessary knowledge, skills and abilities for use of mass spectrometry in the identification of Cannabis and Controlled Substances.

OBJECTIVES

1. The trainee will demonstrate a comprehension of mass spectrometry theory and interpretation by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate practical knowledge and skills in the operation of the mass spectrometer by successfully performing a variety of practical exercises. These demonstrations will include the following:
   A. A working knowledge of the mass spectrometry software by generating a complete and accurate method for the analysis of a controlled substance to be evaluated by the training coordinator on a pass/fail basis.

   B. The ability to identify substances using the mass spectrometry technique by correctly identifying a series of unknowns with a practical criterion test score of 100%.

ANCILLARY

   C. The ability to quantitate using the SIM technique by correctly quantitating an unknown with a practical criterion test score of pass/fail.

LESSON 1

Estimated Time:	3 Days
Purpose:	To familiarize the trainee with the various types of mass spectrometers and how they operate with emphasis on the Hewlett-Packard Mass Selective Detector.
Lecture:	Types of Mass Spectrometers and How They Operate
Exercises:	1. Read the assigned materials. 2. Complete the mass spectrometry study guide. 3. Complete assignments in mass spectrometry.

Required Reading:

1. Quadrupole Mass Spectrometry, VG Micromass Publication 02-439, May 1977.

2. Miller, Phillip E., Denton, M. Bonner, The Quadrupole Mass Filter: Basic Operating Concepts, Journal of Chem Ed., Vol. 63, No. 7, July 86, pp. 617-622.

3. Watson, J. Throck, Introduction to Mass Spectrometry, 1985, pp. 1-16, 75-95.

4. Willard, Hobart H., Merritt, Lynne L., Dean, John L., Settle, Jr., Frank A., Instrument Methods of Analysis, 7th Ed., Wadsworth Publishing Co., Belmont, CA, 1988, pp. 465-491.

5. Silverstein, R. M., Bassler, G., Morrill, Terence C., Spectrometric Identification of Organic Compounds, 5th Ed., John Wiley & Sons, New York, New York, 1991, pp. 3-7.

LESSON 2

Estimated Time: 4 Days

Purpose: The trainee will successfully demonstrate to the training coordinator a working knowledge of the software of the current mass spectrometers.

Lecture/Demonstration(s): Use of Current Software

Exercises:

1. Obtain a current method and develop a working knowledge of its parts.
2. Using this method as a model, set up a method to separate a standard mixture.
3. Print the mass spectrum for each peak.
4. Perform a library search and compare results to reference spectra.

Required Reading:

1. The instrument software manual where applicable.

LESSON 3

Estimated Time: 4 Days

Purpose: The trainee will successfully demonstrate a working knowledge of the software and hardware of the current mass spectrometer.

Lecture: Mass Spectrometer Hardware and Tuning Procedures

Exercises:
1. Perform a routine autotune and printout and evaluate the results.
2. Set up a method to separate a test mixture given by your training coordinator.
3. Run the test mixture and obtain results applying Lesson 2 criteria.

Required Reading:
1. The instrument software and instruction manuals where applicable.

LESSON 4 - ANCILLARY

Estimated Time: 3 Days

Purpose: The trainee will successfully perform a quantitation on the GC/MS using the Selected Ion Monitoring (SIM) method.

Lecture: Quantitation by SIM Mode

Exercises:
1. Develop a method to quantitate a controlled substance.
2. Run the method on a sample obtained from the training coordinator (practical criterion test) scored as a pass/fail.

Required Reading:
1. Instrument software manuals.

LESSON 5

Estimated Time: 3 Days

Purpose: To initiate the trainee to basic mass spectrum interpretation and its application to drug analysis.

Lecture: Basic Mass Spectral Interpretation

Exercises:
1. Using information obtained from the readings, assign structures to spectra obtained from the training coordinator.
2. Compare literature/library spectra to those obtained from the current instrument and explain any differences.
3. Explain a spectrum in terms understood by a layman.
4. Complete study guide on interpretation.
5. Complete a written criterion test on mass spectrometry with a score of no less than 80%.

Required Reading:
1. Watson, J. Throck, Introduction to Mass Spectrometry, pp. 121-143, 153-172, 289-295.

2. Silverstein, R. M., Bassler, G., Morrill, Terence C., Spectrometric Identification of Organic Compounds, 5th Ed., John Wiley & Sons, New York, New York, 1991, pp. 7-41.

Supplemental References:

1. McLafferty, F. W., Interpretation of Mass Spectra, 4th Edition, 1993.
2. Mills, T., et al., Instrumental Data for Drug Analysis, Vol. 1-7, 1993.
3. Yinon, Jehuda, Forensic Mass Spectrometry, Chapter 1, pp. 1-31, 51-57.

LESSON 6

Estimated Time: 3 Days

Purpose: To perform mass spectral analysis of cannabis and drug samples.

Lecture: None

Exercises:

1. Obtain mass spectra on a series of known substances.
2. Obtain mass spectra on a series of unknown substances (practical criterion test).

Required Reading: None

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: ANALYSIS OF CONTROLLED SUBSTANCES

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedures in the Drug Chemistry Procedures Manual – All covered techniques (DC-A through DC-H), DC-IA, B, C; DC II – A, B; Appendices I-V.

UNIT ESTIMATED TIME

20 Days

GOAL

To demonstrate the knowledge, skills and abilities necessary to identify controlled substances.

OBJECTIVES

1. The trainee will demonstrate practical knowledge and skills of the identification of controlled substances by successfully completing a series of unknowns as a practical criterion test with a score of 100%.

2. The trainee will demonstrate a knowledge of controlled substance identification by completing a final comprehensive written criterion test with a score of at least 80%.

LESSON 1

Estimated Time: 19 Days

Purpose: The trainee will successfully demonstrate the skills and abilities necessary to identify controlled substances.

Lecture: None

Exercise:
1. The practical criterion test will consist of a series of unknown substances. The trainee will complete the test, following procedures manual guidelines, with a score of 100%.

LESSON 2

Estimated Time: 1 Day

Purpose: The trainee will demonstrate a knowledge of drug analysis.

Lecture: None

Exercise:
1. Complete written criterion test on drug analysis with a score of at least 80%.

Required Reading:

1. Saferstein, Ph.D., Richard, Forensic Science Handbook, Vol. 2, Regents/Prentice Hall, Englewood Cliffs, NJ, 1988, pp. 69-160.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: SUPERVISED CASEWORK

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Drug Chemistry Procedures Manual.

UNIT ESTIMATED TIME

45 Days

GOAL

To demonstrate the knowledge, skills, and abilities necessary to identify controlled substances and cannabis.

OBJECTIVES

1. The trainee will demonstrate the necessary practical knowledge to analyze evidence submitted to the laboratory containing suspected controlled substances and cannabis by performing casework accurately. Accuracy is defined as no erroneous drug identifications and no failure to identify drugs that were clearly demonstrated by the analytical test data, as determined by the training coordinator. In addition, all standards listed in Command Directive TRN 14 must be met.

LESSON 1

Estimated Time: 45 Days

Purpose: The trainee will successfully demonstrate the skills and abilities necessary to identify controlled substances and cannabis.

Lecture: None

Exercise:

1. The trainee will complete agency-submitted drug and Cannabis cases, the specific number of which will be determined by the Training Coordinator and will consider such variables as case complexity, available resources, and time.

Required Reading: None

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: PHYSICAL IDENTIFICATION

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedures in the Drug Chemistry Procedures Manual for Physical Identification (DC-A-1); Report Wording (Appendix I).

UNIT ESTIMATED TIME

1 Day

GOAL

To achieve a practical knowledge in the ability to identify drugs by their physical appearance.

OBJECTIVES

1. The trainee will demonstrate the ability to identify drugs by using the appropriate reference materials and resources as determined by the training coordinator on a pass/fail basis.

2. The trainee will learn the proper procedures for report wording and the application of this preliminary test as evaluated by the training coordinator on a pass/fail basis.

3. The trainee will complete a written criterion test with a score of no less than 80%.

LESSON 1

Estimated Time: ½ Day

Purpose: To familiarize the trainee with the various reference material used in physical identification of drugs.

Lecture: Physical Identification and Reference Material

Exercises:
1. Read the assigned materials.
2. Complete the practical exercises on identification of drugs using the assigned references.
3. Successfully pass a written criterion test with a score of no less than 80%.

Required Reading:
1. Remington's Pharmaceutical Sciences, 18th Edition, Mack Publishing Co., Easton, Pennsylvania, Chapter 89.

2. Tillson, A. H., and Johnson, D. W., The Identification of Drug Table and Capsule Evidence as to Source, Journal of Forensic Sciences, 19 (4), 1974, pp. 873-883.

Supplemental References:

1. Physician's Desk Reference, 1969 to current year, Medical Economics Co., Oradell, New Jersey.
2. Drug Identification Bible, to current year, Amer-Chem.
3. Physician's Desk Reference for Non-Prescription Drugs, 1980 to current year, Medical Economics Co., Oradell, New Jersey.
4. Redbook – Annual Pharmacist's Reference, Ed., V. Cardinale, Medical Economics Co., Oradell, New Jersey, current year.
5. Project Label – U. S. Drug Enforcement Administration, U. S. Government Printing Office, current year.
6. Internet Services (e.g. erowid.org, dancesasfe.org, microgram.gov).
7. Koelling, A., The Identification of Peyote, Seminar Presentation.
8. Hall, Nancy, The Identification of Peyote, paper presented at the Spring 1983 meeting of the Midwestern Association of Forensic Scientists.
9. Anderson, Edward F., The Biogeography, Ecology and Taxonomy of Lophophora (Cactaceae), Brittonia, Vol. 21, No. 4, October-December 1969, pp. 299-310.

LESSON 2

Estimated Time: ½ Day

Purpose: The trainee will successfully demonstrate a practical knowledge of physical identification.

Lecture: Proper Report Wording

Exercise:

1. The trainee will be given known and unknown samples and will correctly perform a physical identification and exhibit proper report wording.

Required Reading:

1. Drug Chemistry Procedures Manual for Report Wording (Appendix I).

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: POLARIMETRY

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedures in the Drug Chemistry Procedures Manual for Polarimetry (DC- IIB-1).

UNIT ESTIMATED TIME

1 Day

GOAL

To achieve the necessary knowledge, skills and abilities to use polarimetry in the identification of optical isomers of drugs and related substances.

OBJECTIVES

1. The trainee will demonstrate practical skills and abilities by passing a practical examination to the satisfaction of the training coordinator.

LESSON 1

Estimated Time: ½ Day

Purpose: To familiarize the trainee with the chemistry of isomers and polarimetry.

Lecture: Isomers and Their Relationship to Controlled Substances

Exercise:
1. Read assigned materials.

Required Reading:
1. Skoog, D., Principles of Instrumental Analysis, 3rd Ed., CDS Publish- ing, N. Y., N. Y., 1985, pp. 386-404.
2. Supplemental handouts.

Supplemental References:
1. Osal, Arthur, Remington's Pharmaceutical Sciences, 145h Ed., Mack Publishing Co., 1970.
2. Morrison, R. T., Boyd, R. N., Organic Chemistry, 6th Ed., Prentice Hall, Englewood Cliffs, New Jersey, 1992.
3. Willard, Hobart H., Merritt, Lynne L., Dean, John L., Settle, Jr., Frank A., Instrumental Methods of Analysis, 7th Ed., Wadsworth Publishing Co., Belmont, CA, 1988, pp. 412-427.

LESSON 2

Estimated Time: ½ Day

Purpose: To familiarize the trainee with the use of the polarimeter.

Lecture/
Demonstration: The Polarimeter – Its Uses

Exercises:
1. Read assigned materials.
2. Determine the optical activity on assigned materials.
3. Successfully pass a practical criterion test with a score of pass/fail.

Recommended
Reading:
1. Polarimeter instrument manual.
2. Supplemental handouts.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: CLANDESTINE LABORATORY METHODS

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

2 Days

GOAL

To achieve the necessary knowledge to analyze and interpret clandestine laboratory submissions.

OBJECTIVES

1. The trainee will demonstrate a working knowledge of clandestine laboratory methods of synthesis by passing a written criterion test with a score of no less than 80%.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the various methods of clandestine drug manufacturer and analysis.

Lecture: Clandestine Laboratory Synthesis and Analysis

Exercises:

1. Read assigned materials.
2. Prepare a capacity report from the materials submitted by the training coordinator.
3. Successfully complete a written criterion test on clandestine laboratory synthesis and analysis with a score of no less than 80%.

Required References:

1. Christian, Donnell R., Forensic Investigation of Clandestine Laboratories, CRC Press, Boca Raton, FL, 2004, pp 147-159.

Supplemental References:

1. Clandestine Laboratory Guide for Agents and Chemists, Drug Enforcement Administration, U. S. Government Printing Office, 1977.
2. Supplemental handouts.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: STATISTICS, SAMPLING AND UNCERTAINTY

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedures in the Drug Chemistry Procedures (DC-H-1, DC H-1A, DC H-1B, DC H-2, App V).

UNIT ESTIMATED TIME

3 Days

GOAL

To achieve the necessary knowledge to understand and conduct scientific sampling by applying statistical methods of analysis and recognizing measurements of uncertainty.

OBJECTIVES

1. The trainee will demonstrate the practical understanding and proper application of measurement uncertainty as it relates to mass determinations in drug chemistry analysis.

LESSON 1

Estimated Time: 1 Day

Purpose: The trainee will become familiar with statistical terms and concepts.

Lecture: Terminology and Sampling Distribution, Measurement Uncertainty, Sources of Error, and Sampling

Exercise:
1. Complete an assigned exercise on statistics and balance uncertainty.

Required Reading:
1. Bell, S., Forensic Chemistry, Upper Saddle River, NJ, Prentice Hall, 2006, pp. 13-43.
2. Approved recommendation, Part IVC – Quality Assurance (Uncertainty), pp. 35-41.

Supplemental Reading:
1. As assigned by Training Coordinator.

LESSON 2

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the principles of statistics measurements and sampling uncertainty.

Required Reading:

1. Bell, S., Forensic Chemistry, Upper Saddle River, NJ, Prentice Hall, 2006, pp. 46-84.

Supplemental References:

1. As assigned by Training Coordinator.
2. Approved recommendation, Part IVC – Quality Assurance (Uncertainty), pp. 35-41.

Supplemental References:

1. Eurachem/CITAC Guide: *The Expression of Uncertainty in Qualitative Testing*, Committee Draft September 2003.
2. *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10189-9, International Organization for Standardization, Switzerland, 1995.
3. *Guidelines for Evaluation and Expressing the Uncertainty of NIST Measurement Result*s, National Institute of Standards and Technology, NIST Technical Note 1297, 1994 Edition.
4. General Requirements for the Competence of Testing and Calibration Laboratories International Organization for Standardization, ISO/IEC 17025: 2005.

LESSON 3

Estimated Time: 1 Day

Purpose: The trainee will become familiar with sampling and the use of software to obtain statistically significant samples and representative sample number.

Lecture/ Demonstration: Demonstrate the Proper Use of Sampling Software

Exercise:

1. Demonstrate the use of the sampling plan program to determine sampling sizes.

Required Reading:

1. Procedures Manual, DC-H-1 – Sampling Plan.
2. European Network of Forensic Science Institutes, Drugs Working Group. Guidelines on Representative Drug Sampling: 2003.

3. Frank, R. S.; Hinkley, S. W.; and Hoffman, C. G., "Representative Sampling of Drug Seizures in Multiple Container," *Jour. For. Sci.*, 1994; 44(4):750-760.

4. "Random Sampling Overview," Memorandum from PSA Glassburg to Tech Advisor Yokely, 11/22/95.

Lecture/ Supplemental Reference:

1. Coulson, S. A.; Coxon, A.; and Buckleton, J., "How Many Samples from a Drug Seizure Need to be Analyzed," *Jour. For. Sci.* 2001; 46(6):1456-1461.

2. Aitken, C. G. G., Sampling – How Big a Sample?," *Jour. For. Sci.*1999:44(4):750-760.

3. SWGDRUG Methods and Reports Subcommittee. Minimum Recommended Standards for Sampling Seized Drugs for Qualitative Analysis, 2004.

4. Hedayat, A. S. and Zhang, W. G., "Sampling Plans and Related Statistical Inferences of Forensic Drug Study," 1994 Technical Report, No. 94-01.

5. Colon, M.; Rodriguez, G.; and Orlando, D., "Representative Sampling of 'Street Exhibits'," *Jour. For. Sci*., 1993; 38(3):641-648.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

MODULE: DERIVATIZATION

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

Procedures in the Drug Chemistry Procedures Manual for Derivatization (Appendix II and Appendix III).

UNIT ESTIMATED TIME

2 Days

GOAL

To achieve the necessary knowledge, skills, and abilities to perform derivatization for the identification of controlled and other substances.

OBJECTIVES

1. The trainee will demonstrate a practical knowledge of how to perform derivatization by a practical criterion test to be evaluated by the training coordinator on a pass/fail basis.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the theory of derivatization and how to perform derivatization on gamma-hydroxybutyric acid (GHB) and stimulants.

Lecture: Theory of Derivatization

Exercises:

1. Read assigned materials on derivatizing techniques.
2. The training coordinator will demonstrate how to perform derivatization.
   Perform derivatization on standard materials given by the training coordinator.
   Complete a practical criterion test by performing derivatization on compounds of unknowns which will be given by the training coordinator. These will be checked by GC/MS and graded on a pass/fail basis.

Required Reading:

1. McKibben, T., Separation and Identification of Drug Eniantiomers Via N-TFA-(S)-Prolylchloride Derivatization, J. CLICA, January 1992, Vol. 1, No. 2.

2. Blumenfeld, M., Sunday, R., and Harmel, M., Sodium Gamma-Hydroxybutyric Acid: A New Anaesthetic Adjuvant Gamma Hydroxybutyric Acid, International Anesthesia Clinics, Vol. 7, No. 1, Spring 1969, pp. 75-89.

3. Koresh, S., Gamma-Hydroxy Butyrate (GHB), Wisconsin State Crime – Milwaukee, Nov. 1997.

4. Andrews, K., The Headaches of Analyzing a GHB Sample, DEA – Western Laboratory, 1998.

5. Loiken, J., and Paloucek, F., Poisoning and Toxicology Handbook, 2nd Ed., Lexi-Comp Inc., Hudson, OH, 1995, pp. 376-377.

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

APPENDIX A-1: TRAINING CHECKLIST

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INITIAL FORENSIC SCIENCE TRAINING CHECKLIST
DRUG CHEMISTRY

Trainee: _____ Coordinator: _____

Training Start Date: _____ Training End Date: _____

Module	Completion Date	Trainee Initials	Coordinator Initials
General Forensic Science			
Ethics in Forensic Science			
Courtroom Training for Drug Chemistry			
Cannabis			
Controlled Substances Act			
Color Tests			
Thin-Layer Chromatography			
Separations and Extractions			
Gas Chromatography			
Quantitation by Gas Chromatography (optional)			
Fourier Transform Infrared Spectroscopy			
Mass Spectrometry			
Analysis of Controlled Substances			
Supervised Casework			
Physical Identification			
Polarimetry			
Clandestine Laboratory Methods			
Statistics, Sampling, and Uncertainty			
Derivatization			

If a module was not completed, mark it as "NC" ("Not completed").

ILLINOIS STATE POLICE

DRUG CHEMISTRY TRAINING MANUAL

APPENDIX A-2: AUTHORIZATIONS BASED ON SCOPE

Reviewed by:

Gail E. Gutierrez
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE DIVISION OF FORENSIC SERVICES FORENSIC SCIENCES COMMAND

AUTHORIZATIONS BASED ON SCOPE

Field of Testing: Forensic Testing Forensic Scientist: _____

Category: Drug Chemistry

Sub Category: Controlled and Non-controlled Pharmaceuticals and Illicit Drugs; Related Chemicals and Paraphernalia

Analytical Technique	Authorized
1.2 Screening Tests: Color	
2.1 Chromatography: Gas Chromatography	
2.2 Chromatography: Thin Layer Chromatography	
3.1 Spectroscopy: Infrared	
3.2.1 Spectroscopy: GC/MS	
3.3 Spectroscopy: Polarimetry	
4.1 Physical Examination: Physical Measurements	
5.1 Microscopy: Optical	
6.1 General Laboratory Procedures: Weighing/Mass/Force Determination	
6.2 General Laboratory Procedures: Sampling	
6.3 General Laboratory Procedures: Quantitation	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category Botanical Material

Analytical Technique	Authorized
1.2 Screening Tests: Color	
2.1 Chromatography: Gas Chromatography	
2.2 Chromatography: Thin Layer Chromatography	
3.2.1 Spectroscopy: GC/MS	
5.1 Microscopy: Optical	
6.1 General Laboratory Procedures: Weighing/Mass/Force Determination	
6.2 General Laboratory Procedures: Sampling	
6.4 General Laboratory Procedures: General Laboratory Techniques	

These are the areas under which I am authorized to conduct casework.

_____

Forensic Scientist / Date

_____

Training Coordinator / Date

_____

Director of Training / Date

TABLE OF CONTENTS
FORENSIC BIOLOGY

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: CLEAN TECHNIQUE

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

5 Days

GOAL

To understand the importance and practice of clean technique utilized during the Forensic Biology/DNA Procedures.

OBJECTIVES

1. The trainee will demonstrate competency in the use of clean technique in the steps prior to starting analysis and the steps of sample processing by completing a practical criterion test with no less than 100% of the steps performed to training coordinator's satisfaction.

2. The trainee will demonstrate sufficient knowledge and skills required for proper clean technique during all phases of the forensic biology/DNA training. Successful completion will be determined by ongoing training coordinator observation on a pass/fail basis.

LESSON

Lectures:

Clean Technique - Overview of Topics:
- Decontamination of the General Laboratory and Individual Work Areas
- Cleaning and Sterilization Procedures of Laboratory Equipment
- Clean Technique - Initial Steps Prior to Starting Analysis
- Clean Technique - Sample Processing
- Policies for Amplification Set up and Post PCR Product Processing Rooms
- Use of Autoclave

Clean Technique Demonstration

Exercises:

1. Read assigned materials.
2. Prepare general laboratory and individual work areas for sample analysis.
3. Become familiar with use of autoclave.
4. Practice preparing for and processing a series of observation and independent mock exercises.

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.

2. Operating manual for autoclave.

3. Scherczinger, C. A., Ladd, C., Bourke, M. T., Adamowics, M. S., Johannes, P. M., Scherczinger, R., Beesley, T., Lee, H. C., "A Systematic Analysis of PCR Contamination." JFS, 1999, Vol. 44, No. 5, pp. 1042-1045.

4. As assigned.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

CLEAN TECHNIQUE MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Demonstration			
Observation			
Independent exercises			
Practical exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: REAGENT PREPARATION

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth
Director of Training

UNIT ESTIMATED TIME

4 Days

GOAL

To achieve the necessary knowledge, skill and ability to properly prepare reagents for the Forensic Biology/DNA laboratory.

OBJECTIVES

1. The trainee will demonstrate sufficient knowledge and skills required for proper reagent preparation. Successful completion will be determined by training coordinator observation on a pass/fail basis.

LESSON 1

Estimated time: 1 Day

Purpose: To familiarize the trainee with the pH meter usage and performance checks.

Lecture: Use of pH Meter and Performance Checks

Exercises:
1. Read assigned materials.
2. Practice performance checks and measurement with pH meter.

Required Reading:
1. Operating Manual for pH meter.

LESSON 2

Estimated time: 1 Day

Purpose: To familiarize the trainee with the proper use and performance checks of the laboratory balances.

Lecture: Use and Performance Checks of the Laboratory Balances

Exercises:
1. Read assigned materials.
2. Practice performance checks and use of the balances.

Required Reading:
1. Operating Manual for each laboratory balance.

LESSON 3

Estimated time: 1 Day

Purpose: To familiarize the trainee with the procedures to prepare Forensic Biology/DNA laboratory reagents.

Lecture: Reagent Preparation

Exercises:
1. Review chemical storage for the Forensic Biology/DNA section.
2. Review location of MSDS sheets.
3. Review reagent logbook for the Forensic Biology/DNA section.

LESSON 4

Estimated time: 1 Day

Purpose: To familiarize the trainee with the procedures to prepare Forensic Biology/DNA laboratory reagents.

Lecture: Documentation and Labeling Requirements of Prepared Reagents

Exercise:
1. Prepare Forensic Biology/DNA reagents utilized for training.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: EVIDENCE SCREENING QUALITY ASSURANCE

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

3 Days

GOAL

To achieve the necessary knowledge, skill and ability to meet Illinois State Police Command quality assurance standards and guidelines.

OBJECTIVES

1. The trainee will demonstrate knowledge of the ISP quality control program by passing the comprehensive written criterion assessment test with a score of no less than 80%.

2. The trainee will demonstrate knowledge in all aspects of quality assurance control checks and documentation in the Forensic Biology/DNA laboratory by implementing all quality assurance measures. Successful completion will be based upon training coordinator observation on a pass/fail basis.

LESSON 1

Estimated time: 3 Days

Purpose: To familiarize the trainee with quality assurance issues relating to the forensic biology section.

Lecture: Quality Assurance Topics

Exercises:
1. Review log books for applicable instrumentation and equipment.
2. Conduct performance checks as assigned by the training coordinator.

Required Reading:
1. Checklist for ISO17025 and related assessment documents.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: EVIDENCE HANDLING

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

4 Days

GOAL

To achieve the necessary knowledge, skill and ability to properly handle evidence.

OBJECTIVES

1. The trainee will demonstrate proper use of evidence tracking forms by preparation of forms using mock evidence. These forms will then be evaluated by the training coordinator on a pass/fail basis.

2. The trainee will demonstrate proper note taking by preparation of notes using mock evidence. These notes will then be evaluated by the training coordinator on a pass/fail basis.

3. The trainee will demonstrate proper debris removal techniques by using mock evidence. The trainee's technique will be evaluated by the training coordinator on a pass/fail basis.

LESSON 1

Estimated time: 1 Day

Purpose: To familiarize the trainee with proper evidence handling procedures.

Lecture: Evidence Tracking and Handling

Exercises:
1. Read assigned materials.
2. Observe evidence sign in and return.
3. Prepare mock evidence receipt, and evidence.
4. Review case folder items and evidence.

LESSON 2

Estimated time: 2 Days

Purpose: The trainee will learn to prepare proper examination notes.

Lecture: Note Taking in the Forensic Biology/DNA Section

Exercises:
1. Practice taking notes on at least five different exhibits.
2. Correct any deficiencies pointed out by training coordinator.
3. Read assigned materials.

LESSON 3

Estimated time: 1 Day

Purpose: The trainee will learn proper debris removal techniques.

Lecture: Debris Removal

Exercises:
1. Practice debris removal techniques on various types of items.
2. Practice proper labeling and packaging of removed debris.
3. Demonstrate to the training coordinator proper debris removal.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: HAIR TRAINING

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

2 Days

GOAL

The trainee will be expected to accomplish objective that will lead to determination of suitability as well as the preparation of hairs and hair roots for nuclear DNA analysis.

OBJECTIVES

1. The trainee will demonstrate a knowledge of characteristics that differentiate human versus animal hairs.

2. The trainee will be able to select appropriate samples for nuclear DNA testing.

3. The trainee will demonstrate how to use the wet mount technique to mount hairs temporarily for identification of suitability for nuclear DNA testing.

4. By the end of the unit, the trainee will demonstrate the ability to determine the suitability for nuclear DNA testing, temporary mounting of hairs and preparation of hair roots for subsequent nuclear DNA testing. Evaluation of ability will be determined by successful completion of written criterion test with a score of no less than 80%.

LESSON 1

Estimated time: 1 Day

Purpose: Introduce the general morphology of skin, the anatomical parts of hair, definitions, types of hair, and identification of hairs suitable for nuclear DNA analysis.

Lecture: Hair Examination–for–DNA PowerPoint and accompanying lecture

Exercise: 1. Become familiar with determining hairs suitable for nuclear DNA analysis using the Hair Picture Practical Handout and Hair DNA Written Criterion Test.

LESSON 2

Estimated time: 1 Day

Purpose: Demonstration of mounting hairs on slides using the wet mount technique and preparation of hairs of subsequent nuclear DNA testing.

Lecture: None

Exercises:

1. Wet mounting method and practical demonstration of mounting hairs by trainee.

Required Reading:

1. Federal Bureau of Investigation (1977) Microscopy of Hair, A Practical Guide and Manual, pp. 1-7, 19-24, 38-39.

2. Saferstein, R. (1982) Forensic Science Handbook, pp. 184-189, 191-192, 195-200.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: BLOOD STAIN SCREENING

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

9 Days

GOAL

To achieve the necessary knowledge, skill and ability to properly analyze blood stain evidence.

OBJECTIVES

1. The trainee will demonstrate knowledge and skill in the use and maintenance of the stereomicroscope to the satisfaction of the training coordinator on a pass/fail basis.

2. The trainee will demonstrate collection and preservation techniques for blood evidence by passing a practical criterion test with a score of no less than 100%. This may be offered in combination with the criterion tests on other body fluid screening.

3. The trainee will demonstrate proficiency in the use of preliminary tests for blood by successfully completing all exercises and written exercise results. Successful completion will be based upon training coordinator evaluation on a pass/fail basis.

4. The trainee will demonstrate a comprehensive understanding of the materials by successfully passing the biology screening assessment module.

LESSON 1

Estimated time: 1 Day

Purpose: The trainee will learn proper use and maintenance of the stereomicroscope.

Lecture: Stereomicroscope Care and Usage

Exercises:
1. Read assigned materials.
2. Practice cleaning of microscope.
3. Practice using the microscope.

Required Reading
1. Saferstein, R., Forensic Science Handbook, Vol. 1, pp. 417-436.

LESSON 2

Estimated Time: 1 Day

Purpose: The trainee will learn techniques for collection and preservation of blood evidence.

Lecture: Collection and Preservation of Blood Evidence

Exercises:
1. Read assigned materials.
2. Practice collection and preservation techniques.

LESSON 3

Estimated time: 1 Day

Purpose: The trainee will receive information regarding how bloodstain pattern evidence relates to stain collection decision making.

Lecture: Bloodstain Pattern Evidence

Exercises:
1. Read assigned materials.
2. Observe, discuss and study examples of bloodstain patterns through training presented by Illinois State Police Crime Scene personnel.

Required Reading:
1. Lecture handout materials.

Supplemental Reference:
1. Eckert, W., and James, S.; Interpretation of Bloodstain Evidence at Crime Scenes.
2. Laber, T. and Epstein, B.; Experiments and Practical Exercises in Bloodstain Pattern Analysis.
3. McDonell, H.; Flight Characteristics and Stain Patterns of Human Blood.

LESSON 4

Estimated time: 6 Days

Purpose: The trainee will learn how to perform preliminary testing for blood.

Lectures: Blood Constituents
Preliminary Tests for Blood

Exercises:
1. Read the assigned materials.
2. Review procedure for preparing Kastle-Meyer reagent.
3. Perform aged stain study.
4. Perform body fluid study.

5. Conduct tests on fresh vegetables.
6. Test catalase and peroxidase.
7. Perform dilution series study.
8. Perform stain size study.
9. Turn in write up of lab exercises.

Required Reading:

1. Gaensslen, R.E.: Sourcebook in Forensic Serology, Immunology and Biochemistry, pp. 101-116, 221-224.

2. Deforest, P., Gaensslen, R., and Lee, H.; Forensic Science, An Introduction to Criminalistics, Chapters 9 and 10.

3. Saferstein, R.; Forensic Science Handbook, Volume 1, pp. 271-297.

4. Forensic Biology Procedures Manual and appropriate sections of Report Wording and Standards and Controls.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: SEMEN STAIN SCREENING

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

6 Days

GOAL

To achieve the necessary knowledge, skill and ability to properly analyze semen stain evidence.

OBJECTIVES

1. The trainee will demonstrate competency in the use of various light sources and stain observation techniques. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

2. The trainee will demonstrate competency in the use of preliminary testing for semen stains by completing assigned exercises and submission of a report. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

3. The trainee will demonstrate competency in the use of the compound microscope. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

4. The trainee will demonstrate competency in the use of the microscope to find spermatozoa. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

5. The trainee will demonstrate a comprehensive understanding of the material by successfully passing the biology screening assessment module.

LESSON 1

Estimated time: 2 Days

Purpose: To familiarize the trainee with preliminary testing for seminal material.

Lectures: Male Reproductive System
Alternate Light Sources
Preliminary Testing for Semen

Exercises:
1. Read assigned materials.
2. Prepare semen stains on various materials. Observe using ALS, UV and visual exam.
3. Prepare semen dilution stains and dry on various materials. Observe using ALS, UV and visual exam.
4. Prepare AP test reagents.

5. Conduct aged stain study.
6. Conduct size of stain study.
7 Conduct dilution stain study.
8. Test various body fluids.
9. Test fresh mushrooms.

Required Reading

1. Duenhoelter, J.H., Stone, I.C. and Scott, D.E.; "Detection of Seminal Fluid Constituents After Alleged Sexual Assault," Journal of Forensic Science, Oct. 1978, pp. 824-827.

2. Davies, Anne and Wilson, Elizabeth; "The Persistence of Seminal Constituents in the Human Vagina," Forensic Science, 3, (1974), pp. 45-55.

3. Schiff, A.F.; "Reliability of the Acid Phosphatase Test for the Identification of Seminal Fluid," Journal of Forensic Science, Oct. 1978, pp. 883-884.

4. McClosky, K.L., Muscillo, G.C., and Noordewier, B.; "Prostatic Acid Phosphatase Activity in the Postcoital Vagina," Journal of Forensic Science, Oct. 1975, pp. 630-636.

5. DeForest, P., Gaensslen, R., and Lee, H.; Forensic Science an Introduction to Criminalistics, Chapter 10.

6. Gaensslen, R.E.; Sourcebook in Forensic Serology, Immunology and Biochemistry, pp. 149-180.

7. Standefer, J.C., and Street, E.W.; ""Post Mortem Stability of Prostatic Acid Phosphatase," Journal of Forensic Science, Jan. 1977, pp. 165-172.

LESSON 2

Estimated time: 2 Days

Purpose: To familiarize the trainee with microscopic techniques of semen identification.

Lectures: Compound Microscopy
Microscopic Identification of Semen

Exercises:
1. Read assigned materials.
2. Practice, use and maintenance of the compound microscope.
3. Conduct microscopic examination of various sperm cells.

4. Record results of the microscopic examinations.

Required Reading:

1. Weaver, R.L., Lappas, N.T., and Rowe, W.R.; "Utilization of Medically Obtained Evidence in Cases of Sexual Assault; Results of a Survey," Journal of Forensic Science, Oct. 1978, pp. 809-823.

2. Enos, W.R., Beyer, J.C., and Mann, G.T.; "The Medical Examination of Cases of Rape," Journal of Forensic Science, Jan. 1972, Volume 17, Number 1, pp. 50-55.

3. Enos, W.F., and Beyer, J.C.; "Spermatozoa in the Anal Canal and Rectum and in the Oral Cavity of Female Rape Victims," Journal of Forensic Science, Jan 1978, pp. 231-233.

4. Adelman, MM.; "Sperm Morphology," Laboratory Medicine, January 1986, Volume 7, Number 1, pp. 32-34.

5. Adelman, M.M., and Cahill, E.M.; Atlas of Sperm Morphology.

6. Saferstein, R.; Forensic Science Handbook, pp. 416-475.

7. Owen, G.W., and Smalldon, K.W.; "Blood and Semen Stains on Outer Clothing and Shoes Not Related to Crime," Journal of Forensic Science, April 1975, pp. 291-403.

8. Willot, G.M., and Crosse, M.A.; "The Detection of Spermatozoa in the Mouth," Forensic Science Society, 1986, pp. 125-128.

LESSON 3

Estimated time: 2 Days

Purpose: To familiarize the trainee with the use of the P30 test **strip** for the indication of semen.

Lectures:
Monoclonal Antibodies
P30 in Semen
P30 Test Strip for the Indication of Semen

Exercises:
1. Read assigned materials.
2. View video training tapes on sexual assault evidence collection.
3. Conduct aged semen stain study.
4. Conduct semen dilution stain study.
5. Conduct body fluid specificity study.

Required Reading:

1. P30 test strip manufacturer information sheet.

2. ISP Validation Studies.

3. Graves, H.C.B et. al.; "Post Coital Detection of a Male-Specific Semen Protein: Application to the Investigation of Rape," New England Journal of Medicine, 1985, Volume 312 (6), pp. 338-343.

4. Sensabaugh, G. G.; "Isolation and Characterization of a Semen-Specific Protein from Human Seminal Plasma: A Potential New Marker for Semen Identification," Journal of Forensic Science, Jan. 1978, pp. 106-115.

5. Hochmeister, M., Budowle, B., Rudin, O., Gehrig, C., Thali, M., and Dirnhofer, R.; "Evaluation of Prostate-Specific Antigen Membrane Test Assay for the Forensic Identification of Seminal Fluid," Journal of Forensic Sciences, 1999.

6. 720 ILCS - Sex Offenses.

7. Denison, et. al.; "Positive Prostate-Specific Antigen (PSA) Results in Semen-Free Samples," Can. Soc. Forensic Sci J, Vol. 37, No. 4, pp. 197-206.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: SALIVA STAIN SCREENING

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

1 Day

GOAL

To achieve the necessary knowledge, skill and ability to properly analyze saliva evidence.

OBJECTIVES

1. The trainee will demonstrate competency in the use of preliminary tests for saliva by completion of exercises and submission of a report. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

2. The trainee will demonstrate a comprehensive understanding of the material by successfully passing the biology screening assessment module.

LESSON 1

Estimated time: 1 Day

Purpose: To familiarize the trainee with techniques used to indicate saliva stains.

Lecture: Preliminary Testing for Saliva Stains

Exercises:
1. Read assigned materials
2. Conduct an aged stain study.
3. Conduct a specificity study with various body fluids.

Required Reading:

1. Gaensslen, R.E.; Sourcebook in Forensic Serology, Immunology, and Biochemistry, pp. 1838-189.

2. Auvdel, M.J.; "Amylase Levels in Semen and Saliva Stains," Journal of Forensic Science, April 1986, pp. 426-430.

3. Wilot, G.M., Griffiths, M.; "A New Method for Locating Saliva Stains; Spotty Paper for Spotting Spit," Forensic Science International, 1980, Volume 15, pp. 79-83.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: BIOLOGY SCREENING ASSESSMENT

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

5 Days

GOAL

To demonstrate the knowledge, skill and ability necessary to identify biological stain evidence.

OBJECTIVES

1. The trainee will demonstrate practical knowledge and skill of biological stain identification by completing a series of unknowns as a practical criterion test with a score of 100%.

2. The trainee will demonstrate practical knowledge of biological stain identification by completing a final comprehensive written criterion test with a score of at least 80%.

LESSON 1

Estimated time: 5 Days

Purpose: The trainee will successfully demonstrate the knowledge, skill and ability to identify biological stains.

Lecture: None

Exercise: 1. Complete the written test.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: COURTROOM TRAINING (BIOLOGY SCREENING)

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

7 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully perform courtroom testimony.

OBJECTIVES

1. The trainee will demonstrate a knowledge of the court system as it applies to a forensic scientist by passing a written criterion test with a score of no less than 80%.

2. The trainee will participate in at least one mock trial during their training period which will be evaluated on a pass/fail basis.

LESSON 1

Estimated time: 5 Days

Purpose: To familiarize the trainee with the state court system.

Lecture: Courtroom Demeanor Class

Exercise: 1. As assigned in courtroom demeanor class.

Required Readings: 1. As assigned in courtroom demeanor class.

LESSON 2

Estimated time: 2 Days

Purpose: To prepare the trainee for the court proceedings and presentations.

Lecture: None

Exercise: 1. Participate in a mock trial setting on a biology screening case.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: SUPERVISED CASEWORK (BIOLOGY SCREENING)

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

60 Days

GOAL

To achieve the necessary knowledge**,** skill and ability to conduct casework in the Forensic Biology Laboratory.

OBJECTIVES

1. The trainee will demonstrate the knowledge, skill and ability to determine the proper course of action when confronted with a biology case by completing an interview on each case with his/her training coordinator prior to working the case.

2 The trainee will demonstrate the knowledge, skill and ability to process casework by working the case under the direction of the training coordinator.

3. The trainee will demonstrate the knowledge, skill and ability to conduct casework independently by successfully completing at least twenty cases which include a majority of sexual assault cases.

4. The trainee will demonstrate the knowledge, skill and ability to write a report based on the examination conducted by successfully completing a review process with the training coordinator.

5. Successful completion of supervised casework will require that proper casework approach was followed; appropriate evidence was examined; appropriate stains tested, and appropriate stains selected for DNA analysis**;** no erroneous stain identifications or indications reported; no failure to report stains that were clearly demonstrated by the test results, as determined by the training coordinator; and clean technique was followed. In addition, all standards listed in Command Directives TRN 14 must be met.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: INTRODUCTION TO DNA

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

2 Days

GOAL

To achieve the necessary knowledge and thorough understanding of DNA as it relates to forensics.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA as it relates to forensics by successfully passing a written criterion test with a score of no less than 80%.

LESSON

Lectures: Introduction of DNA - Overview of Topics
- What is DNA?
- Where DNA is found?
- Structure
- Nomenclature
- Function
- Forensic DNA analysis

Exercises:
1. Read assigned materials.
2. Intro to DNA written exercise.

Required Reading:
1. Butler, J. M., Forensic DNA Typing, 2nd Edition, Chapters 1 and 2.
2. NRC II, Chapters 1 and 2.
3. As assigned.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INTRODUCTION TO DNA MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Written exercises			
Written exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: ORGANIC DNA ISOLATION

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

18 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully isolate DNA from forensic samples utilizing the Illinois State Police Command Organic DNA Extraction procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA extraction/ isolation by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate competency in the Illinois State Police Command Extraction/Isolation Procedures by completing a practical criterion test with a score of no less than 100%.

LESSON

Lectures:

DNA Extraction/Isolation - Overview of Topics
- Purpose of Extraction
- Theory
- ISP Organic DNA Extraction Procedures
- Reagents
- Minimum standards and controls
- QA/QC
- Casefile documentation and technical review requirements

Demonstration

Exercises:

1. Read assigned materials.
2. Observation extraction exercise.
3. Independent extraction exercises.
4. Theory written exercise.

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.

2. Butler, J. M., Advanced Topics in Forensic DNA Typing: Methodology, Chapter 2.

3. Relevant ISP Validation Studies.

4. As assigned.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

ORGANIC DNA ISOLATION MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Demonstration: non-semen			
Observation: non-semen			
Independent exercises: non-semen			
Demonstration: semen			
Observation: semen			
Independent exercises: semen			
Practical exam			
Written exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: DNA ISOLATION UTILIZING THE DNA IQ™ SYSTEM WITH THE MAXWELL® INSTRUMENT

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

15 Days

GOAL

To achieve the necessary knowledge, skill, and ability to successfully complete automated DNA isolation from forensic samples utilizing the DNA IQ™ System with the Maxwell® instrument as outlined in the Illinois State Police Command DNA Isolation Procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA isolation using the DNA IQ™ System and Maxwell® instrument by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate competency in the Illinois State Police Command DNA Maxwell® Isolation Procedure by completing a practical criterion test with a score of no less than 100%.

LESSON

Lectures:

DNA Isolation Utilizing the DNA IQ™ System with the Maxwell® Instrument
- Purpose of Extraction
- Function of Reagents
- Function of Each Step
- Comparison to Organic Extraction
- Maxwell® instrument
- Quality Assurance and Quality Controls
- ISP DNA Isolation with the DNA IQ™ System Procedures
- Casefile and technical review requirements

Non-semen and semen isolation demonstration

Exercises:

1. Read assigned materials.
2. Observation and Independent non-semen and semen samples.

Required Reading:

1. Promega Corporation. Introducing The Maxwell™ 16 Instrument: A Simple, Robust and Flexible Tool for DNA Purification. *Promega Notes* [Online]. (January 2006; 92).

2. Promega Corporation. Forensic Application of the Maxwell™ 16 Instrument. *Profiles in DNA* [Online]. (February 2006:9).

3. Promega Corporation. The Maxwell® 16 Low Elution Volume System for Forensic Casework. *Profiles in DNA* [Online]. (September 2007; Vol. 10, No. 2, pp. 10-12).

4. Greenspoon SA, Ban JD, Sykes K, Ballard EJ, Edler SS, Baisden M, Covington BL. Application of the Biomek® 2000 Laboratory Automation Workstation and the DNA IQ™ System to the Extraction of Forensic Casework Samples. *J. Forensic Sci,* 2004; 49(1):29-39.

5. Promega Corporation. The Maxwell® 16 Low Elution Volume System for Forensic Casework: Implementation and Routine Use in a Forensic Laboratory. *Profiles in DNA* [Online]. (September 2008; Vol. 11, No. 2, pp. 9-11).

6. ISP Validation Studies for Maxwell® 16.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

DNA IQ™ ISOLATION WITH MAXWELL® MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Demonstration: non-semen			
Observation: non-semen			
Independent exercises: non-semen			
Demonstration: semen			
Observation: semen			
Independent exercises: semen			
Practical exam			
Written exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: DNA QUANTITATION

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

15 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully perform DNA quantitation analysis and interpretation using the Illinois State Police Command DNA Quantitation Procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA quantitation by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate competency in the Illinois State Police Command Quantitation procedures by completing a practical criterion test with a score of no less than 100%.

LESSON

Lectures:

1. Real Time Quantitation (qPCR) – Topics:
   - Purpose of quantitation
   - qPCR Theory
   - Components of PowerQuant kit
   - ISP procedures
   - Interpretation
   - Quality Assurance and Quality Controls
   - Casefile and technical review requirements
2. Demonstration
   - Quantitation plate preparation
   - Analysis

Exercises:

1. Observation exercise: Prepare a standard serial dilution and quantitate and analyze a minimum of 16 previously quantitated samples under observation.
2. Independent exercise: Quantitate and analyze a minimum of two plates with a minimum of 16 previously quantitated samples on each.
3. Quantitation theory written exercise.
4. Review current validation and complete written exercise.
5. Interpretation exercise.

Required Reading:

1. ISP R&D Internal Validation: A comparison of Next Generation Quantification Kits.

2. ISP R&D Project: Amplification of Low Level and Not Detected Samples (2018-01).

3. Ewing, M.M, et. al. "Human DNA quantification and sample quality assessment: Developmental validation of the PowerQuant™ System." Forensic Science International: Genetics. 23(2016) 166-177.

4. Butler, J.M., Forensic DNA Typing Methodology, Chapter 3, pp 49-67.

5. Ewing, M. M., et. al. "The PowerQuant™ System: A New Quantification Assay for determining DNA Concentration and Quality." Promega Corporation, 2014.

6. Green R. L., et. al. "Developmental Validation of Quantifiler Real Time PCR Kits for the Quantification of Human Nuclear DNA Samples". *Journal of Forensic Sciences*. July 2005, Vol 50, No 4, pp 809-825.

7. Richard, M. L. et. al. "Developmental Validation of a Real Time Quantitative PCR Assay for Automated Quantification of Human DNA." *Journal of Forensic Sciences*. September 2003, Vol 48, No5, pp. 1041-1046.

8. Andreasson H. and Allen, M. "Rapid Quantification and Sex Determination of Forensic Evidence Materials." *Journal of Forensic Sciences.* September 2003, Vol 48, No5, pp 936-944.

9. Van der horst, E.H., et. al. "Taq-Man®-based Quantification of Invasive Cells in the Chick Embryo Metastasis Assay." *Biotechniques*. 2004, Vol 37, No 6, pp 940-945.

10. Barbisin, M, et.al. A multiplexed system for quantification of human DNA and male DNA and detection of PCR inhibitors in biological samples. *Forensic Science International: Genetics Supplement Series 1*. August 2008, pp 13-15.

11. PowerQuant™ System Technical Manual.

12. Thermo Fisher Scientific; Real-time PCR handbook.

13. Applied Biosystems® 7500 Real-Time PCR System manuals.

14. Relevant portions of the Bio/DNA Procedures Manual.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

DNA QUANTITATION MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Demonstration			
Observation			
Independent exercises			
Quantitation theory written exercise			
Validation written exercise			
Interpretation written exercise			
Written exam			
Practical exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: PCR AMPLIFICATION

Reviewed by:

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Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

6 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully perform PCR amplification utilizing the Illinois State Police Command PCR Amplification Procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of PCR amplification by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate technical skills in the Illinois State Police Command PCR Amplification procedures by successfully completing a practical criterion test with a score no less than 100%. This criterion test may be given in conjunction with the STR Analysis practical.

LESSON

Lectures:

1. PCR Amplification - Overview of Topics:
   - Purpose
   - Theory
   - Procedure
   - Amplification kit components
   - QA/QC
   - Casefile documentation requirements
2. Calculations - Target Amount of DNA
3. Laboratory Demonstration

Exercises:

1. Observation exercise
2. Independent exercise
3. Theory written exercise
4. Amplification target exercise
5. Read assigned materials

Required Reading:

1. Relevant portions and references of the Illinois State Police Forensic Biology/DNA Procedures Manual.

2. Butler, J. M., Topics in Forensic DNA Typing: Methodology, Chapter 4.
3. Bell, J., "The Polymerase Chain Reaction," Immunology Today, 1989, Vol. 10, No. 10.

4. Mullis, K. B., "The Unusual Origin of the Polymerase Chain Reaction," Scientific American, 1990, April, pp. 56-65.

5. Brownstein, M. J., Carpten, J. D., Smith, J. R., "Modulation of Non Templated Nucleotide Addition by *Taq* DNA Polymerase: Primer Modifications that Facilitate Genotyping," Biotechniques, 1996, Vol. 20, No. 6, pp. 1005-1010.

6. Henegariu, O., et. al. "Multiplex PCR: Critical Parameters and Step by Step Protocols", Biotechniques, 1997 Vol. 23, pp 504-511.

7. Promega Corporation. PowerPlex® Fusion System Technical Manual.

8. Applied Biosystems® GeneAmp PCR System 9700™ User's Manual.

9. Applied Biosystems® ProFlex™ PCR System User Guide.

10. ISP R&D Internal Validation: Thermal Cycler Model 480 and 9700 Comparisons.

11. ISP R&D Internal Validation: Applied Biosystems® 9700™ vs ProFlex™ (2016-10).

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

PCR AMPLIFICATION MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Demonstration			
Observation			
Independent exercises			
Theory written exercise			
Amplification target written exercise			
Written exam			
Practical exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: STR ANALYSIS

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

10 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully perform STR analysis utilizing the Illinois State Police Command STR Analysis Procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of STR analysis and capillary electrophoresis by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate sufficient knowledge and skill in the Illinois State Police Command STR Analysis procedures by completing a practical criterion test covering capillary electrophoresis and data analysis with a score no less than 100%.

3. The trainee will demonstrate sufficient knowledge and skills in the maintenance procedure for capillary electrophoresis instrumentation. Successful completion will be determined by completing a practical criterion test with a score no less than 100%.

LESSON

Lectures:

1. STR Analysis/Capillary Electrophoresis - Overview of Topics
   - Short Tandem Repeats (STR) Characteristics
   - Repeat and Sequence Polymorphisms
   - Advantages/Usefulness
   - Repeat Motifs
   - Allele designation
   - Multiplex
2. Capillary Electrophoresis Theory and Instrumentation:
   - Theory
   - Instruments and components
   - Data Collection
   - Matrix and Spectral
   - Procedure
   - Quality Assurance and Quality Control
   - Casefile documentation
3. Capillary Electrophoresis Demonstration
4. Capillary Electrophoresis Instrument Maintenance Demonstration
5. Data Analysis Theory and Software
6. GeneMapper ID-X Demonstration

Exercises:

1. Read assigned materials.
2. Observation sample set.
3. Practice sample sets: CE and data analysis for two runs with a minimum of 10 samples.
4. Data analysis on the yearly sensitivity samples.
5. Maintenance practice.

Required Reading:

1. Forensic Biology/DNA Procedures Manual IIIC-12- Amplification and Electrophoresis of STRs: PowerPlex® Fusion.

2. Promega Corporation. PowerPlex® Fusion System Technical Manual, Part #TMD039, Revised 3/15.

3. Applied Biosystems® 3500/3500xL Genetic Analyzer User Bulletin, June 2011.

4. GeneMapper® ID-X Software, v 1.0 Getting Started Guide, PN 4375574.

5. GeneMapper® ID-X Software, v 1.5 user Bulletin, PN 100031708 Rev.A, 18 May 2015.

6. ISP R&D Internal Validation: Evaluation of Peak Window Size and Polynomial Degree (07B-09).

7. ISP R&D Project: Capillary Life Study (IP05-03).

8. Oostdik, K., et al. Developmental validation of the PowerPlex Fusion System for analysis of casework and reference samples: A 24-locus multiplex for new database standards. Forensic Science International: Genetics 12 (2014) 69-76.

9. Butler, J. M., Advanced Topics in Forensic DNA Typing: Methodology, Chapters 5 and 6.

10. Moretti, T. R., Baumstark, A. L., Defenbaugh, D. A., Keys, K. M., Smerick, J. B., Budowle, B., "Validation of Short Tandem Repeats (STRs) for Forensic Usage: Performance Testing of Fluorescent Multiplex STR Systems and Analysis of Authentic and Simulated Forensic Samples," Journal of Forensic Sciences, 2001, Vol. 46, No. 3, pp. 647-660.

11. As assigned.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

STR ANALYSIS
MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lectures			
Required readings			
Demonstration			
Observation			
Independent exercises			
Theory Written exercise			
Written exam			
Practical exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: TECAN FREEDOM EVO® 150 AND THE PROMEGA METHODS®: THEORY

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

2 Days

GOAL

To achieve the necessary knowledge and thorough understanding of the processing of non-semen and semen samples from preparation through amplification using the TECAN Freedom EVO® 150 Automated Workstation in order to author and peer reports.

OBJECTIVES

1. The trainee will demonstrate comprehensive understanding of DNA sample processing as it relates to the TECAN Freedom EVO® 150and the Promega Methods® by successfully passing a written criterion test with a score of no less than 80%.

LESSON

Lecture: TECAN Freedom EVO® 150 and the Promega Methods® Validation and Theory

Exercises:
1. Read assigned materials.
2. Review lecture material.
3. Complete TECAN deck layout exercise.
4. Observe TECAN procedures: Sample Extraction, Quantification, Normalization and Amplification.

Required Reading:
1. Relevant portions of the Forensic Biology/DNA Procedures Manual.
2. Tecan Trading AG. Tecan Freedom EVO 150® Operating Manual. Version 3.1 or above [CD], 2006.
3. Illinois State Police Internal Validation of the TECAN Freedom EVO® 150 and the Promega Methods®.
4. Illinois State Police TECAN EVO® 150: Performance Check: Guanidine Isothiocyanate Inhibition, 19-BIO-03.
5. Illinois State Police PowerPlex Fusion Performance Check: Concentration Methods, 20-BIO-08.
6. Welts, F., et al. DNA IQ High Throughput Method Testing on the TECAN Freedom EVO®. Scientific Applications Report, 08/18.

7. Stangegaard, M., et al. Automated extraction of DNA and PCR setup using a TECAN Freedom EVO® liquid handler. Forensic Science International: Genetics Supplement Series 2 (2009) 74-76.

8. Fregeau, C. J., et al. Validation of a DNA IQ-based extraction method for TECAN robo9tic liquid handling workstations for processing casework. Forensic Science International: Genetics 4 (2010) 292-304.

9. Morf, N.V., et al. Internal validation of TECAN robots (Freedom EVO® 150 and 75) for PCR and capillary electrophoresis setup. Forensic Science International: Genetics Supplement Series 3 (2011) e89-e90.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

TECAN AND THE PROMEGA METHODS: THEORY MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Demonstration			
Deck layout exercise			
Written exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: DNA QUALITY ASSURANCE

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

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DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

5 Days

GOAL

To achieve the necessary knowledge and thorough understanding of the FBI Quality Assurance Standards as well as the skill and ability to adhere to Illinois State Police Command Quality Assurance Standards.

OBJECTIVES

1. The trainee will demonstrate sufficient knowledge and skill required for adhering to quality assurance standards during all phases of the biology/DNA training. Successful completion will be determined by training coordinator observation on a pass/fail basis.

   The trainee will participate in quality assurance procedures by routinely monitoring, identifying, documenting, and correcting any problems in the DNA testing being conducted. The following quality assurance activities may take place throughout the duration of training: temperature rotation for water baths/refrigerator/freezers, thermal cycler temperature verification and uniformity tests, quality control tests for reagents, chemical inventory tracking, facility bleach monitoring.

2. The trainee will demonstrate a comprehensive understanding of quality assurance standards by successfully passing a written criterion test with a score of no less than 80%.

LESSON

Lectures:
DNA Quality Assurance - Overview of Topics
History of DNA Guidelines and Organizations
FBI Quality Assurance Standards
Accreditation
Standards vs. Guidelines
ISP DNA Quality Assurance

Exercises:
1. Read assigned materials.
2. Complete quality assurance written exercise.

Required Reading:
1. Quality Assurance Standards for Forensic DNA Typing Laboratories, current version.

2. Quality Assurance Standards for Forensic DNA Databasing Laboratories, current version.

3. Relevant SWGDAM Quality Assurance Guidelines.

4. Forensic Biology/DNA Procedures Manual, Appendix IV-B.

5. Butler, J. M., Forensic DNA Typing: Methodology, Chapter 7.

6. Butler, J. M., Forensic DNA Typing: Interpretation, Appendix 2.

7. As assigned.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

DNA QUALITY ASSURANCE MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Written exercise			
Written exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: AUTOSOMAL STR INTERPRETATION

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

30 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully interpret data obtained from autosomal STR analyses using the Illinois State Police Command Procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of STR interpretation as it relates to forensics by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate sufficient knowledge and skill in the autosomal Illinois State Police Command STR Interpretation procedures by completing an interpretation practical criterion test that covers an arrange of samples routinely encountered in casework with a score of no less than 100%.

LESSON

Lectures: Interpretation- Overview of topics:

- Electropherogram evaluation
- ISP Validations
- Analytical and Stochastic Thresholds
- Peak Height Ratio
- Artifacts
- Microvariants
- Genetic Anomalies
- Mixtures
- Degradation
- Low template and off-scale data
- Electropherogram documentation
- Standards and Controls
- Casefile documentation and Technical Review

Exercises:

1. Read assigned materials.
2. Written exercise: Interpretation.
3. Written exercise: Validation.
4. Interpretation exercises: single source, artifacts, degraded profiles, partial profiles, mixed contributor profiles, low template profiles.

Required Reading:

1. Relevant portions and references of the Forensic Biology/DNA Procedures Manual.

2. Clayton, T. M., Whitaker, J. P., Sparkes, R. Gill, P., "Analysis and Interpretation of Mixed Forensic Stains Using DNA STR Profiling," FSI, 1998, Vol. 91, pp. 55-70.

3. Butler, J.M., Forensic DNA Typing: Interpretation, Chapters 1-8.

4. Illinois State Police Internal Validation: PowerPlex Fusion and and Applied Biosystems 3500 Genetic Analyzer (Project #2014-08).

5. Oostdik, K., et al. (2014) Developmental validation of the PowerPlex Fusion System for analysis of casework and reference samples: A 24-locus multiplex for new database standards. Forensic Science International: Genetics 12, 69-76.

6. Katsanis, S.H., Wagner, J.K. (2013) Characterization of the Standard and Recommended CODIS markers. Journal of Forensic Sciences, 58 Supp1, S169-72.

7. Buckleton, J., et al. (2005) Forensic DNA Evidence Interpretation. Washing, DC: CRC Press..

8. Scientific Working Group on DNA Analysis Methods (SWGDAM) (2010) SWGDAM Interpretation guidelines for autosomal STR typing by forensic DNA testing laboratories.

9. Gill, P., et al. (2006). DNA Commission of the International Society of Forensic Genetics: Recommendations on the interpretation of mixtures. Forensic Science International. 160: 90-101.

10. Gill, P., et al. (2008) National recommendations of the technical UK DNA working group on mixture interpretation for the NDNAD and for court going purposes. Forensic Science International: Genetics, 2, 76-82.

11. Schneider, P. M., et al. (2009). The German Stain Commission: recommendations for the interpretation of mixed stains. International Journal of Legal Medicine, 123, 1-5 (originally published in German in 2006- Rechtsmedizin 16: 401-404).

12. Budowle, B., et al. (2009) Mixture interpretation: defining the relevant features for guidelines for the assessment of mixed DNA profiles in forensic casework. Journal of Forensic Sciences, 54, 810-821.

13. Moretti T., et al. (2001) Validation of short tandem repeats (STRs) for forensic usage: performance testing of fluorescent multiplex STR systems and analysis of authentic and simulated forensic samples. Journal of Forensic Sciences 46: 647-660.

14. Bright, J., et al. (2013). Degradation of forensic DNA profiles. Australian Journal of Forensic Sciences, 45:4, 445-449.

15. Chung, D. T., et al. (2004). A study on the Effects of Degradation and Template Concentration on the Amplification Efficiency of the STR Miniplex Primer Sets. Journal of Forensic Sciences, 49, 733-40.

16. Bregu, J., et al. (2013). Analytical Thresholds and Sensitivity: Establishing RFU Thresholds for Forensic DNA Analysis. Journal of Forensic Sciences, 58, 120-129.

17. Monich, U., et al. (2015). Probabilistic characterization fo baseline noise in STR profiles. Forensic Science International: Genetics, 19, 107-122.

18. Estimate Analytical Thresholds Using STR-validator, July 7, 2016, version 1.2.

19. Gilder, J. R., et al. (2007). Run-specific limits of detection and quantitation for STR-based DNA testing. Journal of Forensic Sciences, 52, 97-101.

20. Rakay, C. et al. (2012). Maximizing allele detection. Effects of analytical threshold and DNA levels on rates of allele and locus drop-out. Forensic Science International: Genetics, 6, 723-728.

21. Kelly, H., et al. (2012). Modeling heterozygote balance in forensic DNA profiles. Forensic Science International: Genetics, 6, 729-734.

22. Taylor, D., et al. (2016). Factors affecting peak height variability for short tandem repeat data. Forensic Science International: Genetics, 21, 126-133.

23. Gill, P., Buckleton, J. (2010). A universal strategy to interpret DNA profiles that does not require a definition of low-copy number. Forensic Science International: Genetics, 4, 221-227.

24. Gill, P., et al. (2009). The low-template DNA (stochastic) threshold- Its determination relative to risk analysis for national DNA databases. Forensic Science International: Genetics, 3, 104-111.

25. Buckleton, J. (2009). Validation issues around DNA typing of low level DNA. Forensic Science International: Genetics, 5, 255-260.

26. Taylor, D., Buckleton, J. (2015). Do low template DNA profiles have useful quantitative data? Forensic Science international: Genetics, 16, 13-16.

27. Bright, J., et al (2012) A comparison of stochastic variation in mixed and unmixed casework and synthetic samples. Forensic Science International: Genetics, 6, 180-184.

28. Gill, P., et al. (1998) Interpretation of simple mixtures when artifacts such as stutter are present-with special reference to multiplex STRs used by the Forensic Science Service. Forensic Science International, 95, 213-224.

29. Bright, J., et al. (2014) Variability of mixed DNA profiles separated on a 3130 and 3500 capillary electrophoresis instrument. Australian Journal of Forensic Sciences, 46:3, 304-312.

30. Brookes, C., et al. (2012) Characterizing stutters in forensic STR multiplexes. Forensic Science International: Genetics, 6, 58-63.

31. Sailus, J., et al. Considerations for the evaluation of plus stutter for AmpFℓSTR PCR amplification kits in human identification laboratories. Forensic News: February 2012.

32. Clayton, T.M. et al. (2004). A genetic basis for anomalous band patterns encountered during DNA STR profiling. Journal of Forensic Sciences, 49, 1207-1214.

33. Bright, J., Coble, M. (2020) Forensic DNA Profiling- A Practical Guide to Assigning Likelihood Ratios. Chapter 1. CRC Press.

34. As assigned.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

AUTOSOMAL INTERPRETATION MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Written exercise			
Validation written exercise			
Interpretation exercises			
Written exam			
Practical exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: STATISTICS: Random Match Probability

Reviewed by:

Tabithah L. Marcacci
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Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

5 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully generate random match probability statistics for autosomal STR analyses using the Illinois State Police Command Procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of the random match probability method for calculating statistics as it relates to forensics by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate sufficient knowledge and skill in the Illinois State Police Command procedure for calculating and applying the random match probability by completing a statistics practical criterion test that covers an arrange of samples routinely encountered in casework with a score of no less than 100%.

LESSON

Lectures: Statistics/Population Genetics
- Statistics programs utilized by ISP
- ISP procedures
- Casefile documentations and technical review

Exercises:
1. Read assigned materials.
2. Written exercise.
3. Statistics practical exercise.

Required Reading:
1. Relevant portions of the Forensic Biology/DNA Procedures Manual.
2. NRC I, Chapter 3.
3. NRC II, Chapters 4 and 5.
4. Budowle, B., Moretti, T., Baustark, A. L., Defenbaugh, D.A., "Population Data on the Thirteen CODIS Core Short Tandem Repeat Loci in African Americans, U. S. Caucasians, Hispanics, Bahamians, Jamaicans, and Trinidadians," Journal of Forensic Sciences, 1999, Vol. 44, No. 6, pp. 1277-1286.

5. Budowle, B., Brendan, S., Niezgoda, S., Chakraborty, R., "CODIS STR Loci Data from 41 Sample Populations," Journal of Forensic Sciences, 2001, Vol. 46, No. 3, pp. 453-489.

6. Chakraborty, R., "Samples Size Requirements for Addressing the Population Genetic Issues of Forensic Use of DNA Typing," Human Biology, 1992, Vol. 64, No. 2, pp. 141-159.

7. Moretti, T., et al. (pending) Population data on the expanded CODIS core STR loci for eleven populations of significance for forensic DNA analyses in the United States. Forensic Science International: Genetics XXX.

8. Illinois State Police STR Calculator version 4 (Project #2016-05)

9. Butler, J.M., (2015). Advanced Topics in Forensic DNA Typing: Interpretation. San Diego: Elsevier Academic Press. Chapters 9-13, 16 and Appendixes 1-4.

10. Walsh B., et al. (2008) joint match probabilities for Y Chromosome markers. Forensic Science International, 174, 234-238.

11. As assigned.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

STATISTICS: RANDOM MATCH PROBABILITY MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Written exercise			
Practical exercise			
Written exam			
Practical exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: COMBINED DNA INDEX SYSTEM (CODIS)

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

5 Days

GOAL

To achieve the necessary knowledge, skill and ability to adhere to the NDIS and Illinois State Police Command procedures for sample entry, profile searching, and documentation for the Combined DNA Index System (CODIS) program.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of CODIS by successfully passing the NDIS Eligibility test and a written criterion test with a score of no less than 80%.

LESSON

Lectures:

CODIS:
- Purpose
- DNA Index Systems
- Profile Eligibility
- Indices
- Upload and searching
- Casefile documentation

CODIS Software Demonstration

Exercises:

1. Read assigned materials.
2. Complete the NDIS Eligibility Test
3. Profile eligibility exercise
4. Disposition exercise
5. Keyboard search exercise

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.
2. National DNA Index System (NDIS) Operational Procedure Manual.
3. Butler, J. M., Methodology, Chapter 8.
4. Biology/DNA LIMS User's Guide.
5. As assigned.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

CODIS
MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Software demonstration			
Profile eligibility written exercise			
Disposition written exercise			
Keyboard search exercise			
Written exam			
NDIS Eligibility test			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: COURTROOM TRAINING & LEGAL ISSUES FOR DNA ANALYSIS

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

8 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully testify in court and to become familiar with the legal aspects of forensic DNA analysis.

OBJECTIVES

1. The trainee will become familiar with the legal aspects of forensic DNA casework. Successful completion will be determined by training coordinator evaluation on a pass/ fail basis.

2. The trainee will demonstrate effective DNA expert witness testimony that is simple, concise, and accurate by participating in a DNA mock trial practical criterion test with a score no less than 100%. The following criteria must be graded satisfactory: truthful, technically accurate, understandable, believable, evidence handling, and no defensive responses to questions.

LESSON

Lectures:

Legal Aspects of DNA:
- Court Decisions
- Discovery and Evidence Laws
- ISP Procedures for Discovery
- Subpoenas

Court Preparation:
- Conduct
- Qualifying and Direct Questions

Exercises:

1. Read assigned materials.
2. Prepare DNA qualifying and direct court questions
3. Participate in practice sessions for DNA court testimony
4. Courtroom visit and/or review of DNA testimony transcripts

Required Reading:

1. Relevant portions of Command Directives Manual

2. Butler, J.M., Forensic DNA Typing: Methodology, Chapter 18 & Appendix 4.

3. NRC II, Chapter 6: DNA Evidence in Legal System.

4. Provided transcripts from DNA court testimonies

5. As assigned.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

COURTROOM TRAINING & LEGAL ISSUES FOR DNA ANALYSIS MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lectures			
Required readings			
Qualifying & Direct Questions			
Court testimony practice			
DNA testimony review			
Practical exam: Mock Trial			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: ORAL BOARD EVALUATION

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

10 Days

GOAL

To demonstrate the necessary knowledge, skill and ability to show competency in discussing, defending and explaining the DNA/STR methods, interpretation and statistical procedures utilized within the Illinois State Police Command.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of all facets of the materials presented and practiced during the DNA portion of the forensic biology/DNA training program by successfully passing an oral criterion test with a score of no less than 80%.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

ORAL BOARD EVALUATION MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Oral criterion exam			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: DNA MOCK CASEWORK & REPORT WRITING

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

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Director of Training

UNIT ESTIMATED TIME

50 Days

GOAL

To achieve the necessary knowledge, skill and ability by way of practical experience for working DNA casework and adhering to the Illinois State Police Command Procedures.

OBJECTIVES

1. The trainee will demonstrate sufficient knowledge and skill required to conduct DNA casework according to the Illinois State Police Forensic Biology/DNA Procedures Manual.

   A. A minimum of ten mock cases must be completed from extraction through report. Additional cases may be required if the trainee demonstrates a difficulty with any aspect of casework including but not limited to interpretation, analytical work, productivity, case management, and excessive technical review points.

   B. Three of the ten cases will count as practical criterion test to demonstrate competency in the DNA procedures, interpretation, statistical and report writing procedures.

   C. The trainee will demonstrate sufficient knowledge and skill required to complete a thorough technical review by reviewing his/her own casework casefile and by completing technical review on a minimum of five mock casefiles of his/her peer during the peer review process.

   D. The trainee will develop the knowledge and skill required for casework management.

LESSON

Lectures: Report Writing & Technical Review
- LIMS documentation requirements
- Statistics and CODIS casefile documentation
- Data upload to LIMS
- Report wording
- Technical review requirements

Required Reading:
1. Relevant portions of the Forensic Biology/DNA Procedures Manual.
2. Relevant portions of the Biology/DNA LIMS User's Guide.

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

DNA MOCK CASEWORK & REPORT WRITING MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Required readings			
Mock DNA cases			
Technical Review (minimum of 5)			
Practical criterion test (3 mock cases)			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: SUPERVISED DNA CASEWORK

Reviewed by:

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Lisa M. Fallara
Training Coordinator

Approved by:

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DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

UNIT ESTIMATED TIME

60 Days

GOAL

To achieve the necessary knowledge, skill and ability to conduct DNA casework and adhering to the Illinois State Police Command Procedures.

OBJECTIVES

1. The trainee will demonstrate sufficient knowledge and skill required to conduct DNA casework in an independent manner according to the Illinois State Police Forensic Biology/DNA Procedures Manual. Successful completion will require that major and minor profiles were accurately determined; artifacts were correctly identified and accounted for; no erroneous profile identifications or exclusions were made; statistics were calculated correctly; and clean technique was followed. In addition, all standards listed in Command Directive TRN 14 must be met.

    A. Interpretation and reporting for a ~~A~~ minimum of twelve DNA cases must be completed. The twelve cases should include a minimum of eight DNA cases, a minimum of two Direct to DNA Sexual Assault cases and a minimum of one COIDS hit report. Additional cases may be required if the trainee demonstrates a difficulty with any aspect of casework including, but not limited to, interpretation, analytical work, productivity, case management, and excessive technical review points. Competency will be demonstrated with three of the twelve cases counting as a practical criterion test.

    B. The trainee will demonstrate sufficient knowledge and skill required to complete a thorough technical review on his/her own casework.

    C. The trainee will develop and demonstrate the knowledge and skill required to effectively manage in a productive manner all facets of forensic biology/DNA casework, which includes, but is not limited to, analysis/interpretation/report generation, participating in the quality control/quality assurance procedures in the laboratory, responding to legal/discovery issues, and other duties required for casework management.

    D. The trainee will maintain favorable public relations with user agencies and testify in court concerning the procedures and results of their forensic biology/DNA analysis.

Lectures: CODIS Hit Reports

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

DNA SUPERVISED CASEWORK MODULE CHECKLIST

Trainee: _____ Trainer: _____

Training Start Date: _____ Training End Date: _____

Task	Completion Date	Trainee Initials	Trainer Initials
Lecture			
Supervised Casework			
Practical: 3 Supervised Cases			

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: BONE EXTRACTION

Reviewed by:

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Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

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DNA Technical Leader

William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

Estimated Time: 6 Days (2 days per week for 3 weeks)

Purpose: To understand bone extraction and the adaptation of the biology/DNA procedures to produce DNA data from bone submission.

Objectives:

1. The trainee will demonstrate competency in the extraction of human DNA from a minimum of one of three samples provided.

2. The trainee will demonstrate sufficient knowledge and skills required for proper bone preparation and isolation techniques during bone extraction training. Successful completion will be determined by training coordinator observation on a pass/fail basis.

Part I:

Estimated Time: 2 Days (3 day lapse time for extraction)

Purpose: To familiarize the trainee with the femur bone extraction procedures.

Lectures: Bone Extractions – Overview of Topics
Safety Procedures

Exercises:

1. Extract one femur bone.
2. qPCR will be performed to ensure high molecular weight DNA has been obtained.
3. Amplification and typing will be performed to ensure proper results.

Reading Assignments:

1. *Anatomy of the Human Body*, Bone Physiology section by Henry Gray. 20th ed., re-edited by Warren H. Lewis, Philadelphia: Lea & Febiger, 1918. OTHER AUTHOR: Lewis, Warren Harmon, ISBN: 1-58734-102-6., Bartleby.com, 2000.

2. Frank, W. E., Llewellyn, B. E., "A Time Course Study on STR Profiles Derived from Human Bone, Muscle, and Bone Marrow", *Journal of Forensic Sciences*, 1999, Vol. 4, pp. 778-782.

Part II

Estimated Time: 2 Days (3 day lapse time for extraction)

Purpose: To familiarize the trainee with a rib bone extraction procedure.

Lectures: Bone Extractions **-** Equipment and Techniques
Bone Physiology

Exercises:

1. Each trainee will extract one rib bone.
2. qPCR will be performed to ensure high molecular weight DNA has been obtained.
3. Amplification and typing will be performed to ensure proper results.

Part III:

Estimated Time: 2 Days (3 day lapse time for extraction)

Purpose: To familiarize the trainee with bone extraction procedure.

Lecture: Sources of Error and Interpretation of Results

Exercises:

1. Each trainee will extract any type of available bone.
2. qPCR will be performed to ensure high molecular weight DNA has been obtained.
3. Amplification and typing will be performed to ensure proper results.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: BONE EXTRACTION – FREEZER MILL

Reviewed by:

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DNA Technical Leader

William E. Demuth II
Director of Training

Estimated Time: 5 Days

Purpose: To familiarize the forensic scientist with the concepts of bone extraction.

Lectures:
Bone Extraction Procedure Using the Spex Freezer Mill
ISP Bone Extraction Procedure
QIAquick Silica Filtration for Inhibitor Removal
QIAquick Filter Validation and Procedures

Exercises:

1. Extract one environmentally exposed bone sample. Bone dust will be collected using the Spex Freezer Mill.
2. Quantify extracted DNA by qPCR. Extraction results will be graded as passing if a minimal total of 2ng is obtained from the extraction and no PCR inhibition is identified based on qPCR results.
3. Filter 50µL of the bone extract using a QIAquick filter. Recover the filtered sample in 50µL. Quantify each sample by qPCR. Note removal of inhibitor if identified by qPCR. Identify the approximate recovery efficiency for these filters.
4. Read assigned materials.
5. Review lecture materials.

Required Reading

1. Relevant portions of the ISP Forensic Biology/DNA Procedures Manual.
2. QIAquick handbook.
3. ISP Research and Development Laboratory Bone Extraction Validation Summary.

Supplemental Reference:

1. Spex Freezer Mill Operating Manual.
2. Technical Note: Improved DNA Extraction from Ancient bone Using Silica-Based Spin Columns, DY Yang, et. al., American Journal of Physical Anthropology, 1998, 105: 539-543.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: DNA Isolation from Non-Semen Samples (Excluding Tissue, Hair and Bone)

Reviewed by:

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Training Coordinator

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William E. Demuth II
Director of Training

DNA ISOLATION FROM NON-SEMEN SAMPLES (EXCLUDING TISSUE, HAIR, AND BONE) USING THE DNA IQ™ SYSTEM

Estimated Time: 5 Days

Purpose: To familiarize the forensic scientist/trainee with the concepts of DNA isolation using the DNA IQ™ System and ISP Procedures.

Lectures: DNA Isolation - Overview of Topics:

- Purpose of Extraction
- Function of Reagents
- Function of Each Step
- Comparison to Organic Extraction
- Limitations of the DNA IQTM System
- Controls Used During Isolation
- Contamination Awareness During Isolation
- ISP DNA Isolation with the DNA IQTM System Procedures

Exercises:

1. Read assigned materials.
2. Review lecture material.
3. Prepare extraction reagents.
4. Perform manual extraction and qPCR quantitation on blood standards, minimum of 9 samples total, to include:
   A. Three replicates of ¼ stain from a filter paper blood card.
   B. Three replicates of ⅛ stain from a filter paper blood card.
   C. Three replicates of $^{1}/_{16}$ stain from a filter paper blood card.
5. Perform manual extraction and qPCR quantitation on buccal standards, minimum of 6 samples total, to include:
   A. Three replicates of ½ buccal swab.
   B. Three replicates of ¼ buccal swab.
6. Perform manual extraction and qPCR quantitation on a dilution series using blood:
   A. For example, dilute liquid blood 1/5 and spot a varying series of volume onto material (e.g. 30µL, 20µL, 10µL, 5µL, 2µL, and 1µL).
   B. Extract the generated dilution series of minimally 6 volumes in duplicate, for a minimum of 12 samples total.
7. Perform manual extraction and qPCR quantitation on a dilution series using saliva:
   A. For example, dilute fresh saliva ½ and spot a varying series of volume onto material (e.g. 30µL, 20µL, 10µL, 5µL, 2µL, and 1µL).
   B. Extract the generated dilution series of minimally 6 volumes in duplicate, for a minimum of 12 samples total.

8. Perform manual extraction and qPCR quantitation on forensic casework type non-semen samples (e.g. cigarette butts, blood or saliva stain on blue jeans, etc.), minimum of 6 samples total, to include but not be limited to:
   A. Three replicates of portions of cigarette butts.
   B. Three replicates of blood or saliva stain from black-dyed material (the material can be generated using a black dye such as RIT).
9. Record all results and observations.
10. Complete a written report based on the recorded results and observations. This may be done as a group exercise if deemed appropriate.

Required Reading:

1. Relevant portions of the ISP Forensic Biology/DNA Procedures Manual.
2. Relevant ISP Validation Studies.
3. Promega Corporation Technical Bulletin No. 296: DNA IQTM System - Small Sample Casework Protocol.
4. As assigned.

Supplemental Reference:

1. Relevant scientific literature.

Competency Test:

1. Initial competency will be demonstrated by: a.) completion of extraction exercises to training coordinator's satisfaction, and b.) achieving a minimum score of 80% on a written criterion test.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: SILICA FILTRATION

Reviewed by:

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Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

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DNA Technical Leader

William E. Demuth II
Director of Training

SILICA FILTRATION

Estimated Time: 2 Days

Purpose: To familiarize the forensic scientist with the concepts of silica filtration.

Lectures: QIAquick Silica Filtration for Inhibitor Removal and MinElute Silica Filtration for Post PCR Purification Topics:

QIAquick Filter Validation and Procedures
MinElute Filter Validation and Procedures

QIAquick Exercise:

1. Prepare a serial dilution of TE-4 saturated hematin. Prepare a DNA standard at approximately 5ng/µL with each point in the hematin series. Filter 50µL of each mixture using a QIAquick filter. Recover the filtered sample in 50µL. Quantify each sample by qPCR. Note removal of inhibitor in the filtered sample set. Identify the approximate recovery efficiency for these filters. Results are expected to meet those identified in the validation study for inhibitor removal and recovery efficiency.

MinElute Exercises:

1. Create a serial dilution ranging from 0.25ng/µL to approximately 0.0078ng/µL and amplify two 5µL aliquots of each sample using the current autosomal STR amplification chemistry. Filter one replicate dilution in the series with the MinElute filter. Analyze all data based on a 50 rfu threshold. Identify allele/locus drop-out. Compare results to validation study reports identifying stochasm as affecting amplifications of less than 0.125 ng.
2. Forensic Scientists trained in Y-STR analysis will complete the same studies using the current Y-STR amplification system.
3. Read assigned materials.
4. Review lecture materials.

Required Reading:

1. Relevant portions of the ISP Forensic Biology/DNA Procedures Manual.

2. QIAquick and MinElute handbooks.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: AUTOMATED ANALYSIS OF DNA FROM NON-SEMEN SAMPLES USING THE TECAN FREEDOM EVO®

Reviewed by:

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Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

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DNA Technical Leader

William E. Demuth II
Director of Training

AUTOMATED ANALYSIS OF DNA FROM NON-SEMEN SAMPLES USING THE TECAN FREEDOM EVO®

Estimated Time: 15 Days

Purpose: To familiarize the forensic scientist with the concepts of and procedures for the isolation and quantitation of DNA from non-semen samples using automated platforms.

LESSON 1

Estimated Time: 2 Days

Lectures: Introduction to the Tecan – Overview of Topics:
- Software Basics
- Hardware / Deck Layout

Exercises:
1. Read assigned materials.
2. Review lecture materials.

Required Reading:
1. Relevant portions of the Forensic Biology/DNA Procedures Manual.
2. Relevant ISP Validation Studies.
3. As assigned.

LESSON 2

Estimated Time: 13 Days

Lectures: Automated DNA Analysis – Overview of Topics:
- Software Basics and Sample Data Transfer
- DNA IQ™ Automated Method Using SlicPrep™ 96 Device
- DNA IQ™ Automated Method With Manual Preparation
- Automated Setup of qPCR Quantitation Plates

Exercises:
1. Read assigned materials.
2. Review lecture materials.
3. Perform automated extractions using the SlicPrep™ 96 device on blood standards, minimum of 9 samples total, to include:
   A. Three replicates of ¼"sq stain from filter paper blood card.
   B. Three replicates of ⅛"sq stain from filter paper blood card.
   C. Three replicates of 1/16"sq stain from filter paper blood card.

4. Perform automated extractions using the SlicPrep™ 96 device on buccal standards, minimum of 6 samples total, to include:
   A. Three replicates of ½ buccal swab.
   B. Three replicates of ¼ buccal swab.
5. Perform automated analysis with manual preparation on forensic casework type, non-semen samples (e.g. cigarette butts, blood or saliva on blue jeans, etc.), minimum of 5 samples total.
6. Perform a contamination study of automated analysis using the SlicPrep™ 96 device. Blood standards, buccal swabs or a combination of both may be used. Complete a written report based on recorded results and observations. This exercise may be completed as a group if deemed appropriate. The following patterns will be evaluated:
   A. Checkerboard pattern
   B. Zebra pattern
7. Record all results and observations. A minimum total of 5 completed automated analyses must be performed.

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.
2. Relevant ISP Validation Studies.
3. As assigned.

Supplemental Reference:

1. Relevant scientific literature.

Competency Test:

1. Initial competency will be demonstrated by achieving a score of 100% on a practical criterion test consisting of mock non-semen DNA samples.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: AmpFℓSTR MINIFILER

Reviewed by:

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Director of Training

AmpFℓSTR MINIFILER

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the forensic scientist with relevant mini-STR literature, validation study results and ISP procedures.

Lectures: Mini-STR Analysis Topics:
- Multiplex Systems
- Forensic Validation Studies
- ISP Forensic Biology/DNA Procedures Manual

Exercises:
1. Read assigned materials.
2. Review lecture materials.

Required Reading.
1. Relevant portions of the Forensic Biology/DNA Procedures Manual.

Supplemental Reference:
1. Assigned literature.

LESSON 2

Estimated Time: 5 Days

Purpose: Develop practical competency in amplification using the AmpFℓSTR Minifiler PCR Amplification Kit.

Exercises:
1. Extract, purify, isolate and quantify DNA from five previously profiled degraded samples.
2. Amplify extracted DNAs and control samples using the AmpFℓSTR Minifiler PCR Amplification Kit.
3. CE analysis of amplification set.
4. Samples and control results will be reviewed by training coordinator. For results to be accepted:
   A. Positive control results must be correct and complete.

B. Alleles identified in each practice sample must be correct. As samples are degraded complete genotypes are not required for all loci.

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.

Competency Test:

1. Initial competency will be demonstrated by achieving a minimum score of 80% on a written criterion test.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: Y-STR AMPLIFICATION AND THEORY

Reviewed by:

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Lisa M. Fallara
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Approved by:

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William E. Demuth II
Director of Training

LESSON 1

Estimated Time: 3 Days

Purpose: To familiarize the forensic scientist/trainee with the relevant Y-STR literature, validation study results and ISP procedures.

Lectures: Y-STR Analysis – Overview of Topics
- Applications
- Mutation Rates
- Multiplex Systems
- Population Genetics
- Forensic Validation Studies

Exercises:
1. Read assigned materials.
2. Review lecture material.
3. Complete written criterion test by achieving 80% minimum passing score.

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.

2. Sinha, S. K., Budowle, B., Arcot, S. S., Richey, S. L., Chakraborty, R., Jones, M. D., Wojtkiewicz, P. W., Schoenbauer, D. A., Gross, A. M., Sinha, S.K., Shewale, J. G., "Development and Validation of a Multiplexed Y-Chromosome STR Genotyping System, Y-Plex¤ 6, for Forensic Casework," Journal of Forensic Sciences, 2003, Vol. 48, No. 1, pp. 93-103.

3. Sinha, S. K., Nasir, H., Gross, A. M., Budowle, B., Shewale, J. G., "Development and Validation of the Y-Plex¤ 5, a Y-Chromosome STR Genotyping System, for Forensic Casework," Journal of Forensic Sciences, 2003, Vol. 48, No. 5, pp. 985-1000.

4. Krenke, B. E., et. al., "Validation of a Male Specific, 12-Locus Fluorescent Short Tandem Repeat (STR) Multiplex," Forensic Science International, 2005, Vol. 148, No. 1, pp. 1-14.

5. Thompson, J.M., Ewing, M.M., Frank, W.E., et.al., "Developmental Validation of the PowerPlex Y23: A Single Multiplex Y-STR Analysis System for Casework and Database Samples," Forensic Science International: Genetics 2013.

6. Promega Inc. PowerPlex® Y23 Kit User's Manual.

Supplemental Reference:

1. Frank, W. E, Ellinger, E. R., Kirshack, P. A., "Y-Chromosome STR Haplotypes and Allele Frequencies in Illinois Caucasian, African American and Hispanic Males," Journal of Forensic Sciences, 2006, Vol. 51, No. 5, pp. 1207-1215.

2. Assigned literature.

LESSON 2

Estimated Time: 3-5 Days (5 days if samples need extraction and quantification)

Purpose: To introduce amplification using Y-STR amplification kit components and demonstrate inter-laboratory reproducibility with respect to haplotype results.

Lecture: Amplification Set Up and PCR Product Evaluation

Exercises:

1. Extraction, purification, isolation and quantitation of DNA from six previously profiled samples.
2. Amplification of extracted DNAs and control samples using Y-STR amplification kit components.
3. PCR product genotype analysis using capillary electrophoresis.

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.

Supplemental Reference:

1. Assigned literature.

LESSON 3

Estimated Time: 5 days (5 days if samples need extraction and quantification)

Purpose: To evaluate amplification sensitivity using Y-STR amplification kit components.

Lectures: Amplification Set Up and PCR Product Evaluation
Y-STR Sensitivity Limits

Exercises:

1. Amplification of a 2 - 0.031ng serial dilution of one previously quantified DNA using Y-STR amplification kit components.
2. PCR product genotype analysis using capillary electrophoresis.

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.

Supplemental Reference:

1. Assigned literature.

LESSON 4

Estimated Time: 5 Days

Purpose: To complete the analysis of non-probative casework samples and a Y-STR analysis competency test.

Lecture: None

Exercises:

1. Amplify seven non-probative casework samples.
2. PCR product genotype analysis using capillary electrophoresis.
3. Extract, purify, isolate and quantitate 5 competency samples.
4. Amplify competency samples using Y-STR amplification kit components.
5. PCR product genotype analysis using capillary electrophoresis.
6. Validation summary based on results produced by analyst in training.
7. Complete competency test by achieving 100% minimum passing score.

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.

Supplemental Reference:

1. Assigned literature.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

MODULE: PARENTAGE

Reviewed by:

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Approved by:

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William E. Frank
DNA Technical Leader

William E. Demuth II
Director of Training

PARENTAGE ANALYSIS

Estimated Time: 2 Days

Purpose: To familiarize the forensic scientist with the concepts of and statistical basis for parentage analysis.

Lectures: Parentage Analysis Topics:

- ISP Case Acceptance Policies
- Likelihood Ratios
- Parentage, Combined Parentage and Reverse Combined Parentage Indices
- Probability of Paternity
- Probability of Exclusion
- Report Wording Guidelines

Exercises:

1. Hand calculation of parentage, combined parentage and reverse combined parentage indices.
2. Demonstration of the parentage module within Popstats.

Required Reading:

1. Relevant portions of the Forensic Biology/DNA Procedures Manual.
2. Relevant portions of the Command Directives.
3. As assigned.

Competency Test:

1. Initial competency will be demonstrated by: a.) achieving a score of 100% on a practical criterion test consisting of mock parentage trio sets, and b.) achieving a minimum score of 80% on a written criterion test.

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

APPENDIX A-1: FORENSIC BIOLOGY TRAINING CHECKLIST

Reviewed by:

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Tabithah L. Marcacci
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INITIAL FORENSIC SCIENCE TRAINING CHECKLIST
FORENSIC BIOLOGY

Trainee: _____ Coordinator: _____

Training Start Date: _____ Training End Date: _____

Module	Completion Date	Trainee Initials	Coordinator Initials
General Forensic Science			
Ethics in Forensic Science			
Clean Technique			
Reagent Preparation			
Evidence Screening Quality Assurance			
Evidence Handling			
Blood Stain Screening			
Semen Stain Screening			
Saliva Stain Screening			
Biology Screening Assessment			
Courtroom Training-for Forensic Biology			
Supervised Forensic Biology Casework			
Final Forensic Biology Mock Trial			

If a module was not completed, mark it as "NC" ("Not completed").

ILLINOIS STATE POLICE

FORENSIC BIOLOGY/DNA TRAINING MANUAL

APPENDIX A-2: DNA TRAINING CHECKLIST

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INITIAL FORENSIC SCIENCE TRAINING CHECKLIST
DNA

Trainee: _____ Coordinator: _____

Training Start Date: _____ Training End Date: _____

Module	Completion Date	Trainee Initials	Coordinator Initials
Clean Technique			
Reagent Preparation			
Introduction to DNA			
DNA Isolation (Organic Extraction)			
DNA Isolation (DNA IQ™ with Maxwell® 16)			
DNA Quantitation			
PCR Amplification			
STR Analysis			
DNA Quality Assurance			
DNA Guidelines			
STR Interpretation / Statistics / Report Writing			
Combined DNA Index System (CODIS)			
Courtroom Training / Legal Issues for DNA Analysis			
Oral Board Evaluation			
DNA Mock Casework			
Supervised DNA Casework			
Final DNA Mock Trial			
Supplemental DNA Training Modules:			

If a module was not completed, mark it as "NC" ("Not completed").

ILLINOIS STATE POLICE

FORENSIC BIOLOGY TRAINING MANUAL

APPENDIX A-3: FORENSIC BIOLOGY/DNA AUTHORIZATIONS BASED ON SCOPE

Reviewed by:

Tabithah L. Marcacci
Training Coordinator

Lisa M. Fallara
Training Coordinator

Approved by:

Jeanne M. Richeal
DNA Technical Leader

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

AUTHORIZATIONS BASED ON SCOPE

Field of Testing: Forensic Testing Forensic Scientist: _____
Category: Biology

Sub Category: Biological Screening

Analytical Technique	Authorized
1.1 Screening Test: Immunoassay	
1.2 Screening Test: Color	
4.1 Physical Examination: Physical Measurements	
5.1 Microscopy: Optical	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: DNA Analysis in Forensic Casework

Analytical Technique	Authorized
6.4 General Laboratory Procedures: General Laboratory Techniques	
7.1.1 Genetic Analysis: DNA-PCR: Autosomal STR – Fusion	
7.1.2 Genetic Analysis: DNA-PCR: Y STR – PowerPlex Y23	
7.1.3 Genetic Analysis: DNA-PCR: Quantitation – qPCR	
7.2 Genetic Analysis: Data Analysis	
7.3 Genetic Analysis: Population Database	
7.4.1 Genetic Analysis: DNA Extraction: Manual Methods – PCI	
7.4.1 Genetic Analysis: DNA Extraction: Manual Methods – DNA IQ	
7.4.2 Genetic Analysis: DNA Extraction: Automated Methods – DNA IQ/Maxwell 16	
8.1 Electrophoresis: Capillary	

These are the areas under which I am authorized to conduct casework.

_____
Forensic Scientist / Date

_____
Training Coordinator / Date

_____
Director of Training / Date

TABLE OF CONTENTS
FIREARMS AND TOOLMARK

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: INTRODUCTION TO SAFETY WITHIN THE FIREARMS AND TOOLMARKS SECTION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-2 - Safe Firearm Handling
ISP Procedures Manual FA-IA-3 - Pre-Firing Safety Considerations

UNIT ESTIMATED TIME

2 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the safety requirements particular to the firearms and toolmarks section.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the safety requirements particular to the firearms and toolmarks section by successfully passing a written criterion test covering this material. A score of 80% or greater constitutes successfully passing the test.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the safety requirements particular to the firearms and toolmarks section.

Lecture: Safety in the Firearms and Toolmarks Section

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion test covering this module.
5. The trainee must have his/her blood lead level tested and hearing tested.

Required Reading:

1. Hand Tools Institute. *Guide to Hand Tools* 4th Edition. Tarrytown: Hand Tools Institute, 2007. Print.

2. Hand Tool Institute. *Hand Tools Safety in the Workplace*. Tarrytown: Hand Tools Institute, 1989. Video.

3. National Rifle Association. *The Basics of Rifle Shooting*. National Rifle Association. Washington, D.C. 1987.

4. National Rifle Association. *The Basics of Pistol Shooting*. National Rifle Association, Washington D.C., 1987.

5. National Rifle Association. *The Basics of Shotgun Shooting*, National Rifle Association, Washington D.C., 1987.

6. As assigned by training coordinator.

Supplemental References: None

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: INTRODUCTION TO FIREARMS AND TOOLMARK IDENTIFICATION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-ID-10 - Physical Examination and Classification of Fired Evidence
ISP Procedures Manual FA-Appendix II - Minimum Standards and Controls

UNIT ESTIMATED TIME

5 Days

GOAL

Upon completion of this module, the trainee will possess a basic knowledge of the discipline of firearms and toolmarks identification.

OBJECTIVE

1. The trainee must demonstrate a basic knowledge of the discipline of firearms and toolmarks identification by successfully passing a written criterion test covering this material. A score of 80% or greater constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the discipline of firearms and toolmark identification.

Lecture: Introduction to Firearms and Toolmark Identification

Exercises:

1. Complete the *Firearms Identification* course published by the Institute of Applied Science.
2. Read assigned materials.
3. Attend lectures.
4. Be able to define the following terms and subjects:
   a. Science
   b. Forensic Science
   c. Firearms Identification
   d. Toolmark Identification
   e. Class, Individual, and Subclass Characteristics
   f. Objective
   g. Subjective
   h. The possible conclusions that can be rendered in the discipline of firearms and toolmark identification and the basis for these conclusions.
   i. The questions that can be addressed within the discipline of firearms and toolmark identification.
5. Actively participate in "round-table" discussions on the material presented in this module.
6. Successfully pass the criterion test covering this module.

Required Reading:

1. Institute of Applied Science. *Firearms Identification*. Chicago: Institute of Applied Science. Print.

2. As assigned by training coordinator.

3. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

Supplemental Reference: None

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: HISTORY AND EVOLUTION OF FIREARMS AND TOOLMARK IDENTIFICATION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

15 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the historical development and current status of the discipline of firearms and toolmark identification, a familiarity with the overall evolution of firearms and an in-depth appreciation of the evolution of modern firearms.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the historical development and the current status of the discipline of firearms and toolmark identification, the overall evolution of the firearm and an in-depth familiarity with the evolution of the modern firearm by successfully passing a written criterion test covering this material. A score of 80% or greater constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the evolution of the firearm.

Lecture: None

Exercises:

1. View "The Story of the Gun" videos.
2. Actively participate in "round-table discussions on the material presented in these videos.
3. Read any assigned materials.
4. Successfully pass the criterion test covering this module.

Required Reading:

1. *The Story of the Gun: The Complete History of Firearms*. A&E Television Networks, 1996. Videocassette.

2. *Lock N' Load with R. Lee Ermey*, The Complete Season One. A&E Television Networks, 2001. DVD.

3. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*, Ed. John Zent. Fairfax: National Rifle Association, 2006. 41-81. Print.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the historical development and the current status of the discipline of firearms and toolmark identification.

Lecture: The History and Evolution of Firearms and Toolmark Identification

Exercises:

1. Attend lectures.
2. Read assigned materials.
3. Actively participate in "round-table" discussions on the material presented in this lesson.
4. Successfully pass the criterion test covering this module.

Required Reading:

1. Berg, Stanton O. "The Drama of Forensic Ballistics." *Association of Firearms and Toolmark Examiners Journal* 11.4 (1979): 49-56. Print.

2. Brent, William. "Proved Guilty by Ballistics: Hadley vs. Arizona." *Association of Firearm and Toolmark Examiners Journal* 5.6 (1973): 5-9. Print.

3. Cassidy, Frank H., "Information on the History of Comparison Microscopes." *Association of Firearm and Toolmark Examiners Journal* 21.1 (1989): 67-72. Print.

4. Garrison, D. H. "The Gunsmith and the Soldier." *Association of Firearm and Toolmark Examiners Journal* 19.2 (1987): 181-187. Print.

5. Garrison, D. H., "The Guns of Brownsville." *Association of Firearm and Toolmark Examiners Journal* 18.4 (1986): 65-71. Print.

6. Goddard, Calvin H. "A History of Firearms Identification (reprint from the 1936 Chicago Police Journal)." *Association of Firearms and Toolmark Examiners Journal* 21.2 (1989): 263-278. Print.

7. Goddard, Calvin H. "The White Laboratory (reprint from Nov.-Dec. 1954 issue of *Ordnance Magazine*). *Association of Firearm and Toolmark Examiners Journal* 19.3 (1987): 284-288. Print.

8. Goddard, Calvin H. "The Identification of Projectiles in Criminal Cases." *Association of Firearm and Toolmark Examiners Journal* 19.4 (1987): 393-402. Print.

9. Goddard, Calvin H. "The Criminal Investigative Laboratory as an Aid to Law Enforcement in the Far East (reprint from a speech given by Colonel Goddard before the 37th Annual I.A.I. Meeting, Havana, Cuba, 1952." *Association of Firearm and Toolmark Journal* 17.3 (1985): 100-113. Print.

10. Goddard, Calvin H. "The Valentine Day Massacre (reprint from 1930)." *Association of Firearm and Toolmark Journal* 12.1 (1980): 44-59. Print.

11. Hatcher, Julian S., Frank J. Jury and Jac Weller. *Firearms Investigation, Identification and Evidence* 2nd ed. Harrisburg: Stackpole Company, 1977. 1-22. Print.

12. Howe, Walter J. "Firearms Identification: An Interview (reprint from the Jan. 1963 American Rifleman)." *Association of Firearm and Toolmark Examiners Journal* 21.1 (1989): 53-61, Print.

13. Inbau, Fred E. "*Scientific Evidence in Criminal Cases*." *Association of Firearm and Toolmark Examiners Journal* 21.2 (1989): 280-293. Print.

14. Lee, Henry C., Anthony L. Paul, Marshall K. Robinson, and George R. Wilson. "*Examination of Firearm Related Evidence: The Nicola Sacco and Bartolomeo Vanzetti Case*." *Association of Firearm and Toolmark Examiners Journal* 17.3 (1985):13-42. Print.

15. Pollard, Hugh. "*What the Bullet Tells* (reprint from Nov. 1924 issue of Discovery Magazine)." *Association of Firearms and Toolmark Examiners Journal* 19.3 (1987): 289-294. Print.

16. Starrs, James E. "*Once More Unto the Breech: The Firearms Evidence in the Sacco and Vanzetti Case Revisited: Part 1*." *Journal of Forensic Science* 31.2 (1986): 630-653. Print.

17. Starrs, James E. "*Once More Unto the Breech: The Firearms Evidence in the Sacco and Vanzetti Case Revisited: Part 2.*" *Journal of Forensic Science* 31.3 (1986): 1050-1078. Print.

18. Thornton, John I. "*Some Historical Notes on the Comparison Microscope*. *Association of Firearm and Toolmark Examiners Journal* 21.2 (1989): 215-218. Print.

Supplemental Reference:

1. Davis, John E. *An Introduction to Toolmarks, Firearms and the Striagraph*. Springfield: Charles C. Thomas, 1958. Print.

2. Gunther, Jack D. and Charles O. Gunther. *The Identification of Firearms*. New York: John Wiley & Sons, Inc., 1935. Print.

3. Burrard, Gerald. *The Identification of Firearms and Forensic Ballistics*, London: Herbert Jenkins, Ltd., 1935. Print.

4. As assigned by training coordinator.

LESSON 3

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the evolution of modern firearms.

Lecture: Firearms History – A Survey – The Smokeless Powder Era

Exercises:
1. Attend lectures.
2. Read assigned materials.
3. Actively participate in "round-table" discussions on the material presented in this lesson.
4. Successfully pass the criterion test covering this module.

Required Reading:

1. Hughes, David R. *The History and Development of the M-16 Rifle and Its Cartridge*. Missoula" Armory Publications, 1991. Print. (Introduction, Chapters 1 and 2).

2. Ezell, Edward C. *Small Arms of the World*, 12th ed. Mechanicsburg: Stackpole Books, 1983. Print. (Chapters 1, 2, 3 and 4).

Supplemental Reference:

1. Barnes, Frank C. *Cartridges of the World*, 11th ed. Iola: F & W Publications (Gun Digest Books), 2006. Print. (Introduction, Introduction to Chapters 1, 10 and 15 and Chapters 2, 6, 7, 16 and 17).

2. Barnes, Frank C. *Cartridges of the World*, 8th ed. Iola: DBI Books, 1997. Print. (Chapter 14).

3. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

4. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: INSTRUMENTATION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-1A-5 – Barrel and Overall Length Measuring
ISP Procedures Manual FA-IC-5 - Down Loading
ISP Procedures Manual FA-IC-6 - Primed Cartridge Case/Shotshell
ISP Procedures Manual FA-ID-1 - Caliber Determination
ISP Procedures Manual FA-ID-3 - Air Gap
ISP Procedures Manual FA-ID-8 - Wadding Determination
ISP Procedures Manual FA-ID-9 - Shot Determination
ISP Procedures Manual FA-ID-11 - Microscopic Comparison
ISP Procedures Manual FA-IIB-3 - Microscopic Comparison
ISP Procedures Manual FA-VA-2 - Microscopic Comparison
ISP Procedures Manual FA-Appendix II-C - Minimum Standards and Controls – Calibration Standards
ISP Procedures Manual FA-Appendix III - Microscope Cleaning and Maintenance

UNIT ESTIMATED TIME

5 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the operation and maintenance of the tools and instruments utilized in the discipline of firearms and toolmark identification.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the operation and maintenance of the tools and instruments utilized in the discipline of firearms and toolmark identification by successfully passing a written criterion test covering this material. A score of 80% or greater constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the instrumentation utilized within the discipline of firearms and toolmark identification.

Lecture: An Introduction to Firearms and Toolmark Instrumentation

Exercises:
1. Become familiar with the use and maintenance of the following equipment:
   a. Electronic balance
   b. Micrometer
   c. Calipers
   d. Inertia bullet puller
   e. Stereo microscope
   f. Comparison microscope

g. Ruler
h. Other equipment as determined by training coordinator

2. Read any assigned materials.
3. Attend all lectures.
4. Clean and perform preventative maintenance on the comparison microscope.
5. Actively participate in "round-table discussions on the material
6. presented in these videos.
   Successfully pass the criterion test covering this module.

Required Reading:

1. Cook, Claude. "Basic Optics." *Association of Firearm and Toolmark Examiners Journal* 17.4 (1985): 14-56. Print.

2. Deforest, Peter R., R. E. Gaensslen, and Henry C. Lee. *Forensic Science: An Introduction to Criminalistics*. New York: McGraw Hill Inc., 1983. 81-93. Print.

3. Hatcher, Julian S., Frank J. Jury, and Jac Weller. *Firearms Investigation, Identification and Evidence. 2*nd ed. Harrisburg: Stackpole Company, 1977. 229-272. Print.

4. Heard, Brian. "A New Approach to the Examination of Stria on Transparent and Translucent Material." *Association of Firearm and Toolmark Examiners Journal* 18.1 (1986): 25-34. Print.

5. Mathews, J. Howard. *Firearms Identification, Volume* I. Springfield: Charles C. Thomas Publisher, 1973. 36-76. Print.

6. Saferstein, Richard. *Criminalistics: An Introduction to Forensic Science* 5th ed., Edgewood Cliffs: Prentice Hall Inc., 1995. 173-192. Print.

7. Thornton, John I., "Some Historical Notes on the Comparison Microscope." *Association of Firearm and Toolmark Examiners Journal* 21.2 (1989): 215-217. Print.

8. Ziegler, Philip. "Examination Techniques: The Bean Splitter and Reverse Lighting." *Association of Firearm and Toolmark Examiners Journal* 15.2 (1983): 37-41. Print.

Supplemental References:

1. Wheeler, Barbara P. and Lori J. Wilson. *Practical Forensic Microscopy A Laboratory Manual*. Chichester: 2008. Print.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: INTRODUCTION TO PATTERN RECOGNITION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IIA-3 - Test Standards
ISP Procedures Manual FA-IIB-3 - Microscopic Comparison
ISP Procedures Manual FA-Appendix III - Microscope Cleaning and Maintenance

UNIT ESTIMATED TIME

30 Days

GOAL

Upon completion of this module, the trainee will possess the basic knowledge, skills and abilities to perform pattern recognition and identification utilizing the comparison microscope. This module will also allow the trainee to gain experience in assessing class characteristics and using the comparison microscope.

OBJECTIVE

1. The trainee must demonstrate a basic knowledge, skills and abilities to perform pattern recognition and identification utilizing the comparison microscope by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the following concepts:

1. The making of a test mark with a typical prying type tool.
2. The organization of microscopic samples, including the markings of tests and tools.
3. The use of the comparison microscope to make basic toolmark comparisons.
4. The identification of simple toolmark patterns.
5. The relationship between the microscopic nature of the toolmark and the surface structure of the tool.

Lecture: Introduction to Pattern Recognition, Part 1

Exercises:

1. Read any assigned materials.
2. Attend all lectures.
3. Each trainee will make a pair of their own test marks and find a pattern match using the comparison microscope. After finding a pattern match, the trainee will mount the test screwdriver on the comparison microscope and view the surface using the resolution available on the comparison microscope. This process will be repeated with two other different screwdrivers with different degrees of surface roughness.

4. Actively participate in "round-table" discussions on the material presented in this module.
5. Successfully pass the criterion test covering this module when administered.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the following concepts:

1. The ability to make pattern identifications.
2. The relationship of angle of attack and pattern variability.
3. The relationship of direction of light on the appearance of a microscopic toolmark pattern.
4. The effect of angle of light on the appearance of a microscopic toolmark pattern.

Lecture: Introduction to Pattern Recognition, Part 2

Exercises:

1. Read any assigned materials.
2. Attend all lectures.
3. The trainee will make two sets of tests with one screwdriver from a set of six matched screwdrivers. Each set of tests should have low angle to high angle drag marks that represent both flat sides of the screwdriver.
4. The trainee will compare the tests together along the entire length of the tests using a comparison microscope. In doing so, attempt to always keep the best pattern match in view at the hair line. Mark the best pattern match and show it to the training coordinator. This comparison will be done for each flat side of the screwdriver.
5. The trainee will then rotate the test 180 degrees and repeat steps #3 and #4.
6. The trainee will change the lighting on one of the stages by raising the light until the identification is significantly degraded. Compare the tests together along the entire length of the tests as in step #3.
7. Repeat steps #3 through #6 for each of the remaining screwdrivers in the set.
8. The trainee will place each pair of tests on the comparison microscope at one of the best pattern identification marks. The trainee will then rotate only one of the tests 180 degrees and realign it to the best identification mark. The tests will be evaluated for any indication that the two are related.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

LESSON 3

Estimated Time: 5 Days

Purpose: To enhance the ability of the trainee to make pattern identifications.

Lecture: Introduction to Pattern Recognition, Part 3

Exercises:

1. Read any assigned materials.
2. Attend all lectures.
3. The trainee will use one of the screwdrivers in a set of six matched screwdrivers, and make a short, medium angled toolmark.
4. The mark made in #3 will be compared with test marks from the same tool until an identification is made.
5. The identification made in #4 will be labeled and reviewed with the training coordinator.
6. The trainee will repeat #3 using the same screwdriver; however, a short, low angled toolmark will be made.
7. The trainee will repeat #4 and # using this new mark.
8. The trainee will repeat #3 using the same screwdriver; however, a short high angled toolmark will be made.
9. The trainee will repeat #4 and #5 using this new mark.
10. The trainee will repeat #3 through #9 using each one of the remaining five screwdrivers in the matched set.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

LESSON 4

Estimated Time: 10 Days

Purpose:

1. To learn how to make variable angle of progression test marks.
2. To gain insight into the effect of angle of progression upon the striated pattern.
3. To learn how angle of progression affects toolmark width and class characteristic determination.
4. To improve the ability to make pattern identification.

Lecture: Introduction to Pattern Recognition, Part 4

Exercises:

1. Read any assigned materials.
2. Attend all lectures.
3. Utilizing one of a matched set of six, make a test with one side of a screwdriver from low angle of attach to high angle of attack. This will be referred to as the "zero angle test."
4. Make a pair of tests with the same screwdriver from low angle of attack to high angle of attack only using 10-15 degree angle of progression offset to one side.
5. Repeat #4 only using a 20-30 degree angle of progression offset to the same side.
6. Repeat #4 only using an approximately 45 degree angle of progression offset to the same side.
7. Compare the 10-15 degree tests to each other from low angle to high angle.
8. Compare one of the 10-15 degree angle tests to the zero angle test from low angle to high angle.
9. Compare the 20-30 degree angle tests to each other from low angle to high angle.
10. Compare one of the 20-30 degree tests to one of the 10-15 degree tests from low angle to high angle.
11. Compare the 45 degree angle tests together from low angle to high angle. Mark the best pattern identification area and show it to the training coordinator.
12. Compare one of the 45 degree angle tests to one of the 20-30 degree angle tests from low angle to high angle.
13. Make a test with the same side of the screwdriver only with a 10-15 degree angle of progression offset to the other side of zero. Compare this test to the zero angle of progression test and to one of the earlier 10-15 degree angle tests.
14. Repeat #3 through #13 with each remaining screwdriver in the set.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

LESSON 5

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the following concepts:

1. The making of a test mark with a typical striking type tools.
2. The organization of microscopic samples, including the markings of tests and tools.
3. The use of the comparison microscope to make basic toolmark comparisons.
4. The identification of simple toolmark patterns.
5. The relationship between the microscopic nature of the toolmark and the surface structure of the tool.

Lecture: Introduction to Pattern Recognition, Part 1

Exercises:

1. Read any assigned materials.
2. Attend all lectures.
3. Each trainee will make a pair of their own test marks and find a pattern match using the comparison microscope. After finding a pattern match, the trainee will mount the striking tool on the comparison microscope and view the surface using the resolution available on the comparison microscope. This process will be repeated with two other different striking tools with different degrees of surface roughness.
4. Actively participate in "round-table" discussions on the material presented in this module
5. Successfully pass the criterion test covering this module when administered.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: CASTING AND ENHANCEMENT TECHNIQUES

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IIC-1 - Magnesium Smoking
ISP Procedures Manual FA-IIC-2 - Casting

UNIT ESTIMATED TIME

5 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of casting and enhancement techniques.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of casting and enhancement techniques by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with casting and enhancement techniques.

Lecture: Demonstration of Casting and Enhancement Techniques

Exercises:

1. Read and understand the materials provided.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Demonstrate familiarity with the casting techniques utilized by the ISP by casting at least five (5) items.
5. Demonstrate familiarity with the enhancement techniques utilized by the ISP by using them on at least five (5) items.
6. Successfully pass the criterion test covering this module.

Required Reading:

1. Barber, David C. and Frank H. Cassidy. "A New Dimension with 'Mikrosil' Casting Material." *Association of Firearms and Toolmark Examiners Journal* 19.3 (1987): 328. Print.

2. Jannell, R. and G. Geyer. "Smoking a Bullet." *Association of Firearms and Toolmark Examiners Journal* 9.2 (1977): 128. Print.

3. Poole, Robert A. "Mikrosil Casting Material Information." *Association of Firearm and Toolmark Examiners Journal* 15.2 (1983): 80. Print.

Supplemental
Reference: None

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: TOOLS AND THEIR USES

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

30 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the descriptions, nomenclature, general uses, correct operation, proper maintenance and the toolmarks of hand tools.

OBJECTIVES

1. The trainee must demonstrate a thorough knowledge of the descriptions, nomenclature, general uses, correct operation, proper maintenance, and the toolmarks of hand tools by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

2. The trainee must demonstrate the thorough knowledge of the descriptions, nomenclature, general uses, correct operation, proper maintenance and the toolmarks of hand tools by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the descriptions, nomenclature, general uses, correct operation and proper maintenance of hand tools.

Lecture: Basic Hand Tools

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion tests covering this module.
5. Define the following terms as they relate to the actions of a tool and give three examples of tools or methods which could produce each category:
   - A. Shearing
   - B. Pinching
   - C. Fracture
   - D. Scrape marks
   - E. Impressions
   - F. Slicing

Required Reading:

1. *Guide to Hand Tools,* 4th Edition, Hand Tools Institute, Tarrytown, 2007.

2. *Hand Tool Safety in the Workplace*, Hand Tools Institute, Tarrytown, New York, 1989.

3. *Tools and Their Uses: NAVEDTRA 91228-2A*. United States Navy, Naval Education and Training Program Development Center, Pensacola, FL, pp. 1-60 and 78-111.

4. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 2

Estimated Time: 5 Days

Purpose:

1. To familiarize the trainee with pinching type cutting tools.
2. To improve skill and gain confidence in making pattern identifications.
3. To learn how to make and mark tests with pinching type cutting tools.

Lecture: Pinching Type Tools

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion tests covering this module.
5. The training coordinator should provide at least three pairs of side wire cutters and two pairs of bolt cutters.
6. Make two sets of tests with one of the side wire cutters and compare all four edges of one set against the corresponding four edges of the other set using the comparison microscope.
7. Repeat Exercise #6 with the other two pairs of side wire cutters.
8. Utilizing lead strips, make a random cut, through the wide part of both ends of this un-indexed test mark to the tests made from this same tool in the above steps.
9. Repeat Exercise #8 with the other two pairs of side wire cutters and continue this activity until comfortable with finding pattern identifications with each pair of side wire cutters.
10. Make a set of unknowns using all three pairs of the side wire cutters.
11. Repeat Exercise #10 using the two pairs of bolt cutters.

Required Reading:

1. Cassidy, Frank, "An Unusual Toolmark from a Bolt Cutter." *Association of Firearm and Toolmark Examiners Journal* 26.1, (1994); 21. Print.

2. ANON, "Bolt Cutter Standards." *Association of Firearm and Toolmark Examiners Journal* 9.1 (1977); 12. Print.

3. ANON, "Consecutive Cuts by Bolt Cutters and Their Effect On Identification." *Association of Firearm and Toolmark Examiners Journal* 24.4, (1992); 260. Print.

4. Komar, Susan and Scala, Gregroy, "Examiner Beware – New Bolt Cutter Blades – Class or Individual." *Association of Firearm and Toolmark Examiners Journal* 25.4 (1993); 298. Print.

5. Williams, David L., "Comparison of Cut Telephone Cables." *Association of Firearm and Toolmark Examiners Journal* 21.2, (1989); 221. Print.

6. Arrowood, Michael C. "Toolmark Identification – Back to Basics." *Association of Firearms and Toolmark Examiners Journal* 25.3 (1993); 197. Print

7. Cochrane, D. W. "Class Characteristics of Cutting Tools and Surface Designations." *Association of Firearm and Toolmark Examiners Journal* 8.4 (1976); 30. Print.

8. Meyers, Charles. "Firearms and Toolmark Identification – An Introduction." *Association of Firearms and Toolmark Examiners Journal* 25.4 (1993); 281. Print.

9. Hornsby, Billy. "MCC Bolt Cutters." *Association of Firearm and Toolmark Examiners Journal*. 21.3 (1989); 508. Print.

10. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 3

Estimated Time: 5 Days

Purpose:

1. To familiarize the trainee with shearing type cutting tools.
2. To improve skill and gain confidence in making pattern identifications.
3. To learn how to make and mark tests with shearing type cutting tools.

Lecture: Shearing Type Tools

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion tests covering this module.
5. The training coordinator should provide at least three matched pairs of conventional tin snips as well as a set of unknowns created using these tools.
6. Make a set of tests with each pair of tin snips. Be sure and label both blades of the tool and corresponding test marks. Using the comparison microscope, compare the impression marks and the scrape marks of one set against the corresponding marks of the other sets.
7. Compare the tests made in Exercise #6 with the supplied unknowns.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 4

Estimated Time: 5 Days

Purpose:

1. To familiarize the trainee with chopping/cleaving type cutting tools.
2. To improve skill and gain confidence in making pattern identification.
3. To learn how to make and mark tests with chopping/cleaving type cutting tools.

Lecture: Chopping/Cleaving Type Tools

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion tests covering this module.

5. The training coordinator should provide the following materials:
   A. One hand axe or hatchet
   B. One sheath type hunting or military knife or similar non-folding knife
   C. Three matched cold chisels
   D. One automotive tire or section of tire side-wall
   E. Unknowns created using these tools.
6. Make a set of tests with the cold chisels and compare both edges of one set against the corresponding edges of the other set using the comparison microscope. Be sure and label all edges of the tool and corresponding test mark. Using the comparison microscope, compare the tests to the unknowns.
7. Make two impression marks with the hand axe by making incomplete cuts through pieces of heavy sheet lead. Using the comparison microscope, compare the tests to each other.
8. Cut out two small sections of tire side-wall. Make an inch wide puncture mark using the sheath knife by placing each section of tire side-wall. After making the test punctures, split the tests in two, exposing the striated surface of the puncture mark. Using the comparison microscope, compare the tests to each other. Be sure and compare both sides.

Required Reading:

1. Watson, Donald J. "The Identification of Tool Marks Produced from Consecutively Manufactured Blades in Soft Plastic." *Association of Firearm and Toolmark Examiners Journal*. 10.3 (1978): 43. Print.

2. Rathman, Garry. "Tires and Toolmarks." *Association of Firearm and Toolmark Examiners Journal* 24.2. (1992): 146. Print.

3. Cilwa, R. B. & Townshend, D. G. "Tool Mark Identification Knife to Cut Wire." *Association of Firearm and Toolmark Examiners Journal*. 8.4 (1976): 66. Print.

4. Galan, J. I. "Identification of a Knife Wound in Bone." *Association of Firearm and Toolmark Examiners Journal* 18.4. (1986): 72. Print.

5. Tuira, Y. J. "Tire Stabbing with Consecutively Manufactured Knives." *Association of Firearm and Toolmark Examiners Journal* 14.1 (1982): 50. Print.

6. Hamby, James E. "Matching of Tool Marks in Rubber." *Association of Firearm and Toolmark Examiners Journal* 1.20, (1969): 29. Print.

7. Vaughn, Richard & Gilman, Philip. "An Identification with a Puncture Type Tool." *Association of Firearm and Toolmark Examiners Journal* Vol. 13, #4. October 1981. p. 78.

8. Garcia, Carol. "Are Knife-Prints Reliable Evidence: An Analysis of Tool Mark Evidence and Ramirez v. State." *Association of Firearm and Toolmark Examiners Journal* 25.4. (1993): 266. Print.

9. Kockel, R. "About the Appearance of Clues or Marks from Knife Blades." *Association of Firearm and Toolmark Examiners Journal* 12.3 (1980): 16. Print.

10. Harding, L. F. "A Glossary of Knife Terminology." *Association of Firearm and Toolmark Examiners Journal* 14.3 (1982): 34. Print.

11. Love, Ed. "Knives and Knife Terminology." *Association of Firearm and Toolmark Examiners Journal* 21.3 (1989): 490. Print.

12. Bridgemon, Rondal, R. "The Examination of Cut Tires." *Association of Firearm and Toolmark Examiners Journal* 16.3 (1984): 102. Print.

13. Kelty, Michael J. "Court Presentation of Toolmark Identified in Stab Wounds." *Association of Firearm and Toolmark Examiners Journal* 17.2 (1985): 66. Print.

14. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 5

Estimated Time: 5 Days

Purpose:

1. To familiarize the trainee with gripping type tools.
2. To improve skill and gain confidence in making pattern identification.
3. To learn how to make and mark tests with gripping type tools.

Lecture: Gripping Type Tools

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion tests covering this module.
5. The training coordinator should provide the trainees with four matched pairs of tongue and groove type pliers.
6. Make a set of scrape type test marks from each of the pliers. Be careful in labeling your test mark so that you can use the test to identify the

specific tooth that has made an unknown mark. Using the comparison microscope, identify all three of the unknowns.

7. Make a set of impression toolmark tests with each of the pairs of pliers. Be careful in labeling your test mark so that you can use the test to identify the specific tooth that has made an unknown mark. Using the comparison microscope, identify all three of the unknowns.

Required Reading:

1. Cassidy, F. H. "Examination of Toolmarks from Sequentially Manufactured Tongue and Groove Pliers." *Association of Firearm and Toolmark Examiners Journal* 14.1 (1982): 13. Print.

2. Molnar, S. "Techniques for Making Test Tool Marks Involving a Vice and C-Clamp. *Association of Firearm and Toolmark Examiners Journal* 1.10. (1969): 26. Print.

3. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 6

Estimated Time: 5 Days

Purpose:

1. To familiarize the trainee with striking type tools.
2. To improve skill and gain confidence in making pattern identification.
3. To learn how to make and mark tests with striking type tools.

Lecture: Striking Type Tools

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion tests covering this module.
5. The training coordinator should provide an assortment of used punches, hammers and old firing pins. This group should include three to five hammers, up to a half dozen punches and six to twenty old firing pins.
6. The trainee should select a tool from the above assortment and examine it carefully under the stereo microscope being sure to search specifically for the microscopic imperfections that make the surface of the tool unique.
7. Utilizing the tools provided, make an index mark on the tool and make an impact type test mark on lead with the tool. Transfer the index

mark to the test mark surface so that the tool face can be oriented to the toolmark at a later time. Using the comparison microscope, identify the tests to each other.

8. Select one of the hammers and make a scrape type test mark in lead by striking a light glancing blow to the surface of the lead.
9. Make additional marks attempting to duplicate as closely as possible the same angle of impact with the same part of the tool.
10. Using the comparison microscope, compare the first test mark to the subsequent marks. Continue making and comparing test marks until you have made an identification.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: MANUFACTURING METHODS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

15 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the various machining and hand finishing techniques used in the manufacture of tools.

OBJECTIVES

1. The trainee must demonstrate a thorough knowledge of the various machining and hand finishing techniques used in the manufacture of tools by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

2. The trainee must demonstrate the thorough knowledge of the various machining and hand finishing techniques used in the manufacture of tools by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 15 Days

Purpose: To familiarize the trainee with the manufacturing processes of tools.

Lecture: The Manufacturing Process

Exercises:

1. Read the assigned materials.
2. Actively participate in "round-table" discussions on the material presented.
3. Successfully pass the criterion tests when given.
4. Arrange for a tour of a local machine shop. To the extent possible, produce examples of the various types of machining. Have these samples mounted for display and produce photomicrographs of these toolmarks.
5. Examine and note the following machining techniques used in the manufacture of modern tools:
   - A. Shaping
   - B. Planing
   - C. Drilling
   - D. Reaming
   - E. Turning
   - F. Boring
   - G. Milling
   - K. Abrasive Machining
   - L. Honing
   - M. Lapping
   - N. Grinding
   - O. Sanding
   - P. Ultra-Sonic
   - Q. Tumbling

H. Face Milling
I. Slab Milling
J. Broaching
R. Sand Blasting
S. Sawing
T. Filing

6. Based on the information gathered in the tour of the machine shop, research and note the following:
   A. The effects of use and abuse on machine tools and the resultant effect of such use and/or abuse on the uniqueness of the work product of a given tool.
   B. The specialized field of tool manufacture and the skills and techniques used by the master toolmaker.
   C. The effects of the "chip-forming" phenomenon.

Required Reading:

1. Bordeau, A. J. & Smith, W. C. "Significant Bailing Wire Characteristics." *Association of Firearm and Toolmark Examiners Journal* 7.2 (1975): 9. Print.

2. Skolrood, R. W. "Do Not Disregard Mold Markings." *Association of Firearm and Toolmark Examiners Journal* 7.1 (1978): 73. Print

3. Dujanovitch, Michael B. "Examination of a Key Making Machine." *Association of Firearm and Toolmark Examiners Journal* 15.4 (1983): 22. Print.

4. Cilwa, R. B. & Townsend, D. G. "Identification of Lathe Shavings." *Association of Firearm and Toolmark Examiners Journal* 10.1 (1978): 23. Print.

5. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: STAMPS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

5 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the descriptions, nomenclature, general uses, correct operation, and the toolmarks of hand and machine stamps.

OBJECTIVES

1. The trainee must demonstrate a thorough knowledge of the descriptions, nomenclature, general uses, correct operation, and the toolmarks of hand and machine stamps by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

2. The trainee must demonstrate the thorough knowledge of the descriptions, nomenclature, general uses, correct operation, and the toolmarks of hand and machine stamps by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the descriptions, nomenclature, general uses, correct operation, and the toolmarks of hand and machine stamps.

Lecture: The Manufacturing Process

Exercises:

1. Read the assigned materials.
2. Actively participate in "round-table" discussions on the material presented.
3. Successfully pass the criterion tests when given.
4. Be able to define the following terms:
   - A. Bevel
   - B. Blank
   - C. Bottoming
   - D. Characters
   - E. Concave Stamp
   - F. Convex Stamp
   - G. Die
   - H. Branding Die
   - I. Coining Die
   - J. Debossing Die
   - K. Embossing Die
   - L. Flat Roll Die
   - M. Schmidt Machine
   - N. Positive Identification Stamps
5. Research and become familiar with the Electro-Discharge Machining (EDM) process.

6. Research and become familiar with the Electro-Chemical Etching process.
7. Research and become familiar with the Laser Etching process.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: THE CRIMINAL USE OF TOOLS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IIA - 3 Tool Examination – Test Standards
ISP Procedures Manual FA-IIB-1 - Toolmark Examination – Physical Examination and Classification
ISP Procedures Manual FA-IIB-3 - Toolmark Examination – Microscopic Comparison

UNIT ESTIMATED TIME

15 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of how tools are used to commit criminal acts as well as the marks left by these tools during the commission of said acts.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the criminal use of tools by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the criminal use of cutting type tools.

Lecture: The Criminal Use of Tools

Exercises:

1. Become familiar with the tools present in your laboratory, as well as the tools provided. These tools will include:
   A. Bolt Cutters
   B. Linesman Pliers
   C. Hack Saw
   D. Wood Saw
   E. Single Edged Knife
   F. Aviation and/or Tin Snips
   G. Cutting Disc
2. Utilizing the tools listed in Exercise #1, observe the toolmarks left when the following items are cut, sheared, sliced and/or punctured.
   A. Pad Lock Shackle
   B. Chain
   C. Chain Link Fence
   D. Wire
   E. Insulated Wire
   F. Screen
   G. Rope
   H. Car Tires
3. Complete a laboratory panel for the items utilized in Exercise #1 and #2.
4. Utilizing the standards created in Exercise #2, attempt to identify the toolmarks back to the specific tool.
5. Read the assigned materials.
6. Attend all lectures.

7. Actively participate in "round-table" discussions on the material presented.
8. Successfully pass the criterion test when given.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the criminal use of gripping type tools.

Lecture: The Criminal Use of Tools

Exercises:

1. Become familiar with the tools present in your laboratory, as well as the tools provided. These tools will include:
   A. Pipe Wrenches
   B. Linesman Pliers
   C. Slip Jaw Pliers
   D. Tongue and Groove Pliers
   E. Locking Pliers
   F. All Purpose Nippers (modified)
2. Utilizing the tools listed in Exercise #1, observe the toolmarks left when the following items are used to attack the following:
   A. Aluminum
   B. Brass
   C. Lead
   D. Wood
3. Complete a laboratory panel for the items utilized in Exercise #1 and #2.
4. Utilizing the standards created in Exercise #2, attempt to identify the toolmarks back to the specific tool.
5. Read the assigned materials.
6. Attend all lectures.
7. Actively participate in "round-table" discussions on the material presented.
8. Successfully pass the criterion test covering this module.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 3

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the criminal use of pry type tools.

Lecture: The Criminal Use of Tools

Exercises:

1. Become familiar with the tools present in your laboratory, as well as the tools provided. These tools will include:
   A. Screwdrivers
   B. Wonder Bar/Pry Bar
   C. Tire Iron
   D. Brake Adjusting Tool
   E. Chisels
2. Utilizing the tools listed in Exercise #1, observe the toolmarks left when the following items are used to attack the following:
   A. Aluminum
   B. Brass
   C. Lead
   D. Wood
3. Complete a laboratory panel for the items utilized in Exercise #1 and #2.
4. Utilizing the standards created in Exercise #2, attempt to identify the toolmarks back to the specific tool.
5. Read the assigned materials.
6. Attend all lectures.
7. Actively participate in "round-table" discussions on the material presented.
8. Successfully pass the criterion test covering this module.

Required Reading:

1. Lane, Pat. "Toolmarks on Battery Terminals." *Association of Firearm and Toolmark Examiners Journal* 20.2 (1988): 151. Print.

2. White, R. and Arrowood, M. "An Unusual Toolmark Case." *Association of Firearm and Toolmark Examiners Journal* 7.1 (1975): 19. Print.

3. Wilson, Robert. "Examination of Toolmarks from a Vehicle Involved in a Burglary." *Association of Firearm and Toolmark Examiners Journal* 15.2 (1983): 98. Print.

4. Larsen, David. "Murder — Buttons and Toolmarks." *Association of Firearm and Toolmark Examiners Journal* 1.17 (1971): 15. Print.

5. Lapierre, J.A.G. "Two Interesting and Unusual Toolmark Cases." *Association of Firearm and Toolmark Examiners Journal* 10.2 (1978): 57. Print.

6. Arrowood, M. & Berglund, J. A Toolmark Identification in a Unique Shooting Case. *Association of Firearm and Toolmark Examiners Journal* 8.2 (1976): 83. Print.

7. Paholke, Arthur, R. "The Identification of Class Characteristics of Tool Marks." *Association of Firearm and Toolmark Examiners Journal* 10.2 (1978): 59. Print.

8. Garland, Patrick V. "Identification of a Dent Puller." *Association of Firearm and Toolmark Examiners Journal* 10.3 (1978): 38. Print.

9. Good, Richard. "Tool Mark Identification in a Gambling Case." *Association of Firearm and Toolmark Examiners Journal* 11.15 (1979): 49. Print.

10. Dillon, Duayne, J. "Comparison of Extrusion Striae to Individualize Evidence." *Association of Firearm and Toolmark Examiners Journal* 8.2 (1976): 69. Print.

11. Baney, Ralph. "An Examination of Consecutive Scratch Mark Patterns on Kodak Instant Print Film." *Association of Firearm and Toolmark Examiners Journal* 13.4 (1981): 112. Print.

12. Paholke, Fitzgerald & Sherlock. "A Pill Impression Case." *Association of Firearm and Toolmark Examiners Journal* 22.4 (1990): 442. Print.

13. Meyers, Charles, R. "Toolmarks on a Plastic Bag." *Association of Firearm and Toolmark Examiners Journal* 20.1 (1988): 55. Print.

14. Stone, R. S. "The Examination and Comparison of Plastic Bags Used in Home Heat Sealers." *Association of Firearm and Toolmark Examiners Journal* 21.2 (1989): 384. Print.

15. Templin, R. R. "A Safe Tool Mark." *Association of Firearm and Toolmark Examiners Journal* 12.2 (1980): 20. Print.

16. Tenorio. F. "Identification of a 'Pop-Top' Tab and Beer Can." *Association of Firearm and Toolmark Examiners Journal* 15.2(1983): 56. Print.

17. Bridgemon, R. R. "The Individualization of Beverage Can Pull-Tabs." *Association of Firearm and Toolmark Examiners Journal* 16.3 (1984): 99. Print.

18. Hamby, J. E. "The Comparison of Staples." *Association of Firearm and Toolmark Examiners Journal* 6.5 (1974): 16. Print.
19. Hofmeister, Arthur G. "Examination of Stapler Toolmarks." *Association of Firearm and Toolmark Examiners Journal* 6.5 (1981): 76. Print.

20. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: TOOLMARK CASEWORK APPROACH

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IIA-3 - Tool Examination – Test Standards
ISP Procedures Manual FA-IIB-1 - Toolmark Examination – Physical Examination and Classification
ISP Procedures Manual FA-IIB-3 - Toolmark Examination – Microscopic Comparison

UNIT ESTIMATED TIME

10 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the rules and practices pertinent to proper toolmark evidence handling and casework.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the rules and practices pertinent to proper toolmark evidence handling and casework by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the Evidence Handling Procedures utilized within the Illinois State Police.

Lecture: Evidence Handling Procedures

Exercises:

1. The trainee will go into the vault and examine existing seals to observe various types. The trainee will examine both lab and agency seals.
2. The trainee will become familiar with evidence sign-in procedures. The trainee will observe cases being signed in and then sign cases in (real or simulated).
3. The trainee will become familiar with casework policy. The trainee will be provided with case information and determine:
   A. If a case should be accepted/worked
   B. What examination should be done and in what sequence, i.e., trace, forensic biology, latent prints
4. Read the assigned materials.
5. Attend all lectures.
6. Actively participate in “round-table” discussions on the material presented in this lesson.
7. Successfully pass the criterion test covering this module.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. As assigned by training coordinator.

LESSON 2

Estimated Time: 4 Days

Purpose: To familiarize the trainee with Reports and Report Wording.

Lecture: Reports and Report Wording

Exercises:

1. The trainee will review numerous reports.
2. The trainee will write reports on numerous simulated cases.
3. Read the assigned materials.
4. Attend all lectures.
5. Actively participate in "round-table" discussions on the material presented in this lesson.
6. Successfully pass the criterion test covering this module.

Required Reading: None

Supplemental Reference:

1. As assigned by training coordinator.

LESSON 3

Estimated Time: 1 Day

Purpose: To familiarize the trainee with courtroom procedures as it relates to a toolmark case.

Lecture: Mock Court

Exercises:

1. The trainee will already have participated in the general courtroom demeanor training.
2. The trainee will participate in several mock trials.
3. Attend all lectures.
4. Actively participate in "round-table" discussions on the material presented in this lesson.
5. Successfully pass the criterion test covering this lesson.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: TOOLMARK IDENTIFICATION INITIAL SUPERVISED CASEWORK

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IIA-1 - Tool Examination Method – Physical Examination and Classification
ISP Procedures Manual FA-IIA-2- Tool Examination Method – Trace Material Standards
ISP Procedures Manual FA-IIA-3 - Tool Examination Method – Test Standards
ISP Procedures Manual FA-IIB-1 - Toolmark Examination Method – Physical Examination and Classification
ISP Procedures Manual FA-IIB-2 - Toolmark Examination Method – Trace Material Examination
ISP Procedures Manual FA-IIB-3 - Toolmark Examination – Microscopic Comparison
ISP Procedures Manual FA-APP I Report Wording

UNIT ESTIMATED TIME

60 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of as well as the ability to process analytical cases submitted to the firearm and toolmark identification section for analysis.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge as well as the ability to process analytical cases submitted to the firearms and toolmark identification section for analysis by successfully processing all of the cases assigned. The following standards must be met to successfully complete this module: no erroneous identifications; no erroneous eliminations; and all toolmarks on submitted evidence that the training coordinator deems unquestionably suitable for comparison were called suitable by the trainee. In addition, all standards listed in Command Directive TRN 10 and TRN 14 must be met.

LESSON 1

Estimated Time: 60 Days

Purpose: To familiarize the trainee with the actual processing of casework submitted to the laboratory for analysis.

Lecture: None

Exercises:

1. The trainee will be assigned actual cases to work under the supervision of a qualified examiner. These cases will increase in complexity as the trainee proceeds through the process
2. The trainee will issue reports, cosigned by the individual under whom the case was supervised, interact with law enforcement agencies and testify in court if called to do so.
3. Read the assigned materials.
4. Actively participate in “round-table” discussions on the material presented in this lesson.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FIREARM USAGE FAMILIARIZATION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-2 - Safe Firearm Handling

UNIT ESTIMATED TIME

13 to 18 Days, depending on course availability.

GOAL

Upon completion of this module, the trainee will possess both the knowledge and skills required to safely and properly use a firearm.

OBJECTIVES

1. The trainee must demonstrate both the knowledge and the skills required to safely and properly use a firearm by successfully passing a practical criterion test with a score of 100% and the Crime Laboratory Firearm Usage Course.

LESSON 1 (Optional)

Estimated Time: 5 Days

Purpose: To familiarize the trainee with firearms, and the method of safely handling them.

Lectures: See exercise.

Exercises:
1. Satisfactorily complete the Crime Laboratory Firearms Usage Course. This course will be administered by an outside law enforcement agency.
2. Successfully pass the criterion test covering this module.

Required Reading:
1. See Exercise.

Supplemental References:
1. As assigned by training coordinator.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with common types of firearms, and to become safe when handling and firing these firearms as well as the method of safely handling them.

Lecture: Common Firearms

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion test covering this module.
5. Learn to identify and clear the following categories of firearms:
   - A. Revolvers:
     1. pin type
     2. break open
     3. swing out
   - B. Lever Action Rifles:
     1. with tube magazine
     2. with box type magazine
   - C. Bolt Action Rifles and Shotguns:
     1. with tube magazine
     2. with box type magazines
   - D. Break-Open Shotguns
   - E. Semi-Auto Rifles:
     1. with tube magazines
     2. with box type magazines
   - F. Semi-Auto Pistols:
     1. hammerless
     2. with hammer
   - G. Any other firearm deemed appropriate by the training coordinator.

Required Reading:

1. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*. Ed. John Zent. Fairfax: National Rifle Association. 2006, 99-118. Print.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.
2. As assigned by training coordinator.

LESSON 3

Estimated Time: 1 Day

Purpose: To familiarize the trainee with black powder firearms, and to become safe when handling and firing these firearms as well as the method of safely handling them.

Lecture: Black Powder Firearms

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this lesson.
4. Successfully pass the criterion test covering this module.
5. The training coordinator should demonstrate proper operation of a typical percussion rifle. The demonstration should include loading the rifle with an inert substitute for black powder. The training coordinator should demonstrate how to properly unload the rifle. Each trainee should check the firearm for a loaded condition before it is unloaded and after it is unloaded.
6. Each trainee should successfully disassemble and reassemble a percussion revolver.
7. Each trainee should examine the lock mechanism of a flintlock.

Required Reading:

1. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*. Ed. John Zent. Fairfax: National Rifle Association, 2006. 41-82. Print.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 4

Estimated Time: 5 Days

Purpose: To familiarize the trainee with working with firearms.

To familiarize the trainee with **field stripping** and **basic disassembly-assembly** of some common firearms.

To improve the trainee's manual dexterity when handling, assembling and disassembling firearms.

To become familiar with assembly-disassembly related literature.

Lecture: Assembly – Disassembly

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round table" discussions on the material presented in this lesson.
4. Successfully pass the criterion test covering this module.

5. The training coordinator will demonstrate, instruct and guide the basic field stripping and disassembly-reassembly of the following listed firearms:
   A. Pistols:
      1. Astra, Walther PP or PPK
      2. Raven or Bryco
      3. Browning 25 or Colt Pocket model
      4. Colt government M1911 pistol or similar type
      5. Glock or Sigma
      6. Ruger "P" series
      7. Beretta Model 950
      8. Smith and Wesson double action series (39, 59, 459, etc.)
      9. Desert Eagle
   B. Revolvers:
      1. Old model Ruger or Colt single-action
      2. New model Ruger
      3. Cap and Ball revolver (need not be test fired)
      4. Smith and Wesson K, L, or N frame revolver
      5. Ruger Security-Six or Speed-six or similar
   C. Shotguns and Rifles:
      1. Remington 870 (remove barrel, forend, bolt, locking lug and locking plate, and trigger group)
      2. Mossberg Model 500 or similar pump shotgun
      3. Mauser model 98 (disassemble bolt)
      4. Colt AR15 or similar
      5. Barrel wedge type muzzle loader (remove barrel, lock and trigger plate, need not be test fired)
      6. Simple 22 caliber rifle (remove bolt and remove barreled action from stock)
      7. Break open shotgun or rifle (remove and replace fore stock, barrel, and butt stock)
   D. Other: As time permits and as deemed appropriate, add any other firearm of interest to the above list.
   E. The training coordinator should demonstrate labeling and indexing of test shots.
   F. The trainee should demonstrate the ability to execute the proper field stripping and basic assembly-disassembly of the listed firearms.
   G. The trainee should locate the appropriate disassembly literature and work from those sources.
   H. After reassembly the trainee should have the training coordinator inspect the firearm and approve it for test firing. The trainee, under the supervision of the training coordinator, should test fire each firearm, recover the appropriate projectiles and cartridge case, and save the sample tests for future comparisons.

Required Reading:

1. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*. Ed. John Zent. Fairfax: National Rifle Association, 2006. 41-82. Print.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 5

Estimated Time: 2 Days

Purpose: To familiarize the trainee with firearms handling and firing of firearms.

Lecture: None

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this lesson.
4. Successfully pass the criterion test covering this module.
5. Successfully complete the following course of fire:
   A. Handguns:
      1. Targets
         a. 5 yd 4.25 x 5.5 in. (approx. ¼ sheet paper)
         b. 10 yd 8.5 x 11 in (sheet paper)
         c. 25 yd silhouette target
      2. Course of fire is 4 rounds, standing at each target.
      3. No time limit.
      4. 2 DA/2SA (unless SA only or DA only firearm)
      5. All 4 shots must touch target.
      6. Targets may be repeated until trainee qualifies.
      7. Suggested handguns: 22LR revolver/22LR pistol/38 Spl. revolver "2&4" barrels/9mm pistol/45 auto pistol.
   B. Rifles:
      1. Targets
         a. 5 yd 4.25 x 5.5 in. (approx. ¼ sheet paper)
         b. 10 yd 8.5 x 11 in (sheet paper)
         c. 25 yd. silhouette
      2. Course of fire is 4 rounds, standing at each target.
      3. No time limit.
      4. Targets may be repeated until trainee qualifies.
      5. Suggested rifles: 22LR/5.56 / 7.62 NATO / 30-30 / 7.62x39 / 30-06 / 303 bolt action.

C. Shotguns
   1. Targets
      a. 10 yd silhouette
   2. Course of fire is 4 rounds each target, standing.
   3. No time limit.
   4. Targets may be repeated until trainee qualifies.
   5. Suggested shotgun: 12 ga pump or auto.

Required Reading:

1. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*. Ed. John Zent. Fairfax: National Rifle Association, 2006. 41-82. Print.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: TEST FIRING AND RECOVERY METHODS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-2 - Standard Firearm Examination Method Safe Firearm Handling
ISP Procedures Manual FA-IA-3 - Standard Firearm Examination Method – Pre-Firing Safety Examination
ISP Procedures Manual FA-IC-1 – Test Firing Method – Water Recovery Tank
ISP Procedures Manual FA-IC-2 – Test Firing Method – Cotton Waste Recovery Box
ISP Procedures Manual FA-IC-3 – Test Firing Method – Bullet Trap
ISP Procedures Manual FA-IC-4 – Test Firing Method – Remote Firing
ISP Procedures Manual FA-IC-5 – Test Firing Method – Down Loading
ISP Procedures Manual FA-IC-6 – Test Firing Method – Primed Cartridge Case/Shotshell

UNIT ESTIMATED TIME

5 Days

GOAL

Upon completion of this module, the trainee will possess both the knowledge and skills required to safely and properly test fire a firearm, using the various recovery methods employed by a forensic science laboratory.

OBJECTIVES

1. The trainee must demonstrate both the knowledge and the skills to safely and properly test fire a firearm using the various recovery methods employed by a forensic science laboratory by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing this test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with test firing a firearm in a safe and proper manner.

Lecture: Test Firing

Exercises:

1. Read, understand, and be familiar with any and all Department, Command, Laboratory and/or section documents dealing with:
   A. Test firing
   B. Firearms handling
2. Complete the assigned exercises.
3. Attend all lectures.
4. Actively participate in “round-table” discussions on the material presented in this module.
5. Demonstrate the proper and safe techniques used when test firing into the water recovery tank.
6. Demonstrate the proper and safe techniques used when test firing into the cotton waste recovery box.

7. Demonstrate the proper and safe techniques used when test firing into the bullet trap.
8. Demonstrate the proper and safe techniques used when test firing utilizing a remote firing device.
9. Perform routine maintenance on all of the recovery devices.
10. Successfully pass the criterion tests covering this module.

Required Reading:

1. *Federal Bureau of Investigation*. Technical Protocols for the Handling of Firearms and Ammunition, Quantico, FBI, 1992. Print.

2. *Fundamentals of Gun Safety*, Safety and Education Division of the National Rifles Association of America. 1991. Videocassette.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: MODERN FIREARMS DESIGN I: FIREARMS ACTIONS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-1 Standard Firearm Examination Method - Physical Examination and Classification of Firearms
ISP Procedures Manual FA-IA-3 Standard Firearm Examination Method - Pre-Firing Safety Examination
ISP Procedures Manual FA-IB-3 Miscellaneous Firearm Examination Method - Malfunctioning Firearm Examination

UNIT ESTIMATED TIME

10 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of firearms actions.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of firearms action by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 10 Days

Purpose: To familiarize the trainee with firearms action.

Lecture: Firearms Actions

Exercises:

1. Become thoroughly familiar with the following type actions:
   a. Auto-loading
   b. Bolt
   c. Revolver
   d. Box Lock
   e. Falling Block
   f. Hinged Frame
   g. Lever
   h. Rolling Block
   i. Sidelock
   j. Slide/Pump
   k. Trap Door
2. Read the assigned materials.
3. Attend all lectures.
4. Actively participate in “round-table” discussions on the material presented in this module.
5. Demonstrate familiarity and recognition of firearms action.
6. Successfully pass the criterion test covering this module.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: MODERN FIREARMS DESIGN II: FIRE CONTROL SYSTEMS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-1 Standard Firearm Examination Method - Physical Examination and Classification of Firearms
ISP Procedures Manual FA-IA-3 Standard Firearm Examination Method - Pre-Firing Safety Examination
ISP Procedures Manual FA-IB-3 Miscellaneous Firearm Examination Method - Malfunctioning Firearm Examination

UNIT ESTIMATED TIME

20 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of fire control systems.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of fire control systems by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 10 Days

Purpose: To familiarize the trainee with triggers that have their sears under compression. This will include making the trainee familiar with:
1. The geometry of simple hammer notch and sear systems.
2. The concepts of trigger creep, trigger staging and enclosed angle hammer notches.
3. The arrangement, the differences and the similarities of the trigger group parts on a typical revolver, a typical semi-auto pistol, a typical box lock shotgun, and a typical side lock firearm.
4. The consequences of altering a hammer notch.

Lecture: Firearm Actions

Exercise:
1. Be able to define the following terms:

A. Single Action
B. Double Action
C. Sear
D. Double Action Sear
E. Single Action Sear
F. Hammer Notch
G. Striker
H. Two Stage Trigger
I. Override Trigger
J. Sear Engagement
K. Trigger Staging
L. Disconnector
M. Disconnect
N. Lock Time
O. Slam Fire
P. Firing Pin
Q. Fire Train

2. With the revolvers provided, in the following manner, while dry firing in the **single action mode**:
   A. Attempt to move the triggers without releasing the hammer.
   B. While doing this, observe the hammer for rearward movement prior to releasing.
   C. Repeat this step, only observe the hammer for movement under the stereo microscope. If possible observe the sear movement under the stereo microscope.
   D. Make note of any firearm where the trigger can be staged.
3. If a revolver or other similar hammer/trigger firearm is available that is either equipped with a clear side plate or with a cut-away viewing hold, observe the sear movement of those particular firearms under the stereo microscope.
4. Remove the sideplate of a typical Smith and Wesson double action revolver or similar type revolved and make a sketch or take a picture of the hammer/trigger/sear as they appear at full cock. Make a second sketch or take a picture with the same parts in the uncocked or resting position.
5. If sufficient spare parts are available, alter, by filing and/or stoning, the geometry of the hammer notch and sear of a "Peace Maker" type revolver. Note the change in trigger pull as the angles are changed. If the hammer notch is neutral and the hammer does not rock back when the trigger is pulled, begin by attempting to make it do so. Once the hammer rocks rearward, alter the notch so that the hammer does not rock rearward upon pulling the trigger. After making the hammer notch neutral, continue to file, opening up the notch and/or rounding off the rear corner of the sear to see if a "hair trigger" situation can be created. **These parts should not be left in the firearm after this exercise is completed.**
6. Examine the sear and trigger arrangement on a single action semi-auto pistol, such as the 1911 Colt or any of the derivative designs. Make a sketch or take a picture of the hammer and sear as they appear in full cock. Make a second sketch or take a picture with the same parts in the uncocked or resting position. Note the differences between the single action revolver and single action semi-auto pistol triggers.
7. Examine a typical box lock shotgun with internal hammers. Either a single or double trigger model is appropriate; however, both would be optimal. Note the arrangement of the sear and trigger. Look to see how the mechanism reacts with a hesitation trigger pull. In a hesitation pull, does the hammer notch reset itself on the sear when the trigger is released? Does the hammer rock back before firing? Make a sketch or take a picture of the hammer, sear and trigger as they appear at full cock. Make a second sketch or take a picture with the same parts in the uncocked or resting position.
8. Examine the lock works of a typical percussion or flintlock firearm or of a side lock type shotgun. Sketch the arrangement or take a picture of hammer, trigger and sear as they appear at full cock. Make a second sketch or take a picture with the same parts in the uncocked or resting position.
9. Read the assigned materials.

10. Attend all lectures.
11. Actively participate in "round-table" discussions on the material presented in this module.
12. Successfully pass the criterion test covering this lesson.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*. Ed. John Zent. Fairfax: National Rifle Association. 2006, 99-118. Print.

3. As assigned by training coordinator.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with triggers that have their sears under tension.

Lecture: Firearm Actions

Exercises:

1. Examine several hammer systems where the sear is under tension. Some recommended systems are the trigger groups from the Remington 870/1100 family of shotguns, the Winchester 1200/1300/1400 family of shotguns, Ruger Mini-14 or any other appropriate firearm. Examine the trigger/sear/hammer relationship to see how they operate in concert. Make a sketch or take a picture of at least one example of a trigger/sear/hammer in place in the trigger group. Does the mechanism tolerate a hesitation trigger pull well?
2. Read the assigned materials.
3. Attend all lectures.
4. Actively participate in "round-table" discussions on the material presented in this module.
5. Successfully pass the criterion test covering this lesson.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*. Ed. John Zent. Fairfax: National Rifle Association. 2006, 99-118. Print.

3. As assigned by training coordinator.

LESSON 3

Estimated Time: 5 Days

Purpose: To familiarize the trainee with double action trigger system on revolvers and semi-automatic pistols as well as the hybrid action trigger system found on striker-fired pistols.

Lecture: Firearm Actions

Exercises:

1. Examine several double action revolvers to learn how the double action feature works. Some suggested firearms are S&W, Ruger, Colt Python or Police Positive, H&R and/or any other appropriate firearm.
2. Learn the names of the parts of the double action systems.
3. Make a sketch or take a picture of the parts that are active in the double action trigger pull as they appear in place in the firearm.
4. Identify the parts on the sketch or picture that allow the double action trigger to reset.
5. Examine several double action semi-automatic pistols that have a hammer. The S&W family is recommended as a starting point (this does not include the Sigma line of pistols).
6. Learn the names of the parts of the double action system.
7. Make a sketch of the parts or take a picture that are active in the double action trigger pull as they appear in the firearm.
8. Identify the parts on the sketch or picture that allow the double action trigger to reset.
9. Compare the operation of the double action trigger to reset.
10. Examine the hybrid action striker system of the Glock pistol.
    A. How does it work?
    B. What makes the trigger release the strike?
    C. Why is it not a true double action?
    D. Make a sketch or take a picture of the parts that are active in the release of the striker as they appear in place on the firearm.
11. Read the assigned materials.
12. Attend all lectures.
13. Actively participate in "round-table" discussions on the material presented in this module.
14. Successfully pass the criterion test covering this module.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*. Ed. John Zent. Fairfax: National Rifle Association. 2006, 99-118. Print.

3. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: MODERN FIREARMS DESIGN III: FIREARMS SAFETY SYSTEMS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-1 Standard Firearm Examination Method - Physical Examination and Classification of Firearms
ISP Procedures Manual FA-IA-3 Standard Firearm Examination Method - Pre-Firing Safety Examination
ISP Procedures Manual FA-IB-3 Miscellaneous Firearm Examination Method - Malfunctioning Firearm Examination

UNIT ESTIMATED TIME

10 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of modern firearms safety systems.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of modern firearms safety systems by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 10 Days

Purpose: To familiarize the trainee with firearms safety systems.

Lecture: Firearms Safety Systems

Exercises:

1. Be able to define the following terms:
   - A. Transfer Bar
   - B. Hammer Block
   - C. Rebound Slide
   - D. Rebound Hammer
   - E. Firing Pin Lock
   - F. Inertia Firing Pin
   - G. Disconnect Safety
   - H. Grip Safety
   - I. Magazine Safety
   - J. Loading Gate Safety
   - K. Cylinder Latch Safety
   - L. Active Safety
   - M. Passive Safety
   - N. Manual Safety
   - O. Automatic Safety
   - P. Trigger Safety
2. Examine the safety systems on the following firearms or similar substitutes:
   - A. Ruger “P” series pistol
   - B. Colt 1911 type pistol
   - C. Glock pistol
   - D. 9mm Makarov pistol
   - E. S&W first, second, and third generation pistols
   - F. Mauser Hsc. Pistol
   - G. S&W Revolver

H. Colt Revolver
I. Ruger SP/GP series revolver
J. Baby Browning Pistol
K. Davis Ind. Derringer
L. Raven pistol (both safety versions)
M. Remington 870/1100 shotgun
N. Ruger Mini 14 rifle
O. Mauser 98 rifle
P. Mossberg 500 shotgun
Q. Double barrel hammerless shotgun
R. Winchester 94 and/or Martin lever action rifle
S. RG-10 or RG-14 revolver
T. Non-transfer bar H&R revolver
U. Non-transfer bar external hammer single shot shotgun

3. Complete a panel for each firearm listed to include the following information:
   A. Make and Model.
   B. Name of each safety.
   C. Where the safety is located.
   D. The type of unintentional firing that each safety was meant to prevent.
   E. Mechanically how each safety works to prevent an unintentional firing.

   Note: The literature and parts diagrams for each firearm should be checked in order to learn the names of the safety and parts involved and in order to help find safety systems not immediately apparent from an external examination.

   F. If the firearm has a provision to prevent firing when the action is opened, be sure to include this on the list of safety devices.
   G. If the safety acts directly upon the hammer or striker be sure and not whether or not the striker or hammer is lifted from the sear.
4. Complete the assigned exercises.
5. Attend all lectures.
6. Read and understand the materials presented.
7. Actively participate in "round-table" discussions on the material presented in this module.
8. Successfully pass the criterion test covering this module.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: MODERN FIREARMS DESIGN IV: FIREARMS FEED SYSTEMS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-1 Standard Firearm Examination Method - Physical Examination and Classification of Firearms
ISP Procedures Manual FA-IA-3 Standard Firearm Examination Method - Pre-Firing Safety Examination
ISP Procedures Manual FA-IB-3 Miscellaneous Firearm Examination Method - Malfunctioning Firearm Examination

UNIT ESTIMATED TIME

10 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of modern firearm feed systems.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of modern firearm feed systems by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 10 Days

Purpose: To familiarize the trainee with firearm feed systems to include:
1. The basic operational characteristics of revolver cylinder indexing devices.
2. The basic operational characteristics of break-open shotgun and revolver ejection systems.
3. The feed mechanisms on typical tubular magazine shotguns.
4. The feed mechanisms on typical tubular rimfire rifles.
5. The feed mechanism on typical detachable box magazine fed firearms.
6. The feed mechanism on typical internal box magazine fed firearms.
7. The operation of typical extractors and ejectors.

Lecture: Feed Systems

Exercises:
1. Be able to define the following terms:
   A. Cylinder
   B. Chamber
   C. Timing
   D. Ratchet
   E. Hand
   F. Cylinder Stop
   G. Cylinder Lock

H. Magazine:

1. Blind Box
2. Box
3. Detachable
4. Drum
5. Rotary
6. Staggered Column
7. Tubular

I. Magazine Cut-off
J. Clip
K. Follower
L. Belt

2. Utilizing the reference collection, locate five examples of a cylinder stop on a revolver. Make a sketch or take a picture of the cylinder stop and describe what causes the cylinder stop to engage and disengage from the cylinder notch. Indicate this relationship on the sketch or picture. On each example, estimate how many degrees of rotation that the cylinder stop is out of contact with the cylinder.
3. Examine the hand and ratchet on a:
   A. Ruger single action revolver
   B. S&W or Ruger double action revolver
   C. Colt Python or Diamond Back revolver
   D. Identify which revolvers have a hand that disengages from the ratchet before the hammer is released.
4. Utilizing the reference collection, locate an auto-ejecting break open revolver with a working auto-eject mechanism and a similar revolver whose auto-eject mechanism does not work. Examine the working sample and describe how the ejector works. Make a sketch or take a picture that illustrates your description. Based on this knowledge examine the non-working firearm and diagnose why it does not work.
5. Utilizing the reference collection, locate an auto-ejection break open shotgun and an extraction only break open shotgun. Examine the ejection mechanism and sketch it or take a picture.
6. Examine the following shotguns:
   A. Remington 870/1100
   B. Winchester 1200/1300/1400
   C. Savage/Springfield 67
   D. Mossberg 500

   Cycle the action utilizing dummy shotshells and identify the specific parts in each system that control the timing of the cutoff and release of the shotshells. Identify the shotguns that have both a shotshell stop and a magazine cutoff and those that have only a shotshell stop.
7. Examine the feed system of a rear feed tubular magazine rimfire rifles. Sketch or take a picture of each feed system and describe how it operates. Note which systems have a carrier and which systems lack this feature.
8. Examine the following firearms:
   A. The firearms utilized in Exercises #6 & #7.
   B. Raven 25 cal pistol
   C. Remington model 700 rifle
   D. Beretta 950 pistol
   E. Beretta 92 pistol

F. Luger P08 pistol

Note the location of the firing pin, the extractor(s) and the ejector as is typically done on a standard firearm panel. Make note of any ejectors that use a spring type device to assist in ejection.

9. Examine an available selection of clips and note how they function.
10. Examine several different types of detachable box magazine fed weapons. Not what types of magazines are utilized and how the feed system functions.
11. Complete the assigned exercises.
12. Attend all lectures.
13. Read and understand the materials presented.
14. Actively participate in "round-table" discussions on the material presented in this module.
15. Successfully complete the criterion test covering the material presented in this module.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: MODERN FIREARMS DESIGN V: LOCKING SYSTEMS AND BARRELS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-1 Standard Firearm Examination Method - Physical Examination and Classification of Firearms
ISP Procedures Manual FA-IA-3 Standard Firearm Examination Method - Pre-Firing Safety Examination
ISP Procedures Manual FA-IB-3 Miscellaneous Firearm Examination Method - Malfunctioning Firearm Examination

UNIT ESTIMATED TIME

10 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of modern firearm locking systems and barrels.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of modern firearm locking systems and barrels by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with firearm barrels and rifling systems.

Lecture: Barrels

Exercises:

1. Read and understand the materials presented.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion test covering this module.
5. Be able to define the following terms:
   - A. Rifling
   - B. Land/Groove
   - C. Broach
   - D. Reamer
   - E. Button
6. Become thoroughly familiar with the following rifling types:
   - A. Cut
   - B. Broached
   - C. Gang Broached
   - D. Hammer Forged/Swaged
   - E. Enfield
   - F. Metford
   - G. Lancaster
   - H. Newton Parabolic
   - J. Polygonal
   - K. Henry
   - L. Polygroove
   - M. Whitworth
   - N. Newton-Pope
   - O. Schalk-Pope
   - P. Virgule
   - Q. Paradox

I. Micro-Groove
R. Rope/Twine

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*. Ed. John Zent. Fairfax: National Rifle Association. 2006, 141-167. Print.

3. As assigned by training coordinator.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with firearm locking systems.

Lecture: Locking Systems

Exercises:

1. Read and understand the materials presented.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion test covering this module.
5. Be able to define the following terms:
   A. Breech Block
   B. Locking Lug(s)
   C. Bolt
   D. Slide
6. Examine the following firearms and note the load bearing locking structures and latching devices:
   A. Remington 870/1100 series shotgun
   B. Winchester 1200/1300/1400 series shotgun
   C. Savage model 99 rifle
   D. Winchester model 10 rifle
   E. Winchester model 94 rifle
   F. Marlin lever-action rifle
   G. Beretta model 92 pistol
   H. Colt Government model pistol
   I. "Tilt barrel recoil operated pistol"

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: MODERN AMMUNITION I: CENTERFIRE AND RIMFIRE SMALL ARMS AMMUNITION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-2 – Standard Firearm Examination Method – Safe Firearm Handling
ISP Procedures Manual FA-IB-6 – Miscellaneous Firearms Examination Method – Ammunition Reference Collection
ISP Procedures Manual FA-ID-1 – Fired Evidence Examination Method – Caliber Determination
ISP Procedures Manual FA-ID-3 – Fired Evidence Examination Method – Air Gap
ISP Procedures Manual FA-ID-7 – Fired Evidence Examination Method – GRC Utilization
ISP Procedures Manual FA-ID-10 – Fired Evidence Examination Method – Physical Examination and Classification of Fired Evidence
ISP Procedures Manual FA-ID-14 – Fired Evidence Examination Method – Bullet Replica
ISP Procedures Manual FA-Appendix II – Standards and Controls

UNIT ESTIMATED TIME

30 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of centerfire and rimfire small arms ammunition.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of centerfire and rimfire small arms ammunition by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 20 Days

Purpose: To familiarize the trainee with ammunition and ammunition components.

Lecture: Centerfire and Rimfire Ammunition

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion test covering this module.
5. Become familiar with laboratory ammunition. This would include ammunition for casework and the ammunition reference collection.
6. Disassemble different brands of ammunition to compare the components in all common cartridges and bullet styles to include pistol, rifle, and rimfire ammunition.
7. Examine ammunition of different brands to compare the primer sealant used (or not used).
8. Examine different ammunition for the various types of powder used in different cartridge names, brands, and dates of manufacture.

9. Examine the ammunition available for primer crimping and neck crimping.
10. Compare the bullet types currently available with those available in the past.
11. Examine commercially reloaded ammunition to identify the source of the components.
12. Become familiar with proprietary bullets or other components of various manufactures.
13. Be able to define the following terms:
    A. Abbreviations:
        i. RN
        ii. JHP
        iii. JSP
        iv. SWC
        v. LWC
        vi. LRN
        vii. FMJ
        viii. AP
        ix. HSP
        x. HPBT
        xi. PSP
        xii. SJHP
    B. Bullets:
        i. Ogive
        ii. Hard Ball
        iii. Cannelure
        iv. Copper Wash
        v. Jacketed
        vi. Grease Groove
        vii. Soft Point
        viii. Spire Point
        ix. Ball Ammunition
        x. Sabot
        xi. Lubaloy®
        xii. Hollow Point
        xiii. Bearing Surface
        xiv. Semi-Wadcutter
        xv. Spitzer
        xvi. Truncated Cone
        xvii. Wadcutter
        xviii. Boattail
        xix. Semi-Jacketed
        xx. Partitioned Bullet
        xxi. Round Nose
    C. Cartridge:
        i. Belt
        ii. Semi-Rimmed
        iii. Web
        iv. Straight Case
        v. Extractor Groove
        vi. Primer Sealant
        vii. Rimless
        viii. Cannelure
        ix. Boxer Primer
        x. Mouth
        xi. Berdan Primer
        xii. Neck
        xiii. Staked Primer
        xiv. Base
        xv. Rim
        xvi. Bottle Necked
        xvii. Shoulder
        xviii. Crimp
        xix. Head Stamp
        xx. Primer Annulus
14. Become familiar with the following:
    A. Caseless Cartridges
    B. Rockets
    C. Trounds
    D. Flechettes
    E. Sabots
    F. Multiple Loads
    G. Tracers
    H. Frangible Bullets
    I. Exploding Bullets

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: MODERN AMMUNITION II: SHOTSHELLS, SHOTSHELL TYPE CARTRIDGES AND COMPONENTS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-2 – Standard Firearm Examination Method – Safe Firearm Handling
ISP Procedures Manual FA-IB-6 – Miscellaneous Firearms Examination Method – Ammunition Reference Collection
ISP Procedures Manual FA-ID-1 – Fired Evidence Examination Method – Caliber Determination
ISP Procedures Manual FA-ID-3 – Fired Evidence Examination Method – Air Gap
ISP Procedures Manual FA-ID-7 – Fired Evidence Examination Method – GRC Utilization
ISP Procedures Manual FA-ID-8 – Fired Evidence Examination Method – Wadding Determination
ISP Procedures Manual FA-ID-9 – Fired Evidence Examination Method – Shot Determination
ISP Procedures Manual FA-ID-10 – Fired Evidence Examination Method – Physical Examination and Classification of Fired Evidence
ISP Procedures Manual FA-Appendix II - Standards and Controls

UNIT ESTIMATED TIME

20 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of shotshells, shotshell type cartridges, and components.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of shotshells, shotshell type cartridges and components by successfully passing a written criterion test covering this material. A score of 80% or greater constitutes successfully passing the test.

LESSON 1

Estimated Time: 20 Days

Purpose: To familiarize the trainee with the types of ammunition, nomenclature and components related with shotshells and shotshell type cartridges.

Lecture: Shotshells and Their Components

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. All work should be done using laboratory panels. Every step of the exercise should involve the use of the stereo microscope. Before disassembly of any items, a thorough microscopic examination should be performed. Using the samples provided by the training coordinator, create a set of exemplars of shot, wadding and components by disassembly of shotshells and cartridges containing shotshell type components. Compare the components. After labeling the standards, weigh and measure total shot weight, the individual shot and record

this information. Determine the averages of the shot weights and measurements. Measure and draw components of the shotshells and cartridges. Inspect, draw and record the attributes of the shotshells and cartridges. Compare after-market components to the exemplars you have created. IT IS IMPORTANT TO OBSERVE AND COMPARE ALL THE ATTRIBUTES FROM ONE TO THE OTHER OF ALL EXEMPLARS YOU HAVE CREATED.

5. Using the taxonomic chart, take samples of the shot from the previous exercise and reexamine the shot. Use smooth-jawed pliers to crush, but not completely flatten the shot and observe the results. Compare your results to the taxonomic chart.
6. Fire tests samples provided by the training coordinator, using a recovery system designed to recover shot and wadding components while minimizing damage, but not to eliminate it. Recover samples after each shot until the samples are consumed. Some of these samples will be duplicates. The wads from these will be soaked for two days and compared to the ones fired, but not soaked. Examine the fired samples in the same manner as described above.
7. Successfully pass the criterion test covering this module.

Required Reading:

1. Frost, George E. *Ammunition Making*. Washington D. C.: National Rifle Association of America, 1990. Print.

2. Barnes, Frank C. *Cartridges of the World*. 8th ed. Northbrook: DBI Books (Krause Publications, Inc.). 1997. Print.

3. Burrard, Gerald. *The Identification of Firearms and Forensic Ballistic.* London: Herbert Jenkins, Ltd. 1934. Print.

4. As assigned by training coordinator.

Supplemental References:

1. Bussard, Michael E. and Stanton L. Wormley, Jr. *NRA Firearms Sourcebook*. Ed. John Zent. Fairfax: National Rifle Association. 2006, 255-292. Print.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FIREARMS IDENTIFICATION CASEWORK APPROACH

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

All of the procedures within the ISP Procedures Manual – Firearms Examination Protocol.

UNIT ESTIMATED TIME

10 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the rules and practices pertinent to proper firearm identification evidence handling and casework.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the rules and practices pertinent to proper firearms identification evidence handling and casework by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the Evidence Handling Procedures utilized within the Illinois State Police.

Lecture: Evidence Handling Procedures

Exercises:

1. The trainee will go into the vault and examine existing seals to observe various types. The trainee will examine both laboratory and agency seals.
2. The trainee will become familiar with evidence sign-in procedures and will observe cases being signed in and then sign in cases (real or simulated).
3. The trainee will become familiar with casework policy. The trainee will be provided with case information and determine:
   A. If a case should be accepted/worked.
   B. What examinations should be done and in what sequence, i.e., trace, forensic biology, latent prints.
4. Read any assigned materials.
5. Attend all lectures.
6. Actively participate in "round-table" discussions on the material presented in this module.
7. Successfully pass the criterion test covering this lesson.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. As assigned by training coordinator.

LESSON 2

Estimated Time: 4 Days

Purpose: To familiarize the trainee with Reports and Report Wording.

Lecture: Reports and Report Wording

Exercises:

1. The trainee will review numerous reports.
2. The trainee will write reports on numerous simulated cases.
3. Read any assigned materials.
4. Attend all lectures.
5. Actively participate in "round-table" discussions on the material presented in this module.
6. Successfully pass the criterion test covering this lesson.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. As assigned by training coordinator.

LESSON 3

Estimated Time: 1 Day

Purpose: To familiarize the trainee with courtroom procedures as it relates to a firearm identification case.

Lecture: Mock Court

Exercises:

1. The trainee will already have participated in the general courtroom demeanor training.
2. The trainee will participate in several mock trials.
3. Attend all lectures.
4. Actively participate in "round-table" discussions on the material presented in this module.
5. Successfully pass the criterion test covering this lesson.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FIREARMS IDENTIFICATION INITIAL SUPERVISED CASEWORK

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

All of the procedures within the ISP Procedures Manual – Firearms Examination Protocol.

UNIT ESTIMATED TIME

120 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the procedures utilized as well as the ability to process analytical cases submitted to the firearms identification section for analysis.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the procedures utilized as well as the ability to process analytical cases submitted to the firearms identification section for analysis by successfully processing all of the cases assigned. The following standards must be met to successfully complete this module: no erroneous identifications; no erroneous eliminations; no misinterpreted or overstated serial number restoration results; and all toolmarks on submitted evidence that the training coordinator deems unquestionably suitable for comparison were called suitable by the trainee. In addition, all standards listed in Command Directive TRN 10 and TRN 14 must be met.

LESSON 1

Estimated Time: 120 Days

Purpose: To familiarize the trainee with the actual processing of casework submitted to the laboratory for analysis.

Lecture: None

Exercises:

1. The trainee will be assigned actual cases to work under the supervision of a qualified examiner. These cases will increase in complexity as the trainee proceeds through the training process.
2. The trainee will issue reports, cosigned by the individual under whom the case was supervised, interact with law enforcement agencies and testify in court if called to do so.
3. Read any assigned materials.
4. Actively participate in "round-table" discussions on the material presented in this module.

Required Reading:

1. As assigned by training coordinator.

Supplemental References:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: AIR-POWERED FIREARMS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-1 – Physical Examination and Classification
ISP Procedures Manual FA-IA-2 – Safe Firearm Handling
ISP Procedures Manual FA-IA-3 - Pre-Firing Safety Examination
ISP Procedures Manual FA-IC-1 – Water Recovery Tank
ISP Procedures Manual FA-IC-2 – Cotton Waste Recovery Box
ISP Procedures Manual FA-IC-3 – Bullet Trap

UNIT ESTIMATED TIME

5 Days

GOAL

Upon completion of this module, the trainee will possess a basic knowledge of common air-powered firearms

OBJECTIVE

1. The trainee must demonstrate a basic knowledge of common air-powered firearms by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with air-powered firearms.

Lecture: Air-Powered Firearms

Exercises:

1. Read any assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion test covering this module.
5. Properly complete a standard firearms panel and test fire all available basic types (spring, CO_2, pneumatic) of air-powered firearms of various calibers. Test shots will be compared. Identification will be verified by the training coordinator.
6. Become familiar with the sections of Illinois Statutes concerning air-powered firearms.

Required Reading:

1. "Air Guns: A Guide to Air Pistols and Rifles." Fairfax: The National Rifle Association, First Edition, 1991, Print.

2. State of Illinois Compiled Statutes: 430/ILCS 65/1.1 Firearm Owner's Identification Card Act Definitions.

Supplemental References:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. Manufacturers catalogs of air-powered firearms.
   Examples: Daisy, Crossman, Benjamin, RWS, and Marksman.

3. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: RELOADING CARTRIDGES

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

All of the ISP Procedures contained within the section FA-ID - Fired Evidence Examination Method.

UNIT ESTIMATED TIME

3 Days

GOAL

Upon completion of this module, the trainee will possess a basic knowledge of reloading cartridges and its utility in casework.

OBJECTIVE

1. The trainee must demonstrate a basic knowledge of reloading cartridges and its utility in casework by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with basic reloading equipment and procedures.

Lecture: Reloading Equipment and Procedures

Exercises:

1. Read any assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion test covering this module.
5. The trainee will have basic reloading equipment demonstrated by the training coordinator/or by viewing basic reloading tapes.
6. The trainee will reload both straight-wall and bottleneck-type cartridges.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

LESSON 2

Estimated Time: 2 Days

Purpose: To familiarize the trainee with forensic/casework application of cartridge reloading.

Lecture: Forensic Application of Reloading

Exercises:

1. Read any assigned materials.
2. Attend all lectures.
3. Actively participate in "round-table" discussions on the material presented in this module.
4. Successfully pass the criterion test covering this module.
5. Examine once-fired factory cases as they are marked by the various stages of the reloading process.
6. Examine numerous reloaded cartridges for indicators useful in determining reloading.
7. The trainee will be shown how to make a "reduced load" rifle cartridge.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: MUZZLE TO GARMENT DISTANCE DETERMINATION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-VA-1 – Visual Examination
ISP Procedures Manual FA-VA-2 – Microscopic Examination
ISP Procedures Manual FA-VB-1 - Modified Griess – Direct Application Technique
ISP Procedures Manual FA-VB-2 - Modified Griess – Reverse Application Technique
ISP Procedures Manual FA-VB-3 - Sodium Rhodizonate – Bashinsky Transfer Technique
ISP Procedures Manual FA-VB-4 – Sodium Rhodizonate – Direct Application Technique
ISP Procedures Manual FA-VB-5 – Dithiooxamide
ISP Procedures Manual FA-VC-1 – Non-Shot Pellet Pattern Production
ISP Procedures Manual FA-VC-2 – Shot Pellet Pattern Production

UNIT ESTIMATED TIME

15 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of how to perform muzzle to garment distance determination.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of muzzle to garment distance determination by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the use and application of muzzle to garment distance determination techniques.

Lecture: Incorporated within the Exercises.

Exercises:
1. When available, attend and successfully complete the FBI Gunshot Residue School.
2. Read any assigned materials.
3. Prepare any chemicals and/or materials required for this class.
4. Actively participate in "round table" discussions on the material presented in this lesson.
5. The FBI certificate of completion may serve as a substitute practical criterion test.

Required Reading:
1. Included with the Exercises.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 2

Estimated Time: 10 Days

Purpose: To familiarize the trainee with the specific procedures and techniques utilized by the Illinois State Police in the performance of muzzle to garment distance determination.

Lecture: Case Work Approach to Distance Determination

Exercises:

1. Become familiar with the procedures listed below:
   A. FA-VA-1 – Visual Examination
   B. FA-VA-2 – Microscopic Examination
   C. FA-VB-1 - Modified Griess – Direct Application Technique
   D. FA-VB-2 - Modified Griess – Reverse Application Technique
   E. FA-VB-3 - Sodium Rhodizonate – Bashinsky Transfer Technique
   F. FA-VB-4 –Sodium Rhodizonate – Direct Application Technique
   G. FA-VB-5 – Dithiooxamide
   H. FA-VC-1 – Non-Shot Pellet Pattern Production
   I. FA-VC-2 – Shot Pellet Pattern Production
2. Utilizing the procedures listed in Exercise #1, perform distance determinations on the unknowns provided.
3. Complete a laboratory panel for the examination performed in Exercise #2.
4. Read any assigned materials.
5. Attend all lectures.
6. Actively participate in "round-table" discussions on the material presented in this module.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: SERIAL NUMBER RESTORATION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

All of the ISP Procedures contained within the section FA-IV Serial Number Restoration Method.

UNIT ESTIMATED TIME

10 Days

GOAL

Upon completion of this module, the trainee will possess a basic knowledge of serial number restoration.

OBJECTIVES

1. The trainee must demonstrate a basic knowledge of serial number restoration by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

2. The trainee must demonstrate a basic knowledge of serial number restoration by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee, with the theory and technique of serial number restoration.

Lecture: Serial Number Restoration

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in "round table" discussions on the material presented in this module.
4. Successfully pass the criterion tests covering this module.
5. Mix the standard chemicals utilized by the Illinois State Police for the purpose of serial number restoration.
6. Utilizing the materials provided by your training coordinator restore the serial numbers that have been obliterated utilizing approved Illinois State Police procedures.
7. Successfully complete ten (10) serial number restoration cases under supervision.

Required Reading:

1. As assigned by instructor.

Supplemental Reference:

1. Association of Firearm and Tool Mark Examiners Training and Standardization Committee. *AFTE Glossary* 6th ed. Virginia Beach: Association of Firearm and Toolmark Examiners, 2014. Online.

2. As assigned by instructor.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the methodology utilized by the Bureau of Alcohol, Tobacco, Firearms and Explosives (BATFE) to restore obliterated serial numbers.

Lecture: Determined within Exercise #1.

Exercises:

1. When available, successfully complete the Serial Number Restoration Workshop presented by the Bureau of Alcohol, Tobacco, Firearms and Explosives to include: metal polishing, chemical, electrolytic, magnaflux and plastic restoration.
2. Attend all lectures.
3. Successfully pass the criterion tests covering this module.
4. A BATFE certificate of course completion may serve as a substitute for the criterion test.

Required Reading:

1. Determined within Exercise #1.

Supplemental Reference:

1. As assigned by instructor.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FIREARMS AND MICROSCOPIC COMPARISON FAMILIARITY

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Acting Director of Training

PROCEDURAL REFERENCE

All of the ISP Procedures contained within the section FA-I Firearms Examination.

UNIT ESTIMATED TIME

160 Days

GOAL

Upon completion of this module, the trainee will possess a knowledge and familiarity with the process of analyzing firearms, correctly completing a firearms panel and performing microscopic comparisons of fired evidence.

OBJECTIVE

1. The trainee must demonstrate a knowledge and familiarity with the process of analyzing firearms, by correctly completing a firearms panel and performing microscopic comparisons of fired evidence by successfully passing practical criterion quizzes at the end of each lesson and successfully passing the practical criterion test at the end of this module. A score of 100% constitutes successfully passing the quizzes and test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee, specializing in the discipline of firearms identification, with the process of analyzing firearms, correctly completing a firearms panel, and performing microscopic comparisons of fired evidence from 22 caliber rimfire firearms.

Lecture: None

Exercises:

1. Read the assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Successfully pass the practical quiz covering this lesson and the practical criterion test covering this module.
4. Assemble, disassemble and complete a firearms panel on the 22 caliber firearms provided to you by your training coordinator.
5. Fire and collect test shots from these firearms.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

LESSON 2

Estimated Time: 20 Days

Purpose: To familiarize the trainee with the process of analyzing firearms, correctly completing a firearms panel, and performing microscopic comparisons of fired evidence from 25 caliber firearms.

Lecture: Determined within Exercise #1.

Exercises:
1. Read the assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Successfully pass the practical quiz covering this lesson and the practical criterion test covering this module.
4. Assemble, disassemble and complete a firearms panel on the 25 caliber firearms provided to you by your training coordinator.
5. Fire and collect test shots from these firearms.

Required Reading:
1. As assigned by training coordinator.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 3

Estimated Time: 20 Days

Purpose: To familiarize the trainee with the process of analyzing firearms, correctly completing firearms panel and performing microscopic comparisons of fired evidence from 32 caliber firearms.

Lecture: None

Exercises:
1. Read the assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Successfully pass the practical quiz covering this lesson and the practical criterion test covering this module.
4. Assemble, disassemble and complete a firearms panel on the 32 caliber firearms provided to you by your training coordinator.
5. Fire and collect test shots from these firearms.

Required Reading:
1. As assigned by training coordinator.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 4

Estimated Time: 20 Days

Purpose: To familiarize the trainee with the process of analyzing firearms, correctly completing a firearms panel and performing microscopic comparisons of fired evidence from 38 caliber firearms.

Lecture: None

Exercises:
1. Read the assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Successfully pass the practical quiz covering this lesson and the practical criterion test covering this module.
4. Assemble, disassemble and complete a firearms panel on the 38 caliber firearms provided to you by your training coordinator.
5. Fire and collect test shots from these firearms.

Required Reading:
1. As assigned by training coordinator.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 5

Estimated Time: 20 Days

Purpose: To familiarize the trainee with the process of analyzing firearms, correctly completing a firearms panel and performing microscopic comparisons of fired evidence from 9mm caliber firearms.

Lecture: None

Exercises:
1. Read the assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Successfully pass the practical quiz covering this lesson and the practical criterion test covering this module.
4. Assemble, disassemble and complete a firearms panel on the 9mm caliber firearms provided to you by your training coordinator.
5. Fire and collect test shots from these firearms.

Required Reading:
1. As assigned by training coordinator.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 6

Estimated Time: 20 Days

Purpose: To familiarize the trainee with the process of analyzing firearms, correctly completing a firearms panel and performing microscopic comparisons of fired evidence from 40 S&W / 10 mm caliber firearms.

Lecture: None

Exercises:
1. Read the assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Successfully pass the practical quiz covering this lesson and the practical criterion test covering this module.
4. Assemble, disassemble and complete a firearms panel on the 40 S&W caliber firearms provided to you by your training coordinator.
5. Fire and collect test shots from these firearms.

Required Reading:
1. As assigned by training coordinator.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 7

Estimated Time: 20 Days

Purpose: To familiarize the trainee with the process of analyzing firearms, correctly completing a firearms panel and performing microscopic comparisons of fired evidence from 45 caliber firearms.

Lecture: None

Exercises:
1. Read the assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Successfully pass the practical quiz covering this lesson and the practical criterion test covering this module.
4. Assemble, disassemble and complete a firearms panel on the 45 caliber firearms provided to you by your training coordinator.
5. Fire and collect test shots from these firearms.

Required Reading:
1. As assigned by training coordinator.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 8

Estimated Time: 20 Days

Purpose: To familiarize the trainee with the process of analyzing firearms, correctly completing a firearms panel and performing microscopic comparisons of fired evidence from various caliber firearms.

Lecture: None

Exercises:

1. Read the assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Successfully pass the criterion test covering this module.
4. Assemble, disassemble and complete a firearms panel on the various caliber firearms provided to you by your training coordinator.
5. Fire and collect test shots from these firearms.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: SOUND SUPPRESSION DEVICES

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IB-2 Silencer Examination

UNIT ESTIMATED TIME

5 Days

GOAL

Upon completion of this module, the trainee will possess a basic knowledge of sound suppressing devices.

OBJECTIVE

1. The trainee must demonstrate and will possess a basic knowledge of sound suppressing devices, by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 4 Days

Purpose: To familiarize the trainee with the manufacture, recognition and examination of sound suppression devices.

Lecture: Sound Suppression Devices

Exercises:

1. Read any assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Attend all lectures.
4. Successfully pass the criterion test covering this module.
5. Examine and diagram the common systems utilized in sound suppression devices.
6. Test fire firearms fitted with a sound suppression device (both with the device on and off).
7. Become familiar with both the State and Federal laws covering sound suppression devices.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

LESSON 2

Estimated Time: 1 Days

Purpose: To familiarize the trainee with the methodology utilized by the Bureau of Alcohol, Tobacco, Firearms and Explosives (BATFE) to recognize and examine sound suppression devices.

Lecture: Determined within Exercise #1.

Exercises:

1. When available, successfully complete the Silencer Workshop presented by the Bureau of Alcohol, Tobacco, Firearms and Explosives. Attend all lectures.
2. Actively participate in "round table" discussions on the material
3. presented in this module.
   Successfully pass the criterion test covering this module.
4.

Required Reading:

1. Determined within Exercise #1.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FULL-AUTO CONVERSIONS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-1 Physical Examination and Classification of Firearms
ISP Procedures Manual FA-IB-3 Malfunctioning Firearm Examination

UNIT ESTIMATED TIME

10 Days

GOAL

Upon completion of this module, the trainee will possess a basic knowledge of the conversion of a firearm to a fully automatic mode.

OBJECTIVE

1. The trainee must demonstrate and will possess a basic knowledge of the conversion of a firearm to the fully automatic mode, by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 9 Days

Purpose: To familiarize the trainee with the manufacture, recognition and examination of firearms that have been converted to fire in the fully automatic mode.

Lecture: Full-Auto Conversions

Exercises:

1. Read any assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Attend all lectures.
4. Successfully pass the criterion test covering this module.
5. Examine and diagram the common systems utilized in the conversion of a firearm to fire in the fully automatic model.
6. Test fire firearms that have been converted to fire in the fully automatic mode.
7. Become familiar with both the State and Federal laws covering the conversion of firearms to fire in the fully automatic mode.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

LESSON 2

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the methodology utilized by the Bureau of Alcohol, Tobacco, Firearms and Explosives (BATFE) to recognize and examine firearms that have been converted to fire in the fully automatic mode.

Lecture: Determined within Exercise #1.

Exercises:

1. When available, successfully complete the Full-Auto Conversion Workshop presented by the Bureau of Alcohol, Tobacco, Firearms and Explosives.
2. Attend all lectures.
3. Actively participate in "round table" discussions on the material presented in this module.
4. Successfully pass the criterion test covering this module.

Required Reading:

1. Determined within Exercise #1.

Supplemental Reference:

1. As assigned by the instructor.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FIREARMS LAWS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

2 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of both the Federal and State laws concerning firearms and ammunition.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of both the Federal and State laws concerning firearms and ammunition, by successfully completing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the Federal and State laws concerning firearms and ammunition.

Lecture: Firearms Laws

Exercises:

1. Read any assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Attend all lectures.
4. Successfully pass the criterion test covering this module.
5. Become familiar with both the State and Federal laws covering the conversion of firearms and ammunition.

Required Reading:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FIREARMS CLEANING

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

5 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the proper method to clean and maintain a firearm.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the proper method to clean and maintain a firearm, by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the proper method to clean and maintain a firearm.

Lecture: Firearms Maintenance

Exercises:

1. Read any assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Attend all lectures.
4. Successfully pass the criterion test covering this module.
5. Become familiar with the various methodologies to clean a firearm, particularly the barrel and breech face.
6. Become familiar with the ramifications that cleaning has on evidentiary firearms.
7. Properly clean the firearms provided to you by the training coordinator.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FIREARMS FINISHES

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IA-1 Physical Examination and Classification

UNIT ESTIMATED TIME

2 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the various finishes utilized on a firearm.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the various finishes utilized on a firearm, by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the various finishes utilized on a firearm.

Lecture: Firearms Finishes

Exercises:
1. Read any assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Attend all lectures.
4. Successfully pass the criterion test covering this module.
5. Correctly identify the various finishes commonly used on firearms.

Required Reading:
1. As assigned by training coordinator.

Supplemental Reference:
1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FIREARMS REFERENCE COLLECTION UTILIZATION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IB-5 – Firearms Reference Collection

UNIT ESTIMATED TIME

2 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of how to properly utilize the firearms reference collection.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of how to properly utilize the firearms reference collection, by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the purpose, maintenance, and proper utilization of the firearms reference collection.

Lecture: Firearms Reference Collection

Exercises:

1. Read any assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Attend all lectures.
4. Successfully pass the criterion test covering this module.
5. Correctly utilize the firearms reference collection to demonstrate an assignment for the training coordinator.
6. If possible, observe and assist in the maintenance of the firearms reference collection to include auditing and receiving of new firearms.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: AMMUNITION REFERENCE COLLECTION UTILIZATION

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-IB-6 – Ammunition Reference Collection

UNIT ESTIMATED TIME

2 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of how to properly utilize the ammunition reference collection.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of how to properly utilize the ammunition reference collection, by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the purpose, maintenance, and proper utilization of the ammunition reference collection.

Lecture: Ammunition Reference Collection

Exercises:

1. Read any assigned materials.
2. Actively participate in "round table" discussions on the material presented in this module.
3. Attend all lectures.
4. Successfully pass the criterion test covering this module.
5. Correctly utilize the ammunition reference collection to demonstrate an assignment for the training coordinator.
6. If possible, observe and assist in the maintenance of the ammunition reference collection to include auditing and receiving of new firearms.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: COURTROOM BEHAVIOR

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

15 Days

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of how to properly conduct themselves in a courtroom environment.

OBJECTIVES

1. The trainee must demonstrate a thorough knowledge of proper conduct in a courtroom environment by successfully passing a written criterion test covering this material. A score of 80% constitutes successfully passing the test.

2. The trainee must demonstrate a thorough knowledge of proper conduct in a courtroom.

LESSON 1

Estimated Time: 5 Days

Purpose: To introduce the trainee with the appropriate conduct within the courtroom setting.

Lecture: See Exercise #1.

Exercises:
1. Satisfactorily complete the Illinois State Police Courtroom Demeanor Course.
2. Read any assigned materials.
3. Actively participate in "round-table" discussions on the material presented in this lesson.
4. Attend all lectures.
5. Successfully pass the criterion test covering this module.

Required Reading:
1. See Exercise #1.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 2

Estimated Time: 5 Days

Purpose: To enhance the trainee's familiarization with the appropriate conduct within the courtroom setting.

Lecture: See Exercise #1.

Exercises:
1. Satisfactorily complete the Illinois State Police Advanced Courtroom Demeanor Course.
2. Read any assigned materials.
3. Actively participate in "round-table" discussions on the material presented in this lesson.
4. Attend all lectures.
5. Successfully pass the criterion test covering this module.

Required Reading:
1. See Exercise #1.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 3

Estimated Time: 5 Days

Purpose: To refine the trainee's ability to testify and function within the courtroom environment.

Lecture: Courtroom Demeanor and the Firearms and Toolmark Examiner

Exercises:
1. Satisfactorily complete all mock courts given.
2. Read any assigned materials.
3. Actively participate in "round-table" discussions on the material
4. presented in this lesson.
5. Attend all lectures.
6. Successfully pass the criterion test covering this module.

Required Reading:
1. As assigned by training coordinator.

Supplemental Reference:
1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: ARMORER SCHOOLS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

Unknown

GOAL

Upon completion of this module, the trainee will possess a thorough knowledge of the firearm system covered in the class attended as well as gaining a certification as an armorer for that particular system.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the firearm system covered in the class attended as well as gaining a certification as an armorer for that particular system, by successfully completing the course and receiving its certification.

LESSON 1

Estimated Time: Unknown

Purpose: To provide the trainee a thorough knowledge of the firearm system covered in the class attended as well as gaining a certification as an armorer for that particular system.

Lecture: See Exercise #1.

Exercises:

1. As available the following armorer schools should be attended:
   - A. Smith & Wesson Pistol
   - B. Smith & Wesson Revolver
   - C. Smith & Wesson Sigma Series
   - D. Glock
   - E. Remington 1100 & 870 Shotgun
   - F. Ruger Pistol
   - G. Ruger Revolver
   - H. Ruger Rifle
   - I. H&K
   - J. Beretta
   - K. Sig Arms
   - L. Colt Pistol
   - M. Colt Revolver
   - N. Colt AR15/M16

Required Reading:

1. See Exercise #1.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: FACILITY TOURS

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

Unknown

GOAL

Upon completion of this module, the trainee will possess an enhanced appreciation and knowledge of the topic covered by the tour.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the topic covered by the tour, by providing either a presentation or written report detailing what was observed as well as the forensic significance or application.

LESSON 1

Estimated Time: Unknown

Purpose: To provide the trainee with an enhanced appreciation and knowledge of the topic covered by the tour.

Lecture: See Exercise #1.

Exercises:

1. As available the following facility tours should be taken:
   - A. Machine Shop
   - B. Barrel Manufacturers
   - C. Tool Manufacturers
   - D. Federal Ammunition
   - E. Remington Ammunition
   - F. Armalite
   - G. Springfield Armory
   - H. Appropriate Museums
   - I. Other Forensic Science Laboratories

Required Reading:

1. See Exercise #1.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

MODULE: NIBIN (NATIONAL INTEGRATED BALLISTICS INFORMATION NETWORK)

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

ISP Procedures Manual FA-VA-1 Visual Examination
ISP Procedures Manual FA-VA-2 Microscopic Examination

UNIT ESTIMATED TIME

15 Days

GOAL

The trainee will possess a thorough knowledge of how to utilize the NIBIN System.

OBJECTIVE

1. The trainee must demonstrate a thorough knowledge of the NIBIN System and how to operate it by successfully passing a practical criterion test covering this material. A score of 100% constitutes successfully passing the test.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the use and application of the NIBIN System.

Lecture: Incorporated within the Exercise.

Exercises:
1. Attend and successfully complete the BATF NIBIN/IBIS Users Training.
2. Read any assigned materials.
3. Prepare any chemicals and/or materials required for this class.
4. Actively participate in "round-table" discussions on the material presented in this lesson.
5. A certificate of completion may serve as the substitute for the practical criterion test.

Required Reading:
1. Included with the Exercises.

Supplemental Reference:
1. As assigned by training coordinator.

LESSON 2

Estimated Time: 10 Days

Purpose: To familiarize the trainee with the specific procedures and techniques utilized by the Illinois State Police in the use of the NIBIN System.

Lecture: NIBIN

Exercises:

1. Become familiar with the procedures listed below:
   A. FA-VA-1 – Visual Examination
   B. FA-VA-2 – Microscopic Examination
2. Utilizing the procedures listed in Exercise #1, enter at least 10 discharged cartridge cases and 10 fired bullets into the NIBIN System.
3. Complete a laboratory panel for the examinations performed in Exercise #2.
4. Read any assigned materials.
5. Attend all lectures.
6. Actively participate in "round-table" discussions on the material presented in this lesson.
7. Successfully pass the criterion test covering this lesson.

Required Reading:

1. As assigned by training coordinator.

Supplemental Reference:

1. As assigned by training coordinator.

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

APPENDIX A-1: TRAINING CHECKLIST

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INITIAL FORENSIC SCIENCE TRAINING CHECKLIST
FIREARMS

Trainee: _____ Coordinator: _____

Training Start Date: _____ Training End Date: _____

Module	Completion Date	Trainee Initials	Coordinator Initials
General Forensic Science			
Ethics in Forensic Science			
Introduction to Safety in the Firearms and Toolmarks Section			
Introduction to Firearms and Toolmark Identification			
History and Evolution of Firearms and Toolmark Identification			
Instrumentation			
Introduction to Pattern Recognition			
Casting and Enhancement Techniques			
Tools and Their Uses			
Manufacturing Methods			
Stamps			
The Criminal Use of Tools			
Toolmark Casework Approach			
Toolmark Identification Supervised Casework			
Firearm Usage Familiarization			
Test Firing and Recovery Methods			
Modern Firearms Design I: Firearms Actions			
Modern Firearms Design II: Fire Control Systems			
Modern Firearms Design III: Firearms Safety Systems			
Modern Firearms Design IV: Firearm Feed Systems			
Modern Firearms Design V: Locking Systems and Barrels			
Modern Ammunition I: Centerfire and Rimfire Small Arms Ammo			
Modern Ammunition II: Shotshells, Shotshell Type Cartridges, and Components			
Firearms Identification Casework Approach			
Firearms Identification Initial Supervised Casework			
Air-Powered Firearms			
Reloading Cartridges			

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INITIAL FORENSIC SCIENCE TRAINING CHECKLIST
FIREARMS

Trainee: _____ Coordinator: _____

Training Start Date: _____ Training End Date: _____

Module	Completion Date	Trainee Initials	Coordinator Initials
Muzzle to Garment Distance Determination			
Serial Number Restoration			
Firearms and Microscopic Comparison Familiarity			
Sound Suppression Devices			
Full-Auto Conversions			
Firearms Laws			
Firearms Cleaning			
Firearms Finishes			
Firearms Reference Collection Utilization			
Ammunition Reference Collection Utilization			
Courtroom Behavior			
Armorer Schools			
Facility Tours			
NIBIN			

If a module was not completed, mark it "NC" (Not completed").

ILLINOIS STATE POLICE

FIREARMS AND TOOLMARKS TRAINING MANUAL

APPENDIX A-2: AUTHORIZATIONS BASED ON SCOPE

Reviewed by:

Caryn Tucker
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

AUTHORIZATIONS BASED ON SCOPE

Field of Testing: Forensic Testing
Materials Tested

Forensic Scientist: _____
Category: Firearms

Sub Catergory: Firearms

Analytical Technique	Authorized
4.1 Physical Examination: Physical Measurements	
4.3 Physical Examination: Performance Evaluation	
5.1 Microscopy: Optical	
6.1 General Laboratory Procedures: Weighing/Mass/Force Determination	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: Ammunition

Analytical Technique	Authorized
4.1 Physical Examination: Physical Measurements	
4.2 Physical Examination: Striation/Impression/Mark Comparison	
4.5 Physical Examination: Pattern Recognition	
5.1 Microscopy: Optical	
6.1 General Laboratory Procedures: Weighing/Mass/Force Determination	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: Distance Determination

Analytical Technique	Authorized
1.2 Screening Tests: Color	
1.3 Screening Tests: Other Chemical Tests	
4.1 Physical Examination: Physical Measurements	
4.5 Physical Examination: Pattern Recognition	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: Serial Number Restoration

Analytical Technique	Authorized
1.3 Screening Tests: Other Chemical Tests	
5.1 Microscopy: Optical	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: NIBIN

Analytical Technique	Authorized
4.2 Physical Examination: Striation/Impression/Mark Comparison	
4.4 Physical Examination: Population Database Comparison	
5.1 Microscopy: Optical	
6.4 General Laboratory Procedures: General Laboratory Techniques	

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

AUTHORIZATIONS BASED ON SCOPE

Field of Testing: Forensic Testing
Materials Tested

Forensic Scientist:
Category: Firearms

Sub Category: Toolmarks

Analytical Technique	Authorized
4.1 Physical Examination: Physical Measurements	
4.2 Physical Examination: Striation/Impression/Mark Comparison	
4.5 Physical Examination: Pattern Recognition	
5.1 Microscopy: Optical	
6.4 General Laboratory Procedures: General Laboratory Techniques	

These are the areas under which I am authorized to conduct casework.

Forensic Scientist / Date

Training Coordinator / Date

Director of Training / Date

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FOOTWEAR/TIRE TRACKS

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ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: GENERAL INFORMATION AND HISTORY

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

NONE

UNIT ESTIMATED TIME

5 Days*

* *Unit estimated time is not stated as concurrent or complete days. A study of the general information and history of footwear and tire track identification will be performed in conjunction with additional units of instruction and application.*

GOAL

The trainee will acquire a basic knowledge of the general information and history regarding the forensic field of footwear and tire track identification and the acceptance of such evidence in courts of law.

OBJECTIVES

1. The trainee will demonstrate a familiarity with the history and how interest in the use of footwear and tire track evidence has evolved over the years by successfully completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a knowledge of the value of footwear and tire track evidence in criminal investigations by successfully completing a written criterion test with a score of no less than 80%.

LESSON 1 –Historical Background on Use of Footwear and Tire Track Evidence

Estimated Time: 3 Days

Purpose: To acquire a basic knowledge of the history of footwear and tire track identification.

Introduction: A basic knowledge of the history of footwear and tire track evidence will help give the trainee a perspective of what role they will have in the criminal justice system and how the science has progressed to its current state. Footwear and tire track impression identification has progressed from an "aid to investigation" to a science which has been accepted in court as proof positive that a shoe or tire was present at a crime scene.

An understanding of the history of the science will construct a solid foundation for the trainee to build upon as they progress from training and into a career as a footwear and tire track examiner.

Lecture: A Historical Overview of Footwear and Tire Track Examination

Exercise: 1. Read selected sources.

Suggested Readings:

1. Abbott, John R., *Footwear Evidence*, A. c. Germann, Ed., Charles C. Thomas, Springfield, IL, 1964, pp. 8-12.
2. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 1-26, 413-458.
3. Cassidy, Michael J., *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Ontario, 1987, pp. 109-125.
4. Hamm, Ernest D., "Track Identification: An Historical Overview," Journal of Forensic Identification, 39:6 (1989).
5. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL, 1993, pp. 1-14, 147-161.

LESSON 2 – Significant Court Decisions Regarding Footwear and Tire Track Evidence

Estimated Time: 2 Days

Purpose: To acquire a familiarity with court decisions regarding footwear and tire track evidence and the impact those decisions have had on the field being accepted in court as an identification science.

Introduction: Numerous significant court decisions have helped footwear and tire track evidence progress to the accepted identification science it is considered today. It is not necessary for an examiner to become a law expert on court decisions regarding impression evidence; however, a familiarity with some of these opinions will help the trainee understand the importance of the evidence they will be examining.

Lecture: Discussion of Court Decisions Regarding Footwear and Tire Track Evidence

Exercise:

1. Read selected court decisions.

Suggested Readings:

1. People vs. Campbell, 146 ILL. 2d. 363, 586 N.E. 2d 1261 (1992).
2. People vs. Henne, 165 ILL. App. 3d 315, 518 N.E. 2d 1276 (1988).
3. People vs. Robbins, 21 ILL. App. 3d 317, 315 N.E. 2d 198 (1974).
4. People vs. Hanson, 31 ILL. 2d 31, 198 N.E. 2d 815 (1964).
5. People vs. Diaz, 169 ILL. App 3d 66, 522 N.E. 2d 1386 (1988).
6. People vs. Stanberry, 126 ILL. App. 2d 244, 261 N. E. 2d 765 (1970).
7. People vs. Ferguson, 172 ILL. App. 3d 1, 526 N.E. 2d 525 (1988).

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: MANUFACTURING PROCESSES

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

NONE

UNIT ESTIMATED TIME

10 Days*

***** *Unit estimated time is not stated as concurrent or complete days. Training on various manufacturing processes will be performed in conjunction with additional training units of instruction and application. Tours of shoe and tire manufacturing plants will be conducted at a time convenient for the manufacturer and may occur at any time during the training period.*

GOAL

The trainee will acquire a working knowledge of various processes used by shoe and tire manufacturers to assemble their products and how these processes affect class and individualizing characteristics.

OBJECTIVES

1. The trainee will demonstrate a familiarity with the basic footwear outsole and tire construction methods by successfully completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a knowledge of the different types of shoe outsole construction and tire construction and the importance of these processes in the identification process by successfully completing a written criterion test with a score of no less than 80%.

3. The trainee will demonstrate a knowledge of terminology used in various aspects of the footwear and tire manufacturing processes by successfully completing a written criterion test with a score of no less than 80%.

4. The trainee will demonstrate a practical skill in demonstrating how features in footwear outsole and tire tread design are used in the comparison process based upon training coordinator observation and review on a pass/fail basis.

LESSON 1 –Shoe Manufacturing Processes

Estimated Time: 5 Days

Purpose: To acquire a basic working knowledge of the history of the various manufacturing processes involved in producing shoes and how these processes can affect the comparison process.

Introduction: The specific method of manufacture of a pair of shoes may have an influence on the design and size characteristics of those shoes and subsequently be of importance in the comparison process. Class characteristics of outsoles are usually shared by all other shoes from that

manufacturer of that particular size and design. However, depending on the manufacturing process, class characteristic differences can exist even within the same size and design from the same manufacturer. Some methods of manufacture of some types of shoes can create certain features which are unique even before the shoes are worn. Knowledge of these manufacturing processes and the ability to recognize class characteristics and individualizing characteristics generated during the manufacturing process may assist the examiner's ability to identify or eliminate a pair of shoes when compared to an unknown impression.

Lecture: Shoe Manufacturing Processes

Exercise:

1. Tour of shoe manufacturing plant or plants to see various methods of manufacture of shoes.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 1-26, 413-458.

2. Bodziak, William J., "Manufacturing Processes of Athletic Shoe Outsoles and Their Significance in the Examination of Footwear Impression Evidence," Journal of Forensic Sciences, Vol. 31, No. 1, January 1986, pp. 153-176.

3. Cassidy, Michael J., *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Ontario, 1987, pp. 67-89.

4. Hamm, Ernest D., "The Individuality of Class Characteristics in Converse All Star Footwear," Journal of Forensic Identification, 39:5 (1989) 277-292.

5. Music, Doreen K. and William J. Bodziak, "A Forensic Evaluation of the Air Bubbles present in Polyurethane Shoe Outsoles as Applicable in Footwear Impression Comparisons," Journal of Forensic Sciences, 33:5 (1988) pp. 1185-1197.

LESSON 2 – Tire Manufacturing Processes

Estimated Time: 5 Days

Purpose: To acquire a basic working knowledge of the manufacturing processes involved in producing tires and how these processes can affect the comparison process.

Introduction: Although the number of methods of production of tires may not be as many as those for producing shoes, a basic knowledge of the manufacturing process can still aid the examiner in the comparison process. Class characteristics of tires are exhibited by the tire size, width, and tread

design and are usually shared by all tires produced by that manufacturer in that particular size and model. Tires display fewer class characteristic variations that are created by the manufacturing process than shoes and fewer still that make a tire unique before it becomes used. Knowledge of the manufacturing process and the ability to recognize elements of class characteristics can help the examiner identify or eliminate a tire when compared to an unknown impression.

Lecture: Tire Manufacturing Processes

Exercise:

1. Tour of tire manufacturing plant or plants to see methods of manufacture of tires.

Suggested Readings:

1. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL, 1993, pp. 1-36, 67-76, 81-110, 117-124, 171-176.

2. Nause, S/Sgt. Lawren, *Forensic Tire Impression Identification*, Canadian Police Research Center, NRC Publication, 2001; pp. 105-216.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: CLASS AND INDIVIDUALIZING CHARACTERISTICS

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

NONE

UNIT ESTIMATED TIME

10 Days*

* *Unit estimated time is not stated as concurrent or complete days. Discussion and demonstration of class and identifying characteristics will be conducted in conjunction with additional units of instruction on impression development, photography, analysis, comparison, and evaluation exercises.*

GOAL

The trainee will attain the necessary skills to recognize class characteristics and to make a determination of what constitutes identifying (or individual) characteristics of footwear and tire track evidence.

OBJECTIVES

1. The trainee will demonstrate the practical skills required to recognize class characteristics of footwear and tire track evidence upon observation and evaluation by the training coordinator on a pass/fail basis.

2. The trainee will demonstrate the practical skills required to recognize identifying (or individual) characteristics of footwear and tire track evidence upon observation and evaluation by the training coordinator on a pass/fail basis.

LESSON 1 – Class Characteristics

Estimated Time: 3 Days

Purpose: To learn the importance and recognition of class characteristics and to successfully compare class characteristics between known and unknown footwear and tire track impressions.

Introduction: Class characteristics are defined as a feature or a group of features which are common to a group of objects. Class characteristics of footwear and tire track impressions can include such things as the shapes and sizes of elements of the pattern design, the spatial relationship of elements of the pattern design, and the number of elements present in the pattern design. These features serve to include or eliminate known standards as having made evidence impressions. The ability to recognize class characteristics and to successfully compare those features between knowns and unknowns is the first step in the comparison process of footwear and tire track evidence.

Lecture: Class Characteristics

Exercise:

1. Practical exercises in recognition and comparison of class characteristics.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 179-196, 329-335, 357-374, 413-458.

2. Cassidy, Michael J., *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Ontario, 1987, pp. 91-96.

3. Music, Doreen K. and William J. Bodziak, "A Forensic Evaluation of the Air Bubbles in Polyurethane Shoe Outsoles as Applicable in Footwear Impression Comparisons," Journal of Forensic Sciences, 33:5 (1988), pp. 1185-1197.

4. McDonald, Peter, *Tire Imprint Evidence* CRC Press, Inc., Boca Raton, FL, 1993, pp. 1-14, 73-80, 117-124.

LESSON 2 – Individualizing Characteristics

Estimated Time: 7 Days

Purpose: To learn the importance and recognition of individualizing characteristics and their role in the identification process when used to compare known and unknown footwear and tire track impressions.

Introduction: Individualizing characteristics are defined as a feature or group of features which are unique to an individual or specific item. These features are caused by the everyday wear and use of shoes and tires. They can be represented by cuts, tears, holes, wear marks, randomly placed debris, and flaws acquired after the shoe or tire was manufactured. Individualizing characteristics are used to establish similar size, shape, design, and manufacture. Careful observation and recognition is required because some features produced during the manufacturing process, such as air bubbles, can easily be mistaken for individualizing characteristics.

Lecture: Individualizing Characteristics

Exercise:

1. Practical exercises in recognition and comparison of individualizing characteristics.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 1307-328, 335-356.

2. Cassidy, Michael J., *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Ontario, 1987, pp. 96-108.

3. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL, 1993, pp. 21-26, 79-80-134-146.

4. Music, Doreen K. and William J. Bodziak, "A Forensic Evaluation of the Air Bubbles in Polyurethane Shoe Outsoles as Applicable in Footwear Impression Comparisons," Journal of Forensic Sciences, 33:5 (1988), pp. 1185-1197.

5. Nause, S/Sgt. Lawren, *Forensic Tire Impression Identification*, Canadian Police Research Centre, NRC Publication, 2001, pp. 217-252.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: SPECIALIZED PROCESSING TECHNIQUES - CHEMICAL PROCESSING - POROUS

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

FW-IA; LP-IA

UNIT ESTIMATED TIME

16 Days*

* *Unit estimated time is not stated as concurrent or complete days. Impression visualization by chemical processing of porous items will be performed in conjunction with additional units of instruction and application as well as evidence impression analysis, comparison, and evaluation. Trainees who have already completed training in these techniques as part of the training in a different forensic specialty (such as Latent prints) may not need to receive training on some or all of these techniques. Application of these techniques to footwear/tire track evidence will be discussed regardless of the trainee's experience.*

GOAL

The objectives of this unit are to instruct the trainee in approved methods of physical processing of porous evidence items for the development, enhancement, and the preservation of evidence impressions. Upon completion of this training unit, the trainee will have an understanding of all processing protocols currently in use by the ISP Forensic Science Command Footwear/Tire Track section. The trainee will obtain and demonstrate the skills needed for the proper application of these procedures. This will be accomplished through practical exercises to demonstrate the appropriate skills have been obtained and by a final written criterion test covering all processing protocols.

OBJECTIVES

1. The trainee will demonstrate a satisfactory understanding of factors which contribute to the proper selection of chemical processing methods. Evaluation of this understanding will be by completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a working knowledge of the chemical processing techniques, their interdependence, and how they relate to the sequential processing protocol. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

3. The trainee will demonstrate a complete understanding of the general and specialized chemical formulae utilized. Demonstrated competency will be based upon successful preparation of reagents and training coordinator observation and review on a pass/fail basis.

4. The trainee will attain a practical working knowledge of preservation procedures using photography. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

5. The trainee will demonstrate comprehensive knowledge and skills of all processing procedures through practical exercise based upon training coordinator observation and review on a pass/fail basis.

LESSON 1 – Physical Developer

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of physical developer on porous surfaces suspected of containing evidence impressions.

Introduction: Physical developer is a product of British Home Office research and was devised specifically for the examination of wetted or water soaked porous items. This technique utilizes silver nitrate in an unstable ferrous/ferric redox solution in combination with a detergent solution. Physical developer deposits freed silver from the solution on any non-water soluble waxy, oily, or fatty material that may be present in the footwear impression. Physical developer is not affected by prior treatment with and can be used sequentially with iodine fuming, potassium Thiocyanate, or ammonium Thiocyanate. Physical developer is usually used after those methods have been employed.

Physical developer requires special care and exact adherence to procedures. Some glassware and utensils must be dedicated to the technique and reagent contamination must be avoided. Several chemicals must be purchased from sole source vendors due to required purity. In spite of these obstacles, the results often obtained from physical developer can be productive.

Lecture: Impression Visualization Chemical Processing Porous – Physical Developer

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 147-152.

2. Phillips, Clarence E., Douglas, O. Cole and Gary W. Jones, "Physical Developer: A Practical and Productive Latent Print Developer," Journal of Forensic identification, 1990, 40(3):135-147.

Additional Resources:

1. Lee, Henry C. and R. E. Gaensslen, Eds., *Advances in Fingerprint Technology*, Elsevier Science Publishers, NY, 1991.

2. Lennard, Christopher J., and Pierre A. Margo, "Sequencing of Reagents for the Improved Visualization of Latent Fingerprints," Journal of Forensic Identification, September/October 1988, 38(5): 197-210.

LESSON 2 – Zinc Chloride

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of zinc chloride on porous surface suspected of containing evidence impressions.

Introduction: While numerous metal salt solutions will cause a color change of ninhydrin-developed impressions, zinc chloride is selected when laser examination is indicated. Zinc emits a weak but observable fluorescence when illuminated with the 488 nm or 514.5 nm lines from a forensic light source or laser, or when exposed to filtered light from a xenon arc lamp. The best results are obtained using the 488 nm line. Zinc chloride treated ninhydrin-developed impressions when photographed with a Wratten #48 or Wratten #44A may reveal greater detail and contrast than the untreated ninhydrin impression. However, due to the damage potential of the zinc chloride application, suitable ninhydrin-developed impressions are to be treated only after photographic preservation and only when the possibility of increased contrast is essential.

Lecture: Impression Visualization Chemical Processing Porous – Zinc Chloride

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Lee, Henry C., R. E. Gaensslen, Eds., *Advances in Fingerprint Technology*, Second Edition, CRC Press 2001; pp. 130-131, 135, 190, 191, 212.

2. Lennard, Christopher J. and Pierre A. Margo, "Sequencing of Reagents for the Improved Visualization of Latent Fingerprints," Journal of Forensic Identification, September/October 1988, 38(5): 197-210.

3. Herod, D. w., and E. Roland Menzel, "Laser Detection of Latent Fingerprints: Ninhydrin Followed by Zinc Chloride," Journal of Forensic Science, 1982, 27:3, pp. 513-518.

4. Kent, Terry, Ed., *Fingerprint Development Techniques*, Heanor Gate Publisher, Derbyshire, England, 1993.

5. Menzel, E. Roland, Fingerprint Detection with Lasers, Second Edition, Marcel Dekker, NY, 1999; pp. 3, 180, 199.

LESSON 3 – Silver Nitrate

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of silver nitrate on porous surfaces suspected of containing evidence impressions.

Introduction: Silver nitrate reacts with sodium and potassium chloride to form silver chloride, a compound more photosensitive than silver nitrate. This procedure is particularly destructive in both general chemical reaction and the amount of water immersion required. Silver nitrate does not yield consistently high success on porous items, is expensive, and prohibits effective laser examinations and therefore should be avoided when processing routine paper or porous items. Yet with certain surfaces, such as raw or unfinished wood and wax-impregnated papers it is one of the most effective procedures currently available.

Lecture: Impression Visualization Chemical Processing Porous – Silver Nitrate

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William, J., *Footwear Impression Evidence*, Elsevier Science Publishing Co. Inc., New York, New York, p. 146.

2. Abbot, John R., "Reproduction of Footprints," RCMP Quarterly, 1941, 9(2):186-193.

3. Davis, Roger J., Notes on the use of chemical reagents for footwear-mark enhancement, presented at the Florida Department of Law Enforcement Seminar on Footwear Impression Evidence, Tallahassee, FL, 1988.

4. Davis, Roger, J., "A Systematic Approach to the Enhancement of Footwear marks," Canadian Society Forensic Science Journal, 1988, 21(3):98-105.

5. Keedwell, E., J. Birkett and R. J. Davis, "Chemical Methods for the Enhancement of Footwear Marks," Metropolitan Forensic Science Laboratory Report, January, 1988.

6. Loveridge, F. H., "Shoe Print Development by Silver Nitrate," Fingerprint Whorld, 1984, 10(38):58.

Additional Resources:

1. Lee, Henry C., R. E. Gaensslen, Eds., *Advances in Fingerprint Technology*, Elsevier Science Publishers, NY, 1991.

2. Kent, Terry, Ed., *Fingerprint Development Techniques*, Heanor Gate Publisher, Derbyshire, England, 1993.

3. Olson, Robert, *Scott's Fingerprint Mechanics*, Charles C. Thomas Publisher, Springfield, IL, 1978.

LESSON 4 – Potassium Thiocyanate

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of potassium thiocyanate on porous surfaces suspect of containing evidence impressions.

Introduction: Iron is sometimes present in the residue of footwear/tire track impressions, particularly if these impressions resulted from soil on the shoes/tires. Iron will react with thiocyanate ions in an acid solution. This procedure works well for wet residue impressions and muddy impressions.

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations ad they appear in Footwear/Tire Track Procedures Manual.

3. Demonstrate the correct use of all instruments involved with this procedure including equipment used in the appropriated preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., "Footwear Impression Evidence: Detection, Recovery, and Examination,´2nd Edition, CRC Press LLC, Boca Raton, FL, 200, pp. 145-147.

LESSON 5 – Ammonium Thiocyanate

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of ammonium Thiocyanate on porous surfaces suspected of containing evidence impressions.

Introduction: Iron is sometimes present in the residue of footwear/tire track impressions, particularly if these impressions resulted from soil on the shoes/tires. Iron will react with thiocyanate ions in an acid solution. This procedure works well for wet residue impressions and muddy impressions.

In some instances, the ammonium thiocyanate application has been found to be more sensitive and produce better enhancement than potassium thiocyanate.

Lecture: Impression Visualization Chemical Processing Porous – Ammonium Thiocyanate

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instruments involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection*, Recovery, and Examination," 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 145-147.

LESSON 6 – Ninhydrin

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of ninhydrin on porous surfaces suspected of containing evidence impressions.

Introduction: Ninhydrin, or triketo-hydrindene hydrate, is an extremely sensitive indicator of alpha-amino acids, proteins, peptides, and polypeptides. The reaction produces a violet to blue-violet coloring of these substances and is effective with older deposits with even minute amounts of amino acids. While ninhydrin can be used on any surface, normally processing is confined to porous items which have not subsequently become water-soaked or do not contain inherent animal proteins.

Lecture: Impression Visualization Chemical Processing Porous – Ninhydrin

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instruments involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., Footwear Impression Evidence: Detection, Recovery, and Examination," 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 145-147.

2. Lee, Henry C. and R. E. Gaensslen, Eds., *Advances in Fingerprint Technology*, Second Edition, CRC Press, 2001; pp 38, 107, 127-131, 177-180, 184, 186, 187, 188-189, 243.

LESSON 7 – 8-Hydroxyquinoline

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of 8-Hydroxyquinoline on porous surfaces suspected of containing evidence impressions.

Introduction: 8-Hydroxyquinoline reacts with various metal ions that may be present in small amounts in evidence impressions. The reaction causes fluorescence which is detectable under ultraviolet light. Sometimes, the evidence impression may not contain reactive metal ions, but the substrate does.

In this instance, the evidence impression will be present as a dark impression on a fluorescing background. However, if both the evidence impression and the substrate have a chemical composition which

fluoresces, enhancement results may be interfered with. This procedure works well for the enhancement of impressions made by either wet or dry residue as long as the residue contains the reactive metal ions.

Lecture: Impression Visualization Chemical Processing Porous - 8-Hydroxyquinoline

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instruments involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection*, Recovery, and Examination," 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 157-158.

LESSON 8 – 7,8-Benzoflavone

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of 7,8-benzoflavone to porous surfaces previously processed with iodine and to attain the necessary skill for the preservation of detected evidence impressions.

Introduction: Iodine fuming of oily material may produce faint or incomplete reactions due to the age of the evidence impression. Additional exposure to iodine may fail to intensify such reactions. 7,8-benzoflavone acts as a catalyst which bonds iodine to the detected oily matter and effects a color change from reddish brown to an intense blue-black. Often, added detail is revealed and previously visible impressions are more distinct. The addition of 7,8-benzoflavone negates the transitory characteristics of iodine-developed impressions and is a fixing technique, bonding the iodine to the substrate. It also allows for subsequent processing with ninhydrin, zinc chloride and/or physical developer.

Lecture: Processing Porous/Nonporous – 7,8-Benzoflavone

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.

2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 141-143.

2. Davis, Roger J., Notes on the use of chemical reagents for footwear-mark enhancement. Presented at the Florida Department of Law Enforcement Seminar on Footwear Impression Evidence, Tallahassee, FL, 1988.

3. Davis, Roger J., "A Systematic Approach to the Enhancement of Footwear Marks," Canadian Society Forensic Science Journal, 21(3):98-105, 1988.

4. Keedwell, E., J. Birkett and R. J. Davis, "Chemical Methods for the Enhancement of Footwear Marks," Metropolitan Forensic Science Laboratory Report, January, 1988.

5. Lee, Henry, C. and R. E. Gaensslen, Eds., *Advances In Fingerprint Technology*, Second Edition, CRC Press, 2001, pp.116-117.

Additional Resources:

1. Lennard, C. J. and P. A. Margot, "Sequencing of Reagents for the Improved Visualization of Latent Fingerprints," Journal of Forensic Identification, 38 (5), September/October 1988, pp. 197-210.

2. Mashiko, K. and M. Ishizaki, "Latent Fingerprint Processing iodine 7,8-Benzoflavone Method," Identification News, November 1977, pp. 3-5.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: SPECIALIZED PROCESSING TECHNIQUES - PHYSICAL PROCESSING - NONPOROUS

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

FW-IIA; LP-IIA

UNIT ESTIMATED TIME

8 Days*

* *Unit estimated time is not stated as concurrent or complete days. Impression visualization by physical processing of nonporous items will be performed in conjunction with additional units of instruction and application as well as evidence impression analysis, comparison, and evaluation. Trainees who have already completed training in these techniques as part of the training in a different forensic specialty (such as Latent Prints) may not need to receive training on some or all of these techniques. Application of these techniques to footwear/tire track evidence will be discussed regardless of the trainee's experience.*

GOAL

The objectives of this unit are to instruct the trainee in approved methods of physical processing of nonporous evidence items for the development, enhancement, and the preservation of evidence impressions. Upon completion of this training unit, the trainee will have an understanding of all processing protocols currently in use by the ISP Forensic Science Command Footwear/Tire Track section. The trainee will obtain and demonstrate the skills needed for the proper application of these procedures. This will be accomplished through practical exercises to demonstrate the appropriate skills have been obtained and by a final written criterion test covering all processing protocols.

OBJECTIVES

1. The trainee will demonstrate a satisfactory understanding of factors which contribute to the proper selection of physical processing methods. Evaluation of this understanding will be by completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a working knowledge of the physical processing techniques, their interdependence, and how they relate to the sequential processing protocol. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

3. The trainee will demonstrate a complete understanding of the general and specialized chemical formulae utilized. Demonstrated competency will be based upon successful preparation of reagents and training coordinator observation and review on a pass/fail basis.

4. The trainee will attain a practical working knowledge of preservation procedures using photography. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

5. The trainee will demonstrate comprehensive knowledge and skills of all processing procedures through practical exercise based upon training coordinator observation and review on a pass/fail basis.

LESSON 1 – Powders and Particulates

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of powders and particulates on nonporous surfaces suspected of containing evidence impressions.

Introduction: Fingerprint powders and particulate developers are very fine particles with an affinity for moisture throughout a wide range of viscosity. Grease, oil, and most contaminants that coat the surface of footwear or tires possess sufficient moisture and viscosity to attract and bind the fine particles together. Contact between footwear or tires and a nonporous surface will sometimes result in a transfer of the coating to that surface. The non-absorbency of the surface prevents penetration by the deposited moisture. All fingerprint powders and particulate developers are indiscriminate in adhesion to moisture. Surfaces coated with residue in addition to suspected evidence impressions will attract powders and particulate developers throughout the surface.

Dependent upon the composition of the residue, the deposited moisture will range from a most apparent appearance to the barely perceptible or invisible, even under oblique lighting. Powder or particulate application is the effort to produce or improve the appearance for preservation.

The most effective agent in terms of adherence to moisture, non-adherence to dry surfaces, particle size, shape, uniformity, and intensity of color is carbon. Carbon is black, and as a result, black powders and particulate developers which contain carbon will consistently produce the best results. Other colored powders and particulate developers may be required due to the substrate encountered, but should be restricted to absolute necessity.

Magnetic powders are powder-coated, fine iron filings subject to magnetic attraction. These adhere to moisture to a lesser degree than carbon powders, but can be applied with less destructive force to the surface.

Most commercial black fingerprint powders have a high carbon base. According to the manufacturer's particular formula and production methods, the carbon base may be from a variety of sources, including lamp black, bone, or wood charcoal. Ground carbon alone cannot match the adhesion ability of fine particle carbon soot, but commercial powders contain milled carbon of highly uniform size and shape along with additional ingredients to preserve the milled condition and retard air moisture absorption.

Lecture: Impression Visualization Physical Processing Nonporous – Powders and Particulates

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., Footwear Impression Evidence: Detection, Recovery, and Examination, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 147-152.

Additional Resources:

1. Lee, Henry C. and R. E. Gaensslen, Eds., Advances in Fingerprint Technology, Second Edition, CRC Press, 2001; pp. 38, 107, 108-113.
2. Olson, Robert, Scott's Fingerprint Mechanics, Charles C. Thomas Publisher, Springfield, IL, 1978.

LESSON 2 – Small Particle Reagent

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of small particle reagent on nonporous surfaces suspected of containing evidence impressions.

Introduction: Small particle reagent (SPR) was devised and refined by the British Home Office as an effective procedure for processing wet surfaces. Surfaces, both porous and nonporous, which are wet at the time of an evidence impression deposit or become wet after deposit, seldom retain sufficient water soluble material for conventional processing methods. Nonporous items which have been allowed to dry offer some potential if the deposit contains non-water soluble oily matter, but the drying process lessens the possibility of adequate adhesion for powders or particulates.

Molybdenum disulfide is a lipid-sensitive reagent. Initial efforts to create a suspension of molybdenum disulfide in water used photoflo as a means of reducing surface tension. These met with limited success. Introduction of photoflo to the mixture requires a critical measurement as too much photoflo prevents complete adhesion of the molybdenum disulfide particles to the lipids. Organic solvents can not be used as these solvents may remove the lipid material.

Refinements in the surfactant solution have not only improved the uniformity of suspension but have increased the application of SPR to other surfaces. SPR is very effective in the secondary treatment of cyanoacrylate ester developed impressions by adhering to faint impressions generally better than powders and particulates. Molybdenum disulfide is produced in various particle sizes. Smaller particle size is more effective and Lightning Powder Company provides the proper particle size.

Lecture: Impression Visualization Physical Processing Nonporous – Small Particle Reagent

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Davis, Roger J., Notes on the use of chemical reagents for footwear-mark enhancement, presented at the Florida Department of Law Enforcement Seminar on Footwear Impression Evidence, Tallahassee, FL, 1988.

2. Davis, Roger, J., "A Systematic Approach to the Enhancement of Footwear marks," Canadian Society Forensic Science Journal, 1988, 21(3):98-105.

3. Keedwell, E., J. Birkett and R. J. Davis, "Chemical Methods for the Enhancement of Footwear Marks," Metropolitan Forensic Science Laboratory Report, January, 1988.

Additional Resources:

1. Lee, Henry C., R. E. Gaensslen, Eds., Advances in Fingerprint Technology, Second Edition, CRC Press, 2001: pp.38, 113-115.

2. Onstwedder, John III and Thomas E. Gamboe, Jr., "Small Particle Reagent: Developing Latent Prints on Water-Soaked Firearms and Effect on Firearms Analysis," Journal of Forensic Sciences, 1989, 34(2):321-327.

3. Pounds, C. A. and R. J. Jones, "Physiochemical Techniques in the Development of Latent Fingerprints," Trends in Analytical Chemistry, 1983, 2(8):180-183.

LESSON 3 – Cyanoacrylate Ester Fuming

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of cyanoacrylate esters on nonporous surfaces suspected of containing evidence impressions.

Introduction: Cyanoacrylate esters are the active ingredients in super bond adhesives and are generally available according to the type of alcohols used in manufacturing. Most cyanoacrylates are methyl or ethyl esters. Regardless of type, the esters volatilize into long chain molecules with a positive electrical charge. In an atmosphere of relatively high humidity, the cyanoacrylate ester molecules are attracted to oily residue and polymerize upon the deposit.

Properties of the polymer are dependent upon the type of cyanoacrylate ester used. Both ethyl and methyl esters produce a visible white coating. Ethyl ester polymers are softer and less durable while methyl ester polymers can usually only be removed with solvents. However, the durable, hard property of the methyl ester appears to inhibit dye applications, especially with Rhodamine 6G.

Locktite products contain a cyanoacrylate ethyl ester and have proved to be quite effective for fuming. Locktite 495 Super Bonder provides a liquid useful for heat acceleration techniques while Hard Evidence is a gel which reacts to exposure to air. Any product containing ethyl ester generally will be more effective when subsequent laser dye applications are indicated. Cyanoacrylate ester fuming is highly effective with nonporous items.

Lecture: Impression Visualization Physical Processing Nonporous – Cyanoacrylate Ester Fuming

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., Footwear Impression Evidence: Detection, Recovery, and Examination, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 158-159.

2. Cushman, Barry, Q. and Neal J. Simmons, "A Cyanoacrylate Fuming Method for the Development of Footwear Impressions," Journal of Forensic Identification, 46:4, 1996.

3. Paine, Noel, "Use of Cyanoacrylate Fuming and Related Enhancement Techniques to Develop Shoe Impressions on Various Surfaces," Journal of Forensic Identification, 48:5, 1998.

Additional Resources:

1. Lee, Henry C., R. E. Gaensslen, Eds., "Cyanoacrylate Fuming," Identification News, 1984, 34(3):8-14.

2. Lee, Henry C., R. E. Gaensslen, Eds., Advances in Fingerprint Technology, Second Edition, CRC Press, 2001: pp. 38, 91-92, 117-125, 212.

3. Lennard, Christopher J. and Pierce A. Margot, "Sequencing of Reagents for the Improved Visualization of Latent Fingerprints," Journal of Forensic Identification, September/October 1988, 38(5):197-210.

LESSON 4 – Gelatin Lifting

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of gelatin lifters on nonporous surfaces containing evidence impressions.

Introduction: Gelatin lifters permit the lifting of some evidence impressions when the electrostatic lifter is unavailable or is unsuccessful. Gelatin lifters are relatively thick and come in clear, black, or white gelatin on cloth, plastic, or canvas backing with a clear plastic cover sheet. Gelatin lifters can be used on both porous and nonporous surfaces for lifting original impressions or those that have been dusted with powder. If the electrostatic lifter is available, it should be used prior to the gelatin lifter.

Lecture: Impression Visualization Physical Processing Nonporous – Gelatin Lifters

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations ad they appear in Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct use of all instruments involved with this procedure including equipment used in the appropriated preservation of all developed evidence impressions.

Suggested Readings:

1. Abbott, John R., "Reproduction of Footprints," RCMP Quarterly, 9(2):186-193, 1941.

2. Bodziak, William J., "Footwear Impression Evidence: Detection, Recovery, and Examination,´2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 16, 24, 116-119, 121-122, 296.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: SPECIALIZED PROCESSING TECHNIQUES - CHEMICAL PROCESSING - NONPOROUS

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

FW-IIB; LP-IIB

UNIT ESTIMATED TIME

4 Days*

* *Unit estimated time is not stated as concurrent or complete days. Impression visualization by chemical processing of nonporous items will be performed in conjunction with additional units of instruction and application as well as evidence impression analysis, comparison, and evaluation. Trainees who have already completed training in these techniques as part of the training in a different forensic specialty (such as Latent Prints) may not need to receive training on some or all of these techniques. Application of these techniques to footwear/tire track evidence will be discussed regardless of the trainee's experience.*

GOAL

The objectives of this unit are to instruct the trainee in approved methods of chemical processing of nonporous evidence items for the development, enhancement, and the preservation of evidence impressions. Upon completion of this training unit, the trainee will have an understanding of all processing protocols currently in use by the ISP Forensic Science Command Footwear/Tire Track section. The trainee will obtain and demonstrate the skills needed for the proper application of these procedures. This will be accomplished through practical exercises to demonstrate the appropriate skills have been obtained and by a final written criterion test covering all processing protocols.

OBJECTIVES

1. The trainee will demonstrate a satisfactory understanding of factors which contribute to the proper selection of chemical processing methods. Evaluation of this understanding will be by completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a working knowledge of the chemical processing techniques, their interdependence, and how they relate to the sequential processing protocol. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

3. The trainee will demonstrate a complete understanding of the general and specialized chemical formulae utilized. Demonstrated competency will be based upon successful preparation of reagents and training coordinator observation and review on a pass/fail basis.

4. The trainee will attain a practical working knowledge of preservation procedures using photography. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

5. The trainee will demonstrate comprehensive knowledge and skills of all processing procedures through practical exercise based upon training coordinator observation and review on a pass/fail basis.

LESSON 1 – Ardrox

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of ardrox on nonporous surfaces suspected of containing evidence impressions.

Introduction: Ardrox P133D is an industrial penetrant manufactured by Ardrox, Limited, of Canada, as 970-P10, and available in the United State from Radiatronics, Incorporated, of Overland Park, Kansas. The stain was developed to detect small fractures in construction materials and possesses certain properties that can be successfully utilized in latent print processing, and can be used similarly on footwear and tire track impressions. Ardrox P133D readily penetrates and remains in minute openings, yet is easily rinsed from surrounding surfaces, and is highly luminescent with long wave, ultra violet light excitation.

Ardrox P133D staining was developed as a means of enhancing cyanoacrylate ester polymerized impressions. The properties of Ardrox are highly complementary to the cyanoacrylate ester process, and may yield results that equal or surpass those of the Rhodamine 6G procedure. However, instances have occurred when Rhodamine 6G revealed impression that were not stained by Ardrox P133D with UV excitation. This lack of consistency currently delegates Ardrox P133D as an additional processing technique, not as a replacement for dye and laser examination.

Ardrox P133D is also luminescent with blue laser or 470 nm xenon arc illumination. The effectiveness of Ardrox P133D and UV excitation may justify the omission of dye and laser examination on a case by case basis when the laser is unavailable. However, since the two procedures are compatible, use of Ardrox staining as an additional technique to be utilized in conjunction with the laser dyes, whenever possible, is recommended.

Lecture: Impression Visualization Chemical Processing Nonporous – Ardrox

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. McCarthy, Mary M., "Evaluation of Ardrox as a Luminescent Stain for Cyanoacrylate Processed Latent Impressions," Journal of forensic Identification, 1990, 40(2):75-80.

2. Gamboe, Melissa and Lisa O'Daniel, "Substitute for Freon-Ardrox Formula," Journal of Forensic Identification, 1999, 49(2):134-141.

3. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 158-159.

4. Cushmann, Barry Q. and Neal J. Simmons, "A Cyanoacrylate Fuming Method for the Development of Footwear Impressions," Journal of Forensic Identification, 46:6, 1996.

LESSON 2 – Rhodamine 6G

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of Rhodamine 6G on nonporous surfaces suspected of containing evidence impressions.

Introduction: Rhodamine 6G, like ardrox and zinc chloride, is a supplemental processing procedure designed to enhance faint or indistinct evidence impressions developed by another technique. Rhodamine 6G is used after cyanoacrylate ester fuming. Rhodamine 6G has an affinity for adhesion to polymerized impressions even at levels below visual observation. Excitation of Rhodamine6G with the 488 nm, 510 nm, or 514.5 nm lines of the laser produces extremely bright fluorescence at about 550 nm.

Lecture: Impression Visualization Chemical Processing Nonporous – Rhodamine 6G

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Masters, Nancy E., "Rhodamine 6G: Taming the Beast," Journal of Forensic Identification, September, October 1990, 40(5):265-270.

2. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 158-159.

3. Cushmann, Barry Q. and Neal J. Simmons, "A Cyanoacrylate Fuming Method for the Development of Footwear Impressions," Journal of Forensic Identification, 46:6, 1996.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: SPECIALIZED PROCESSING TECHNIQUES - NONDESTRUCTIVE – POROUS/NONPOROUS

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

FW-IIIA; LP-IIIA

UNIT ESTIMATED TIME

6 Days*

* *Unit estimated time is not stated as concurrent or complete days. Impression visualization by chemical processing of nonporous items will be performed in conjunction with additional units of instruction and application as well as evidence impression analysis, comparison, and evaluation. Trainees who have already completed training in these techniques as part of the training in a different forensic specialty (such as Latent Prints) may not need to receive training on some or all of these techniques. Application of these techniques to footwear/tire track evidence will be discussed regardless of the trainee's experience.*

GOAL

The objectives of this unit are to instruct the trainee in approved methods of nondestructive evidence processing for the development of evidence impressions and the preservation of developed evidence impressions on both porous and nonporous items. Upon completion of this training unit, the trainee will have an understanding of all processing protocols currently in use by the ISP Forensic Science Command Footwear/Tire Track section. The trainee will obtain and demonstrate the skills needed for the proper application of these procedures. This will be accomplished through practical exercises to demonstrate the appropriate skills have been obtained and by a final written criterion test covering all processing protocols.

OBJECTIVES

1. The trainee will demonstrate a satisfactory understanding of factors which contribute to the proper selection of nondestructive processing methods for porous and nonporous items including procedures for specialized circumstances. Evaluation of this understanding will be by completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a working knowledge of the processing procedures, their interdependence, and how they relate to the sequential processing protocol. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

3. The trainee will demonstrate a complete understanding of all aspects of the process including an understanding of any chemical or physical elements involved. Demonstrated competency will be based upon successful preparation of reagents and training coordinator observation and review on a pass/fail basis.

4. The trainee will attain a practical working knowledge of preservation procedures using photography. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

5. The trainee will demonstrate comprehensive knowledge and skills of all processing procedures for porous and nonporous substrates through practical exercise subject to

training coordinator observation and review on a pass/fail basis.

LESSON 1 – Inherent Luminescence

Estimated Time: 3 Days

Purpose: To attain the necessary skills to conduct a nondestructive examination of evidence using inherent luminescence and to attain proficiency in the preservation of luminescent evidence impressions.

Introduction: The use of lasers and alternate/forensic light sources in conjunction with various chemical techniques and dyes have proven very effective in visualizing evidence impressions. Substances found in evidence impression residue may luminesce when illuminated by the proper wavelength of light and viewed with the appropriate filters. Various contaminants may become part of evidence impression residue and may inherently luminesce as well. Additionally, certain materials such as Styrofoam and galvanized or zinc plated metal are observed to consistently produce impression that will luminesce without the application of chemical processing or dyes. This inherent luminesce allows for examination of items that may be altered or destroyed by other procedures.

Lecture: Nondestructive Processing Porous/Nonporous – Inherent Luminescence

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Demonstrate the process on a variety of porous and nonporous substrates that might be encountered in casework. This includes any variations as they appear in the Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 135-140.

LESSON 2 – Iodine Fuming

Estimated Time: 3 Days

Purpose: To attain the skills necessary for effective application of iodine to porous and nonporous surfaces and to attain proficiency in the preservation of iodine detected evidence impressions.

Introduction: Iodine is a sensitive indicator of various waxes and oils which are often present in evidence impression residue. Iodine is absorbed by the oily material which assumes a reddish-brown color. While absorption is quite

rapid and can be most pronounced, no chemical change occurs to either substance. When exposure to the iodine ceases, the oily material release the iodine molecules slowly. The color begins to fade and after several hours, the iodine may be completely dissipated. Return exposure will most often repeat the process while maintained exposure prevents dissipation. Generally iodine dissipates with no trace of exposure or damage to the article. Iodine is a good procedure to use on evidence impressions of wet origin and, if used, should be done before physical developer.

Iodine is effective with relatively fresh oily deposits, but for those older than two weeks, the reaction may not occur or be too faint for recognition. A chemical breakdown of the oily material appears to inhibit absorption. Iodine is normally not destructive and may detect deposits with insufficient amino acids for effective ninhydrin reaction. The application of 7,8-benzoflavone may be used to intensify weak iodine discolorations of impression residue, however, the use of 7,8-benzoflavone may be destructive and remain on an item.

Iodine is toxic and very corrosive to nearly all metals. It can be used to process nearly all types of surfaces, but is normally used with porous items.

Lecture: Nondestructive Processing Porous/Nonporous – Iodine Fuming

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 159-160.

2. Davis, Roger J., Notes on the use of chemical reagents for footwear-mark enhancement. Presented at the Florida Department of Law Enforcement Seminar on Footwear Impression Evidence, Tallahassee, FL, 1988.

3. Davis, Roger J., "A Systematic Approach to the Enhancement of Footwear Marks," Canadian Society Forensic Science Journal, 21(3):98-105, 1988.

4. Keedwell, E., J. Birkett and R. J. Davis, "Chemical Methods for the Enhancement of Footwear Marks," Metropolitan Forensic Science Laboratory Report, January, 1988.

Additional Resources:

1. Cowger, James F., *Friction Ridge Skin Comparison and Identification of Fingerprints*, CRC Press, Boca Raton, FL, 1993.

2. Lee, H. C. and R. E. Gaensslen, Eds., *Advances in Fingerprint Technology*, Second Edition, CRC Press, 2001; pp. 69-70, 73, 107, 115-117, 186.

3. Kent, T., Ed., *Fingerprint Development Techniques*, Heanor Gate Publisher, Derbyshire, England, 1993.

4. Olson, R. D., Sr., *Scott's Fingerprint Mechanics*, Charles C. Thomas Publisher, Springfield, IL, 1978.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: SPECIALIZED PROCESSING TECHNIQUES - BLOOD PROTEIN ENHANCEMENT - POROUS/NONPOROUS

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

FW-IIIB; LP-IIIB

UNIT ESTIMATED TIME

16 Days*

* *Unit estimated time is not stated as concurrent or complete days. Blood protein evidence impression enhancement will be performed in conjunction with additional units of instruction and application as well as evidence impression analysis, comparison, and evaluation. Trainees who have already completed training in these techniques as part of the training in a different forensic specialty (such as Latent Prints) may not need to receive training on some or all of these techniques. Application of these techniques to footwear/tire track evidence will be discussed regardless of the trainee's experience.*

GOAL

The objectives of this unit are to instruct the trainee in approved methods of evidence processing for the development and preservation of blood protein evidence impressions on porous and nonporous items. Upon completion of this training unit, the trainee will have an understanding of all processing protocols currently in use by the ISP Forensic Sciences Command Footwear/Tire Track Section. The trainee will obtain and demonstrate the skills needed for the proper application of these procedures. This will be accomplished through practical exercises to demonstrate the appropriate skills have been obtained and by a final written criterion test covering all processing protocols.

OBJECTIVES

1. The trainee will demonstrate a satisfactory understanding of factors which contribute to the proper selection of blood enhancement processing methods for porous and nonporous items including procedures for specialized circumstances. Evaluation of this understanding will be by completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a working knowledge of the chemical processing procedures, their interdependence, and how they relate to the sequential processing protocol. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

3. The trainee will demonstrate a complete understanding of the general and specialized chemical formulae utilized. Demonstrated competency will be based upon successful preparation of reagents and training coordinator observation and review on a pass/fail basis.

4. The trainee will attain a practical working knowledge of preservation procedures using photography. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

LESSON 1 – Ninhydrin

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of ninhydrin on porous and nonporous surfaces suspected of containing evidence impressions in blood protein.

Introduction: Ninhydrin is a protein indicator which reacts with amino acids. Ninhydrin is also sensitive to the proteins present in blood. Ninhydrin can be used on any surface, but should primarily be used on porous items. Nonporous items are in most instances better processed by using one of the other blood protein enhancement techniques. A positive reaction produces a violet to blue-violet coloring and is effective with even minute amounts of blood.

Lecture: Blood Protein Enhancement Porous/Nonporous – Ninhydrin

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Demonstrate the process on a variety of porous and nonporous substrates that might be encountered in casework. This includes any variations as they appear in the Footwear/Tire Track Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous and nonporous substrates containing potential blood protein that might be encountered in casework and use each of the previously prepared chemical preparations. All application procedures will be demonstrated including any variations as they appear in the Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, p. 169.

2. Lee, H. C. and R. E. Gaensslen, Eds., *Advances in Fingerprint Technology*, Second Edition, CRC Press, 2001; pp. 38, 107, 127-131, 177-180, 184, 186-189, 243.

LESSON 2 – Amido Black

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of amido black on porous and nonporous surfaces suspected of containing evidence impressions in blood protein.

Introduction: Amido black or naphthalene black 10B is a protein indicator particularly sensitive to those proteins present in blood. While other procedures for the enhancement of blood impressions are available, they may pose serious health hazards or display a reaction for short durations. Amido black is a safer, permanent procedure which can be used on porous or nonporous surfaces. Amido black does prevent subsequent serological examination and therefore may only be used after serological examination of the evidence. However, amido black can be applied after cyanoacrylate fuming in many cases.

Lecture: Blood Protein Enhancement Porous/Nonporous – Amido Black

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 165-168.

2. Lee, H. C. and R. E. Gaensslen, Eds., *Advances in Fingerprint Technology*, Second Edition, CRC Press, 2001; pp. 38, 92, 143-144.

Additional Resources:

1. McCarthy, M. M. and D. L. Grieve, "Preprocessing with Cyanoacrylate Ester Fuming for Fingerprint Impressions in Blood," Journal of Forensic Identification, 1989, 39(1):23.

LESSON 3 – Coomassie Staining Solution

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of Coomassie staining solution to porous and nonporous surfaces which may contain evidence impressions in blood protein.

Introduction: Coomassie Brilliant Blue R250 is a protein stain which is sensitive to the proteins in blood. Coomassie may be used to enhance blood impressions on porous or nonporous items. Blood impressions do not require heat fixing of

the proteins although residue must be dry prior to application. No serological analysis can be conducted after the staining procedure; however, Coomassie Brilliant Blue R250 can be applied after cyanoacrylate fuming in many cases.

Lecture: Blood Protein Enhancement Porous/Nonporous – Coomassie Staining Solution

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Davis, Roger J., "A Systematic Approach to the Enhancement of Footwear Marks," Canadian Society Forensic Science Journal, 21(3):98-105, 1988.

2. Lee, H. C. and R. E. Gaensslen, Eds., *Advances in Fingerprint Technology*, Second Edition, CRC Press, 2001, pp. 144-145, 147.

Additional Resources:

1. McCarthy, M. M. and D. L. Grieve, "Preprocessing with Cyanoacrylate Ester Fuming for Fingerprint Impressions in Blood," Journal of Forensic Identification, 1989, 39(1):23.

2. Norkus, P. and K. Noppinger, "New Reagent for the Enhancement of Blood Prints," Identification News, 1986, 26(4):5.

LESSON 4 – Crowle's Staining Solution

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of Crowle's Staining Solution to porous and nonporous surfaces which may contain evidence impressions in blood protein.

Introduction: Crowle's staining solution is a protein indicator which reacts with the proteins in blood. It can be used for enhancement of blood prints on both porous and nonporous items. Crowle's solution is similar in reaction to Coomassie but contains no organic solvents. No serological analysis can be conducted after the staining procedure. However, Crowle's staining

solution can be applied after cyanoacrylate fuming in many cases.

Lecture: Blood Protein Enhancement Porous/Nonporous – Crowle's Staining Solution

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, p. 169.

2. Davis, Roger J., "A Systematic Approach to the Enhancement of Footwear Marks," Canadian Society Forensic Science Journal, 21(3):98-105, 1988.

Additional Resources:

1. Lee, H. C. and R. E. Gaensslen, Eds., *Advances in Fingerprint Technology*, Second Edition, CRC Press, 2001, p. 145.

2. McCarthy, M. M. and D. L. Grieve, "Preprocessing with Cyanoacrylate Ester Fuming for Fingerprint Impressions in Blood," Journal of Forensic Identification, 1989, 39(1):23.

3. Norkus, P. and K. Noppinger, "New Reagent for the Enhancement of Blood Prints," Identification News, 1986, 26(4):5.

LESSON 5 – Luminol

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of Luminol to porous and nonporous surfaces which may contain evidence impressions in blood.

Introduction: Luminol is a presumptive test for blood to help locate bloodstains. It can also be used to enhance evidence impressions in blood. The luminol reaction produces light instead of a color change. This is advantageous when the background or substrate interfere with other chemical enhancement techniques. The disadvantage is that luminol must be applied in total darkness. Since luminol is a water-based solution and blood is water soluble, this treatment may be destructive. All other blood

enhancement techniques should be considered before using luminol. Luminol must be prepared each time its use is desired as it has a very short workability life span. This technique may be considered for detection only of faint blood impressions and when actual enhancement done by another blood enhancement techniques would not work as well.

Lecture: Blood Protein Enhancement Porous/Nonporous – Luminol

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 169-173; 414.

LESSON 6 – Leuco Crystal Violet

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of Diaminobenzidine to porous and nonporous surfaces which may contain evidence impressions in blood.

Introduction: Leuco crystal violet is a clear solution which produces a dark violet color when it comes into contact with even faint traces of blood. This violet colored dye occurs through the catalyzed oxidation by peroxide when leuco crystal violet and hydrogen peroxide come into contact with hemoglobin or its derivatives. Since leuco crystal violet has an affinity for proteinaceous substrates, it will bind to the protein that has been fixed by 5-sulfosalicylic acid. This fixing limits leaching or running of the impression. Leuco crystal violet is capable of enhancing visible impressions an can readily develop undetected blood impressions. Impressions treated with leuco crystal violet will both fluoresce and luminesce under a variety of wavelengths in both the ultraviolet and infra-red spectra.

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.

2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 160-162.

LESSON 7 – Diaminobenzidine (DAB)

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of Diaminobenzidine to porous and nonporous surfaces which may contain evidence impressions in blood.

Introduction: Diaminobenzidine (DAB) (also called 3,3' diaminobenzidine tetra hydrochloride) is very useful for enhancement of blood impressions on both porous and nonporous substrates. DAB has the particular advantage of rarely reacting with the background material. DAB is converted into a dark brown insoluble product in the presence of hydrogen peroxide. The peroxidase activity of hemoglobin in blood produces the reaction, that is why DAB rarely reacts with the substrate. DAB can not be mixed with the fixative (5-sulfosalicylic acid), so the fixative must be applied first, then the DAB can be applied. Cyanoacrylate ester fuming is detrimental to DAB processing and DAB processing must be done before amido black, leuco crystal violet, or luminol processing.

Lecture: Blood Protein Enhancement Porous/Nonporous – Diaminobenzidine

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in Footwear/Tire Track Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 164-165.

LESSON 8 – 2,2'-Azino-Di-[3-Ethylbenzthiazolinesulfonate(6)] Diamonium Salt (ABTS)

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of ABTS to porous and nonporous surfaces which may contain evidence impressions in blood protein.

Introduction: 2,2'-Azino-Di-[3-Ethylbenzthiazolinesulfonate(6)] Diamonium Salt (ABTS) is an effective and safe noncarcinogenic alternative to diaminobenzidine (DAB) for the development of impressions in blood. ABTS is especially effective on porous surfaces. ABTS produces a bright green color when oxidized and may provide an advantage over DAB on dark colored surfaces. As with DAB ABTS rarely reacts with the substrate because the peroxidase activity of hemoglobin in blood produces the reaction. ABTS processing is also similar to DAB in that the fixative (5-sulfosalicylic acid) is applied separately and ABTS processing must be done before amido black, leuco crystal violet, luminol, or cyanoacrylate ester fuming are performed. ABTS can be used after ninhydrin treatment; however, the reverse is not true.

Lecture: Blood Protein Enhancement Porous/Nonporous – ABTS

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure including any variations as they appear in Footwear/Tire Track Procedure Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations
3. as they appear in Footwear/Tire Track Procedures Manual.
   Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed evidence impressions.

Suggested Readings:

1. Caldwell, Jonathan P., William Henderson and Nicholas Kim, "ABTS: A Safe Alternative to DAB for the Enhancement of Blood Fingerprints," Journal of Forensic Sciences, Vol. 45, No. 4, July 2000.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: TEST IMPRESSION METHODS

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

FW-APP III

UNIT ESTIMATED TIME

4 Days*

* *Unit estimated time is not stated as concurrent or complete days. Training will be performed in conjunction with additional units of instruction and application as well as evidence impression analysis, comparison, and evaluation.*

GOAL

The objectives of this unit are to familiarize the trainee with various methods of making test impressions of shoes and tires as known standards for comparison to evidence impressions. The trainee will learn to use an available reasonable means to make test impressions which will make a reliable standard. Upon completion of this training unit, the trainee will have an understanding of all processing protocols currently in use by the ISP Forensic Sciences Command Footwear/Tire Track Section. The trainee will obtain and demonstrate the skills needed for the proper application of these procedures. This will be accomplished through practical exercises to demonstrate the appropriate skills have been obtained and by a final written criterion test covering all processing protocols.

OBJECTIVES

1. The trainee will acquire a satisfactory understanding of commonly used test impression techniques. Evaluation of this understanding will be by completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a working knowledge of commonly used test impression techniques. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

3. The trainee will attain a practical working knowledge of preservation of test impressions. Demonstrate competency will be based upon training coordinator observation and review on a pass/fail basis.

LESSON 1 – Two Dimensional Test Impression Methods

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the more commonly used techniques for making two-dimensional test impression for comparison to evidence impressions.

Introduction: Most evidence impressions received in the laboratory are of the two-dimensional variety. Test impression methods taught in this unit are not intended to be an all inclusive or restrictive list of test impression methods. The occasion may arise where the trainee will need to improvise and use an unusual, new, or seldom used technique to make a reliable

comparison between known standards and questioned impressions. The trainee will also learn proper documentation of the test impression method used.

Lecture: Two-Dimensional Test Impression Methods

Exercises: To obtain and demonstrate familiarity with the skills required for the making of two-dimensional test impressions, the trainee will complete the following exercises:

1. Correctly prepare test impressions of standards using black fingerprint ink or printer's ink and create overlays to be used for comparison based upon training coordinator's observation and review on a pass/fail basis.
2. Correctly prepare test impressions of standards using fingerprint powder and create overlays to be used for comparison based upon training coordinator observation and review on a pass/fail basis.
3. Correctly prepare test impressions of standards using petroleum products and create overlays to be used for comparison based upon training coordinator observation and review on a pass/fail basis.

Suggested Readings:

1. Abbot, John R., *Footwear Evidence*, A. C. Germann, Ed., Charles C. Thomas, Springfield, IL, 1964, pp. 63-67.

2. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 285-298; 304-306.

3. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL, 1993, pp. 111-115.

4. Nause, S/Sgt. Lawren, *Forensic Tire Impression Identification*, Canadian Police Research Centre, NRC Publication, 2001, pp. 23-36.

LESSON 2 – Three-Dimensional Test Impression Methods

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the more commonly used techniques for making three-dimensional test impressions for comparison to evidence impressions.

Introduction: Occasionally, evidence impressions of the three-dimensional variety are received by the laboratory. These are usually depicted by dental stone casts but may be encountered in a variety of media. Comparison can usually be made directly between the standard and the evidence impression; however, sometimes features of the identifiable characteristics may require three-dimensional test impressions to be made. Test impression methods taught in this unit are not intended to be an all inclusive or restrictive list of test impression methods. The occasion

may arise where the trainee will need to improvise and use an unusual, new, or seldom used technique to make a reliable comparison between known standards and questioned impressions. The trainee will also learn proper documentation of the test impression method used.

Lecture: Three-Dimensional Test Impression Methods

Exercises: To obtain and demonstrate familiarity with the skills required for the making of three-dimensional test impressions, the trainee will complete the following exercises:

1. Correctly prepare test impressions of standards using silicone casting materials according to specific manufacturer directions based upon training coordinator's observation and review on a pass/fail basis.
2. Correctly prepare test impressions of standards using modeling clay or similar product based upon training coordinator observation and review on a pass/fail basis.
3. Correctly prepare test impressions of standards using biofoam or similar product based upon training coordinator observation and review on a pass/fail basis.
4. Correctly prepare test impressions of standards using dental stone or similar product based upon training coordinator observation and review on a pass/fail basis.

Suggested Readings:

1. Abbot, John R., *Footwear Evidence*, A. C. Germann, Ed., Charles C. Thomas, Springfield, IL, 1964, pp. 68-71.

2. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 293-306.

3. Nause, S/Sgt. Lawren, *Forensic Tire Impression Identification*, Canadian Police Research Centre, NRC Publication, 2001, pp. 37-56.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: MISCELLANEOUS PROCEDURES

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

FW-IV

UNIT ESTIMATED TIME

4 Days*

* *Unit estimated time is not stated as concurrent or complete days. Training will be performed in conjunction with additional units of instruction and application as well as evidence impression analysis, comparison, and evaluation.*

GOAL

The objectives of this unit are to instruct the trainee in various limited application procedures used for the enhancement, recovery, and preservation of evidence impressions. The trainee is not expected to become proficient in the application of these techniques since they are most often utilized at a crime scene or used infrequently in laboratory processing. Upon completion of this training unit, the trainee will have an understanding of all processing protocols currently in use by the ISP Forensic Sciences Command Footwear/Tire Track Section. The trainee will attain a working knowledge of the application of these techniques and know where further information is available. This will be accomplished through practical exercises to demonstrate the appropriate skills have been obtained and by a final written criterion test covering all processing protocols.

OBJECTIVES

1. The trainee will acquire a satisfactory understanding of limited application procedures. Evaluation of this understanding will be by completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a working knowledge of limited application procedures. Demonstrated completion will be based upon training coordinator observation and review on a pass/fail basis.

3. The trainee will attain a practical working knowledge of preservation of evidence generated by limited application procedures. Demonstrate competency will be based upon training coordinator observation and review on a pass/fail basis.

LESSON 1 – Dental Stone Casting

Estimated Time: 1 Day

Purpose: To become familiar with the application of dental stone to cast footwear and tire track impressions.

Introduction: Dental stone casting allows the convenience of having a three-dimensional impression for comparison to shoes or tires. Although photography of the cast can be done to preserve what was visualized, it is not necessary in order to perform a comparison. Dental stone is a gypsum cement which has been modified for use in the dental industry and has become the preferred

material to use for impression evidence casting. it has the useful qualities of being hard, durable, easy to clean without loss of detail, inexpensive, and it does not have a limited shelf life. The primary use of dental stone would be at a crime scene to collect evidence impressions. However, it may be necessary for the footwear examiner to make casts of test impressions for comparison to a submitted cast. Footwear examiners may also be called upon to assist at crime scenes; therefore, it is important to know how to use dental stone properly.

Lecture: Dental Stone Casting

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare a quantity of dental stone casting materials based upon training coordinator observation and review on a pass/fail
2. basis.
   Demonstrate the correct application of the previously prepared quantity of dental stone to footwear and tire track impressions in various outdoor substrates based upon training coordinator
3. observation and review on a pass/fail basis.
   Demonstrate correct preservation of cast evidence impressions based upon training coordinator observation and review on a pass/fail basis.

Suggested Readings:

1. Abbot, John R., *Footwear Evidence*, A. C. Germann, Ed., Charles C. Thomas, Springfield, IL, 1964, pp. 63-67.

2. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 59-97.

3. Cassidy, Michael J. *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Ontario, 1987, pp. 18-31.

4. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL, 1993, pp. 147-51.

LESSON 2 – Silicone Casting

Estimated Time: 1 Day

Purpose: To become familiar with the application of silicone casting materials to footwear and tire track impressions.

Introduction: Sometimes, conventional lifting tapes and films are not suitable for lifting impressions from textured or uneven surfaces because they do not allow a complete lift to be made. In these instances, some silicone-based casting materials work well, especially for lifting powdered impressions. As

discussed in Appendix III of the Footwear/Tire Track Procedures Manual, silicone casts can also be useful for making test impressions of known standards (shoes or tires). Silicone casting materials are available in a variety of different colors and textures. Proper use of fingerprint powders and colors of silicone can provide good contrast and enhancement of evidence impressions for comparison. Examples of casting materials are Mikrosil, Dow Corning Silicone Rubber, Silmark, Durocast, and Reprosil, or similar extrusion gun products.

Lecture: Silicone Casting

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare a quantity of silicone casting material according to the manufacturer's directions based upon training coordinator observation and review on a pass/fail basis.
2. Demonstrate the correct application of the previously prepared impressions in various substrates based upon training coordinator observation and review on a pass/fail basis.
3. Demonstrate correct preservation of cast evidence impressions based upon training coordinator observation and review on a pass/fail basis.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 65-68, 122-124, 302-303.

LESSON 3 – Electrostatic Dust Lifting

Estimated Time: 1 Day

Purpose: To become familiar with the application of the electrostatic dust print lifter to footwear and tire track impressions.

Introduction: In 1970, Kato Masao, a Shikoku, Japan police office, developed a machine which used static electricity to assist lifting latent footwear impressions. This machine was somewhat cumbersome and required being plugged into a main current source to operate. In 1981, England's Metropolitan Police Laboratory developed a portable high-voltage electrostatic lifting device that could operate on rechargeable batteries.

When the high voltage source is turned on, it creates a static charge on the lifting film. Some of the dust or residue particles of the evidence impression transfer to the lifting film. Since the film is in direct contact with the evidence impression, the transferred impression on the lifting film will be the same size as original impression. It is important to remember that the electrostatic lift must be turned over to be photographed and as such is a reverse image of the original impression.

Lecture: Electrostatic Dust Print Lifting

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare the electrostatic dust print lifter to lift evidence impressions from a variety of surfaces based upon training coordinator observation and review on a pass/fail basis.
2. Demonstrate the correct application of the electrostatic dust print lifter to various impressions and satisfactorily lift the impressions based upon training coordinator observation and review on a pass/fail basis.
3. Demonstrate correct preservation and photography of lifted evidence impressions based upon training coordinator observation and review on a pass/fail basis.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 101-115.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: DIGITAL PHOTOGRAPHY

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

NONE

UNIT ESTIMATED TIME

17 Days*

* *Unit estimated time is not stated as concurrent or complete days. Digital photography will be performed in conjunction with additional training units. Trainees who have completed photography training as part of a different forensic discipline may not need to complete some or all of this training unit. Photography application to footwear and tire track evidence will be discussed regardless of previous training or experience.*

GOAL

The trainee will attain sufficient skills to accurately preserve footwear and tire track impression evidence through digital photography, to utilize digital imaging software to improve clarity, contrast, or enhance evidence impressions, to record all necessary documentation in accordance with the Footwear/Tire Tracks Standards and Controls, and to prepare visual aid presentations for courtroom demonstrations.

OBJECTIVES

1. The trainee will successfully demonstrate the ability to digitally preserve impression evidence visualized by all footwear/tire track procedures, as evaluated by the training coordinator on a pass/fail basis.

2. The trainee will demonstrate the ability and skill to use appropriate techniques to enhance digital images for analytical and documentary purposes, as evaluated by the training coordinator on a pass/fail basis.

3. The trainee will successfully demonstrate the ability to prepare demonstrative exhibits for courtroom testimony utilizing digital imaging and presentation software, as evaluated by the training coordinator on a pass/fail basis.

LESSON 1 – Basic Principles of Digital Photography

Estimated Time: 5 Days

Purpose: To understand the basic principles of digital photography, use of equipment, and materials to produce accurate digital images.

Introduction: Preservation of footwear and tire track impressions may well be the most crucial stage of the examination process. An examiner will find it very difficult to compensate for poorly focused photographs, ineffective lighting, or improper framing. The quality of photography could be the essential element in the case results ranging from unsuitable impressions

to similar class characteristics to a positive identification.

Photography of evidence impressions may not always be under the control of the footwear/tire track examiner. Usually evidence impressions are photographed at the crime scene by a crime scene investigator or other agency representative. Although the examiner has little or no control over this process; a familiarity with proper equipment, techniques, and procedures will give the examiner the ability to aid those doing the field work.

It is essential that the examiner know how to photograph footwear and tire track evidence in the laboratory since this is the type of photography they will be performing most often. Selection of lighting and digital imaging techniques can result in a wide range of enhancement possibilities. To be able to make full effective use of these tools, the examiner needs to have a good solid photography foundation.

Lectures: Principles of Light
Basics of the Digital Camera: Lens Aperture and Shutter Speed

Exercises:
1. Practical exercises in the use of a digital camera.
2. Practical exercises in various lighting techniques.

Suggested Readings:
1. Bodziak, William J., Footwear Impression Evidence: Detection, Recovery, and Examination, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 27-58, 135-139.

LESSON 2 – Photography of Footwear and Tire Track Evidence

Estimated Time: 5 Days

Purpose: To understand the unique process involved in digitally preserving footwear and tire track evidence in a manner to produce high quality full scale enlargements for comparison.

Introduction: Digital photography of footwear and tire track evidence has certain requirements which are different from those encountered in most crime laboratory photography. Images must be reproduced in full scale prints which require use of large scales in the photograph, precise focusing to avoid blurred enlargements and attention to lighting to provide the greatest enhancement of available detail. The ability to properly use available photographic resources is essential to producing analytical quality full scale prints from which comparison can be made.

Lectures: Lighting of Footwear and Tire Track Impressions
Digital Photography of Footwear and Tire Track Impressions
Use of flatbed scanners to preserve Footwear and Tire Track Impression

Exercises:

1. Practical exercises in various lighting techniques for visualizing and preserving footwear and tire track impressions.
2. Practical exercises in preserving footwear and tire track impressions using digital photography and flatbed scanners.

LESSON 3 – Digital Processing Software

Estimated Time: 5 Days

Purpose: To attain the skill and understanding of the methods of image processing available and permissible using Adobe Photoshop software or an equivalent image editing software.

Introduction: Software programs such as Adobe Photoshop can be used to perform various imaging functions. These functions include color reversal, sharpening and contrast/brightness adjustments. The proper use of these functions is vital as their misuse could cause detrimental effects on image quality and integrity.

Lectures: Importing images into Adobe Photoshop
Using the features in Adobe Photoshop to Process Digital Images Printing Digital Images

Exercises:

1. Import digital images into Adobe Photoshop and perform a size calibration.
2. Become familiar with various appropriate processing functions available in Adobe Photoshop.
3. Print digital images at 1:1 scale at highest available resolution.

LESSON 4 – Courtroom Presentations

Estimated Time: 2 Days

Purpose: To attain the skill and understanding of the methods available to prepare courtroom presentations.

Introduction: Visual courtroom presentations are increasingly becoming part of an effective testimony. Software programs such as Microsoft PowerPoint can be used to illustrate how examinations are conducted, comparisons made and conclusions reached. By incorporating text, images and diagrams, presentations can be created that will enhance courtroom testimony.

Lecture: Creating Courtroom Presentations using Microsoft PowerPoint

Exercise:

1. Create a court room presentation illustrating a footwear or tire track examination and how the examiner's conclusion was reached.

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 27-58, 135-139.

2. Cassidy, Michael J., *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Ontario, 1987, pp. 3-4, 13-18, 50-52.

3. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL 1993, pp. 37, 45, 50-51, 53-64, 179.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: IMPRESSION COMPARISON

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

FW-App-I; FW-App-II, FW-App-III; FW-App-IV

UNIT ESTIMATED TIME

10 Days*

***** *Unit estimated time is not stated as concurrent or complete days. Impression comparison, practical exercises, and criterion practical examination will be performed in conjunction with other training units.*

GOAL

The trainee will attain the necessary skills to conduct a thorough quantitative-qualitative analysis of footwear and tire track evidence and test impressions, to perform an accurate comparison of class and individualizing characteristics between unknown and known impressions, and to derive a correct conclusion.

OBJECTIVES

1. The trainee will acquire the ability to recognize class and individualizing characteristics and conduct a quantitative-qualitative analysis of the detail by successfully completing a series of practical exercises which will be evaluated by the training coordinator on a pass/fail basis.

2. The trainee will attain the ability to perform a comparison of recognized class and individualizing characteristics between unknown and known impressions by successfully completing a series of practical examinations with a final score of no less than 100%.

LESSON 1 – Quantitative-Qualitative Analysis of Evidence Impressions

Estimated Time: 2 Days

Purpose: To conduct a quantitative-qualitative analysis of footwear/tire track impressions which determines the suitability of the impression for comparison.

Introduction: General guidelines to casework are provided in the Footwear/Tire Track Procedures Manual. Each case and item of evidence has its own unique circumstances and evidence and requires its own individual evaluation. Through experience and a willingness to be open to various avenues of approach, an examiner can evaluate each item of evidence on its own merits and give full attention to detail without use of a step-by-step formula. This unit will teach some basics that should be considered while examining footwear and tire track evidence.

The potential exists for evidence other than footwear or tire track related evidence to be present. During the initial evaluation of unknowns and standards, the examiner should take note of any possible trace evidence such as hair, fibers, glass, or blood. Comparisons to or collection of these

types of evidence may need to be done prior to the impression comparison. Caution should be exercised before removing items such as rocks, glass, nails, or other debris from the outsole of a shoe or tread of a tire as these items may well be used as individualizing characteristics.

Initial quantitative-qualitative analysis of evidence impressions is focused on determining the pattern design that is present and whether or not sufficient class and individualizing characteristics exist for a comparison to be made. Factors such as the substrate, matrix deposition, condition of the shoe or tire, and the manner by which the impression was made can result in variations or distortions in the size of an impression or appearance of characteristics. Sometimes these variations or distortions may tempt an examiner to erroneously eliminate the known standard. A certain degree of variation should be expected since duplication of the exact circumstances under which an evidence impression is made is virtually impossible.

Lectures: Principles of Comparison
The Philosophy of Suitability

Exercises: To obtain and demonstrate the appropriate skills necessary to determine suitability of footwear and tire track impressions, the trainee will complete the following exercises:

1. Under direct supervision, demonstrate the ability to properly evaluate and record the features and suitability of evidence impressions based upon training coordinator observation and review on a pass/fail basis.
2. Under direct supervision, demonstrate the ability to properly record observations in the form of worksheet documentation in compliance with the standards and controls recorded in the Footwear/Tire Track Procedures Manual Appendix II upon training coordinator observation and review on a pass/fail basis.

Suggested Readings:

1. Abbott, John R., *Footwear Evidence*, A. C. Germann, Ed., Charles C. Thomas, Springfield, IL, 1964, pp. 38-62.

2. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 357-374.

3. Cassidy, Michael J., *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Canada, 1987, pp. 91-108.

LESSON 2 – Overlay Comparison of Class and Individualizing Characteristics

Estimated Time: 4 Days

Purpose: To provide the trainee with the methodology of comparing known standards to unknown impressions through the overlay method.

Introduction: There are several different methods for making test impressions of known standards. One of the most convenient test impression methods is the production of a clear overlay which can be placed directly on top of photographic prints or lifts for comparison of class and individualizing characteristics. The choice of test impression method can depend on the type of unknown impression, but more frequently depends on the individual examiner's personal preference. These test impressions are most commonly used to compare to two-dimensional unknowns, but can also benefit when comparing to a three-dimensional unknown.

In this lesson, the trainee will be exposed o several different common methods of making overlay test impressions. Advantages and disadvantages of these methods will be explored and discussed. Each of the demonstrated techniques will be used by the trainee so they can see for themselves which method is most beneficial to them. Use of a magnifying device and varied lighting will also be learned.

Lectures: Production of Clear Overlay Test Impressions
The Use of Clear Overlay Test Impressions in the Comparison Process

Exercises: To obtain and demonstrate the appropriate skills necessary to produce clear overlay test impressions and use them for comparison to unknown impressions, the trainee will complete the following exercises:

1. Under direct supervision, demonstrate the ability to produce quality clear overlay test impressions using various methods of production upon training coordinator observation and review on a pass/fail basis.
2. Under direct supervision, demonstrate the ability to use clear overlay test impressions to compare to unknown impressions and develop proper conclusions upon training coordinator observation and review on a pass/fail basis.

Suggested Readings:

1. Abbott, John R., *Footwear Evidence*, A. C. Germann, Ed., Charles C. Thomas, Springfield, IL, 1964, pp. 63-71.

2. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 279-306, 329-374.

3. Cassidy, Michael J., *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Ontario, 1987, pp. 91-108.

4. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL, 1993; pp. 73-80, 111-116.

LESSON 3 – Side-by-Side Comparison of Class and Individualizing Characteristics

Estimated Time: 4 Days

Purpose: To provide the trainee with the methodology of comparing known standards to unknown impressions through the side-by-side method.

Introduction: Side-by-side comparison is most commonly conducted between the known standard (a shoe or tire) and a three-dimensional unknown impression (a dental stone cast). This comparison can be greatly aided by the use of oblique lighting, calipers or some other measuring device, and a magnifying device. Although the need for three-dimensional test impressions is rarely encountered, the trainee needs to be aware of how to produce these test impressions.

Lectures: The Use of the Side-by-Side Comparison Method
Production of Three-Dimensional Test Impressions

Exercises: To obtain and demonstrate the appropriate skills necessary to conduct side-by-side comparison and produce quality three-dimensional test impressions, the trainee will complete the following exercises:

1. Under direct supervision, demonstrate the ability to produce quality three-dimensional test impressions using various methods of production upon training coordinator observation and review on a pass/fail basis.
2. Under direct supervision, demonstrate the ability to use standards or tests of standards to make comparisons to unknowns and develop proper conclusions upon training coordinator observation and review on a pass/fail basis.

Suggested Readings:

1. Abbott, John R., *Footwear Impression Evidence*, A. C. Germann, Ed., Charles C. Thomas, Springfield, IL, 1964, pp. 63-71.

2. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 279-306, 329-374.

3. Cassidy, Michael J., *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Ontario, 1987, pp. 91-108.

4. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL 1993, pp. 73-80, 111-116.

5. Nause, S/Sgt. Lawren, *Forensic Tire Impression Identification*, Canadian Police Research Centre, NRC Publication, 2001, pp. 217-252.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: COMPUTER DATABASES AND PUBLICATIONS OF OUTSOLE AND TIRE TREAD PATTERNS

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

All Procedures

UNIT ESTIMATED TIME

2 Days

GOAL

The trainee will become aware of and familiarized with some of the computer databases and publications available for searching for standards of outsole and tire tread designs. The trainee will also learn to access services offered by the Federal Bureau of Investigation and shoe and tire manufacturers which can aid in identifying possible standards which could have produced unknown impressions.

OBJECTIVES

1. Under direct supervision, the trainee will successfully demonstrate the ability to use available computer databases for searching outsole and tire tread standards based upon training coordinator evaluation on a pass/fail basis.

2. Under direct supervision, the trainee will successfully demonstrate the ability to use printed periodicals for searching outsole and tire tread standards based upon training coordinator evaluation on a pass/fail basis.

3. Under direct supervision, the trainee will successfully demonstrate the ability to use sources outside the ISP Forensic Sciences Command to aid in determining possible footwear or tire standards based upon training coordinator evaluation on a pass/fail basis.

LESSON 1 – Computerized Databases

Estimated Time: 1 Day

Purpose: To familiarize the trainee with some of the available computer databases which can be used to attempt to determine a potential source of an unknown patterned impression.

Introduction: At various times in casework, requests are made of the Footwear/Tire Track examiner to attempt to determine a possible brand name of a shoe or tire that made a patterned impression at a crime scene. There have been a couple of computerized databases made available to the examiner to aid in the determination. These include software available to purchase and use at the examiner's laboratory and a database search which can be conducted by the Federal Bureau of investigation. Although these searches are often unsuccessful, it is important that an examiner be aware of these available resources and know how to use them.

Lecture: Computer Databases

Exercise: To obtain and demonstrate the appropriate skills required for the proper use of these reference materials, the trainee will complete the following exercise:

1. Demonstrate the correct use of available outsole and tire tread design publications to attempt to determine a possible source of an evidence impression based upon training coordinator observation and review on a pass/fail basis.

Suggested Readings: None.

Additional Resources:

1. Myers, Don A., *Sole Prints A Reference Guide for Law Enforcement Personnel*, Lightning Powder Company, Inc., Salem, Oregon, 1986.

2. *Tread Design Guide*. Tire Guides, Inc., Boca Raton, FL.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: SUPERVISED CASEWORK

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

All Procedures

UNIT ESTIMATED TIME

17 Days

GOAL

The trainee will utilize all knowledge, skills and abilities acquired from previous instruction to comply with casework demands under varying levels of supervision, including proper evidence handling, documentation, report writing, and quality assurance requirements.

OBJECTIVES

1. The trainee will successfully complete a comprehensive written criterion test on all evidence examination procedures with a score of no less than 80%.

2. Under direct supervision, the trainee will successfully complete a minimum of three simulated cases according to all standards, controls, and quality assurance requirements based upon training coordinator evaluation on a pass/fail basis.

3. Under direct supervision, the trainee will successfully complete a series of lift-only cases according to all standards, controls, and quality assurance requirements based upon training coordinator evaluation on a pass/fail basis.

4. Under direct supervision, the trainee will successfully complete a series of routine evidence examination cases according to all standards, controls, and quality assurance requirements based upon training coordinator evaluation on a pass/fail basis.

5. Under limited supervision, the trainee will successfully complete a more complex series of cases according to all standards, controls, and quality assurance requirements based upon training coordinator evaluation on a pass/fail basis.

6. The following standards must be met to successfully complete this module: no erroneous identifications; no erroneous eliminations; no misinterpreted or overstated results; and all impressions on submitted evidence that the training coordinator deems unquestionably suitable for comparison were called suitable by the trainee. In addition, all standards listed in Command Directive TRN 13 must be met.

LESSON 1 – Casework Requirements

Estimated Time: 2 Days

Purpose: To attain the knowledge and skills of proper evidence handling, casework documentation, and report wording.

Introduction: Prior instruction in footwear/tire track procedures provides the tools needed to conduct accurate and thorough examinations. The ability to

visualize evidence impressions successfully and to perform competent analysis, comparison, and evaluation of revealed impressions does not assure all legal requirements will be met. Accurate and thorough examinations depend upon strict adherence to approved practices in evidence handling and casework documentation. Demonstration that all applicable standards and controls were met is essential. Conclusions and findings must be expressed in written reports so that they are understandable and accurately detail the examination results. In addition to satisfying all legal requirements, casework protocols must all comply with ISO criteria and Forensic Sciences Command policies.

Lecture: Evidence Handling, Note Taking, and Report Writing in CALMS
ISO Certification

Exercise:
1. Review of Footwear/Tire Track Section Minimum Standards and Controls.

Suggested Readings:
1. Relevant sections of the Forensic Sciences Command Directives Manual.
2. Relevant sections of the Facility Operations Manual.
3. Footwear/Tire Track Procedures Manual.

LESSON 2 – Simulated Casework

Estimated Time: 5 Days

Purpose: To attain the skills necessary to conduct an accurate and thorough examination utilizing nonprobative simulated conditions.

Introduction: The use of nonprobative simulated evidence enables the trainee to coordinate all acquired knowledge, skills, and abilities into a unified examination. The trainee will outline a course of action based upon the characteristics of the evidence and the case related questions involved. Once the course of action is determined, the trainee will outline the sequence of activities and conduct the examination according to all applicable standards and controls and quality assurance requirements. All examination procedures, including evidence handling, casework documentation, and draft report writing will be reviewed and discussed.

Lecture: Interaction Between Trainee and Training Coordinator During Casework

Exercises:
1. Simulated case 1 and review.
2. Simulated case 2 and review.
3. Simulated case 3 and review.

Suggested Readings:
1. Relevant sections of the Forensic Sciences Command Directives Manual.

2. Relevant sections of the Facility Operations Manual.
3. Footwear/Tire Track Procedures Manual.

LESSON 3 – Probative Casework

Estimated Time: 10 Days

Purpose: To attain the skills necessary to conduct an accurate and thorough examination of casework involving evidence examination, evaluation of evidence impressions, analysis, and comparison of footwear and tire track evidence.

Introduction: Skills required for accurate and thorough examination, evaluation, analysis, and comparison of footwear and tire track evidence are improved by repetition and experience. Casework provides realistic circumstances to develop these skills. The trainee will conduct examinations under direct supervision during which training coordinator review and supervision will continue the instructional process.

Lecture: Interaction Between Trainee and Training Coordinator During Casework

Exercise:
1. Selected casework performed under direct supervision and review.

Suggested Readings:
1. Abbott, John R., *Footwear Evidence*, A. C. Germann, Ed., Charles C. Thomas, Springfield, IL, 1964, pp. 38-71.

2. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 413-458.

3. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL, 1993, pp. 147-162.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

MODULE: SECTION SPECIFIC COURTROOM TRAINING

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

All Procedures

UNIT ESTIMATED TIME

5 Days*

* *Unit estimated time is not concurrent, but includes mock trials at regular intervals during the training program. Time needed for preparation for mock trials is not included. Estimated time assumes the trainee has received basic courtroom demeanor training.*

GOAL

The trainee will acquire the ability to express proper evidence handling, chain of custody, laboratory procedures, examination methodology, and findings according to established courtroom protocols. This goal will be accomplished by mock trials involving simulated and actual case scenarios addressing specific aspects of footwear/tire track examination.

OBJECTIVES

The trainee will present truthful, technically accurate, understandable, and believable testimony in a mock trial environment following all established protocols for expert witnesses based upon training coordinator or peer review evaluation on a pass/fail basis.

1. The trainee will demonstrate an ability to describe evidence handling, chain of custody, laboratory procedures, and findings based upon training coordinator or peer review evaluation on a pass/fail basis.

2. The trainee will attain the ability to demonstrate convincingly the methodology used to determine individually by use of photographically enlarged visual aids based upon training coordinator or peer review evaluation on a pass/fail basis.

LESSON 1 – Effective Footwear/Tire Track Testimony

Estimated Time: 5 Days

Purpose: To attain specific skills in providing expert Footwear/Tire Track testimony as a supplement to basic courtroom demeanor.

Introduction: The basic courtroom demeanor class provides instruction which is applicable to all forensic scientists regarding fundamentals of testimony and courtroom protocol. It is important that the Footwear/Tire Track examiner learn how to clearly and concisely present the unique details of this forensic science discipline in a courtroom setting. A jury must be able to understand the basis for the expert's conclusions so they can render a decision which does not compromise the integrity of the judicial system and is not prejudiced against the defendant.

Courtroom testimony can be a very demanding aspect of forensic science and can be physically and emotionally draining to the person testifying. The best way to reduce the negative impact on the expert and increase the effectiveness of their testimony is through honing communications skills and familiarization with the field of expertise. The most reliable method of developing these skills is in a simulated courtroom environment using mock trials.

Lecture: Qualifying the Science in the Post-Daubert Era

Exercises:

1. Practical exercises in qualification testimony.
2. Mock Trial 1 and review.
3. Mock Trial 2 and review.
4. Final Mock Trial (Juried).

Suggested Readings:

1. Bodziak, William J., *Footwear Impression Evidence: Detection, Recovery, and Examination*, 2nd Edition, CRC Press LLC, Boca Raton, FL, 2000, pp. 375-379.

2. Abbott, John R., *Footwear Evidence*, A. C. Germann, Ed., Charles C. Thomas, Springfield, IL, 1964, pp. 3-15.

3. Cassidy, Michael J., *Footwear Identification*, Public Relations Branch of the Royal Canadian Mounted Police, Ottawa, Ontario, 1987, pp. 147-157.

4. McDonald, Peter, *Tire Imprint Evidence*, CRC Press, Inc., Boca Raton, FL, 1993, pp. 111-115.

5. Moenssens, Andre A., Fred E. Inbau, and James E. Starrs, *Scientific Evidence in Criminal Cases*, Third Edition, The Foundation Press, Inc., Mineola, New York, 1986, Chapters 1, 11, pp. 784, 795-798.

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

APPENDIX A-1: TRAINING CHECKLIST

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INITIAL FORENSIC SCIENCE TRAINING CHECKLIST
FOOTWEAR / TIRE TRACKS

Trainee: _____ Coordinator: _____

Training Start Date: _____ Training End Date: _____

Module	Completion Date	Trainee Initials	Coordinator Initials
General Forensic Science			
Ethics in Forensic Science			
General Information and History			
Manufacturing Processes			
Class and Individualizing Characteristics			
Specialized Processing Techniques – Chemical Processing – Porous			
Specialized Processing Techniques – Physical Processing – Nonporous			
Specialized Processing Techniques – Chemical Processing – Nonporous			
Specialized Processing Techniques – Nondestructive – Porous / Nonporous			
Specialized Processing Techniques – Blood Protein Enhancement – Porous / Nonporous			
Test Impression Methods			
Miscellaneous Procedures			
Photography			
Digital Imaging			
Impression Comparison			
Computer Databases and Publications of Outsole and Tire Tread Patterns			
Section Specific Courtroom Training			
Supervised Casework			

If a module was not completed, mark it as "NC" ("Not completed").

ILLINOIS STATE POLICE

FOOTWEAR/TIRE TRACKS TRAINING MANUAL

APPENDIX A-2: AUTHORIZATIONS BASED ON SCOPE

Reviewed by:

Forensic Scientist Vickie Reels, Chairperson
Footwear/Tire Track Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

AUTHORIZATIONS BASED ON SCOPE

Field of Testing: Forensic Testing
Materials Tested

Forensic Scientist: _____

Category: Footwear / Tiretracks

Sub Catergory: Development

Analytical Technique	Authorized
1.2 Screening Tests: Color	
1.3 Screening Tests: Other Chemical Tests	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: Comparison

Analytical Technique	Authorized
4.1 Physical Examination: Physical Measurements	
4.2 Physical Examination: Striation/Impression/Mark Comparison	
4.5 Physical Examination: Pattern Recognition	
5.1 Microscopy: Optical	
6.4 General Laboratory Procedures: General Laboratory Techniques	

These are the areas under which I am authorized to conduct casework.

_____
Forensic Scientitst / Date

_____
Training Coordinator / Date

_____
Director of Training / Date

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LATENT PRINT

APPENDICES

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: HISTORICAL REFERENCES TO PERSONAL IDENTIFICATION

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

NONE

UNIT ESTIMATED TIME

5 Days

GOAL

The trainee will acquire a comprehensive understanding of the progression in personal identification methods from the earliest applications to the contemporary usage.

OBJECTIVES

1. The trainee will demonstrate an understanding of significant contributors and events which provided the advancement of personal identification by successfully completing a written criterion test with a score of no less than 80%.

2. The trainee will conduct research on a historical figure who contributed to the advancement of personal identification for the purpose of presenting an oral report. Successful completion of this assignment will be determined by the training coordinator on a pass/fail basis.

LESSON 1 – History of Personal Identification

Estimated Time: 2 Days

Purpose: To familiarize the trainee with a comprehensive account of the progression in personal identification and the functions of fingerprints with a special emphasis on post-Daubert criteria.

Introduction: The need for reliable means of personal identification has existed since the beginning of recorded history. A practical means of identifying individuals was required for the development of civil and legal social systems.

Over the course of history, various methods have been devised to establish personal identity within the requirements of legal certainty. Early methods, such as branding and tattooing, were often cruel and disfiguring. More humane systems attempted to record physical details about the individual, but these were usually flawed, cumbersome, or subject to fraud or deception. Scientific methods which provided greater accuracy and reliability did not appear until the 18th century. One method emerging during this time was the use of the friction ridge skin arrangements present on the fingers commonly called fingerprints.

Although isolated examples of fingerprint usage have been noted for over 5,000 years, the evolution of fingerprints as the most reliable means of personal identification occurred over a span of nearly five decades. This progression involved contributions from numerous individuals before a workable system could be established. In some instances, the contribution by a particular individual was based upon scientific study and research; in others, the addition, although significant, was based upon intuition or speculation.

Systematic application of fingerprints as a means of personal identification, particularly as a vital part of criminal investigation, originated as a police function. Over the course of time, two related but separate functions emerged, each requiring different skills. One area maintains records of personal identity in the form of inked or digitally captured fingerprints stored in large collections which become known standards. The second area involves unknown impressions of friction ridge skin recovered from crime scenes. These are called latent prints.

The foundation of fingerprint identification is based upon the two premises that friction ridge skin arrangements are permanently formed and are believed to be unique to the individual. Initially, the premise of uniqueness was established as a matter of probability, but research during the 20th century has shown that uniqueness is biological in origin. Additional research on the embryological development of friction ridge skin and the origin of inherent uniqueness continues.

Lecture: Personal Identification

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in discussions.
4. Successfully pass the criterion test for this module.

Criterion Test: History

Required Reading:

1. Ashbaugh, D. (1999). The History of Friction Ridge Identification. In *Quantitative-qualitative friction ridge analysis: An introduction to basic and advanced ridgeology* (pp. 11-60). Boca Raton, FL: CRC Press.

2. Barnes, J. (2011). History. In A. McRoberts & D. McRoberts (Eds.), *The fingerprint sourcebook* (pp. 7-22). Washington, DC: U.S. Dept. of Justice, Office of Justice Programs, National Institute of Justice.

3. Berry, J., & Stoney, D. (2001). History and Development of Fingerprinting. In H. Lee & R. Gaensslen (Eds.), *Advances in fingerprint technology* (2nd ed., pp. 1-40). Boca Raton, FL: CRC Press.

4. Cummins, H., & Midlo, C. (1976). History. In *Finger prints, palms and soles: An introduction to dermatoglyphics* (pp. 3-21). New York, NY: Dover Publications.

5. Moenssens, A. (1969). Historical Perspective. In *Fingerprints and the law* (pp. 1-9). Philadelphia, PA: Chilton Book.

6. Moenssens, A. (1971). The History of Fingerprinting. In *Fingerprint techniques* (pp. 1-26). Philadelphia, PA: Chilton Book.

7. U.S. Dept. of Justice, Federal Bureau of Investigation. (1984). The Identification Division of the FBI. In *The science of fingerprints: Classification and uses.* (Rev. 12-84 ed., pp. 1-4). Washington, DC: Author.

8. As assigned by the training coordinator.

LESSON 2 – Oral Presentation

Estimated Time: 3 Days

Purpose: To provide the trainee with further study related to the contributions of a significant person in the history of personal identification and to enhance the trainee's verbal skills.

Introduction: Communication skills are an essential part of a forensic scientist's responsibilities. Effective court testimony depends upon an ability to communicate the basis for a conclusion. As with any skill, effectiveness usually improves with practice.

Lecture: None

Exercises:
1. On-line research.
2. Outline of material.
3. Presentation of findings before an audience; presentation must be a minimum of 10 minutes.

On-line References: Complete latent print examination. Last accessed 01/06/2016. <http://www.clpex.com>.

Latent print examination: Fingerprints, palmprints and footprints. Last accessed 01/06/2016. <http://www.onin.com/fp/>.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: ANATOMY AND PHYSIOLOGY OF FRICTION RIDGE SKIN

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

NONE

UNIT ESTIMATED TIME

10 Days

GOAL

The trainee will achieve a comprehensive understanding of individuality based upon the fetal development of friction ridge skin and will understand the structure and functions of the developed skin as pertaining to latent print deposit and visualization.

OBJECTIVES

1. The trainee will demonstrate a comprehensive knowledge of the embryological development of friction ridge skin, the completed skin structure, and the functions associated with papillary skin by successfully completing a written test with a score no less than 80%.

2. The trainee will write a paper explaining the biological foundation for friction ridge skin individuality. Successful completion of this assignment will be determined by the training coordinator on a pass/fail basis.

LESSON 1 – Anatomy of Friction Ridge Skin

Estimated Time: 2 Days

Purpose: To provide the trainee with the fundamental concepts upon which friction ridge skin individuality and identification are based.

Introduction: All aspects of friction ridge skin analysis, from the recovery of latent prints to the individualization of these impressions to their sole source origin, have underlying principles based upon physiology and anatomy. Friction ridge skin possesses distinctive characteristics that distinguish it from all other areas of skin on the human body.

Individualization based upon recognition of unique friction ridge skin features requires a comprehensive understanding of the origins of that uniqueness. Individuality is established during fetal development during a specific time of gestation. The blueprint provided by heredity establishes a framework for embryonic development, but the influences of external and internal stresses account for an endless variation of precise cell placement during differential growth. After formation, the natural regeneration of skin cells sustains that arrangement in a consistent form. Natural excretions of the skin, such as sweat, may transfer materials to a receptive surface and provide a recording of the details of friction ridge skin.

Reliable and accurate conclusions of identification depend upon a complete understanding of the cause of friction ridge skin uniqueness, the functions of the skin, and the composition of transfers.

Lecture: Physiology of Friction Ridge Skin

Criterion Test: Anatomy and Physiology

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in discussions on the material presented.
4. Successfully pass the criterion test for this module.

Required Reading:

1. Ashbaugh, D. (1999). The Friction Ridge Medium. In *Quantitative-Qualitative Friction Ridge Analysis: An Introduction to Basic and Advanced Ridgeology* (pp. 61-85). Boca Raton, FL: CRC Press.

2. Champod, C., Lennard, C., Margot, P., & Stoilovic, M. (2004). Friction Ridge Skin. In *Fingerprints and other ridge skin impressions* (pp. 1-13). Boca Raton, FL: CRC Press.

3. Cummins, H., Midlo, C. (1976). General Considerations. In *Finger prints, palms and soles: An introduction to dermatoglyphics* (pp. 22-42). New York, NY: Dover Publications.

4. Moenssens, A. (1971). The Nature of Friction Ridge Skin. In *Fingerprint techniques* (pp. 27-63). Philadelphia, PA: Chilton Book.

5. Olsen, R. (1978). *Scott's Fingerprint mechanics* (pp. 5-17). Springfield, IL: Thomas.

6. As assigned by the training coordinator.

LESSON 2 – Individuality of Friction Ridge Skin

Estimated Time: 8 Days

Purpose: To develop a thorough understanding of the origins for uniqueness in friction ridge skin features.

Introduction: Individualization based upon a friction ridge skin impression may be supported by two different approaches. One is based upon probability that a sufficient quantity of random features precludes the possibility of exact duplication. This approach requires empirical data from population sampling which provide a statistical foundation for determining that probability. While such studies have been conducted, statistical models have incorporated only a limited amount of the factors present in friction ridge skin detail. Thus far studies have also been limited in size. The

advent of statistical models employed in DNA testimony has caused some to demand similar models for fingerprint evidence.

The second approach relies upon the premise that all friction ridge skin structure is unique because of biological origin. To support this premise, an examiner must become familiar with the embryological development of friction ridge skin and how that development establishes uniqueness. Certain significant studies conducted by researchers provide the foundation for the process. While a comprehensive knowledge of this biological phenomenon is essential to any examiner, the ability to articulate these principles is equally important.

Exercises:

1. Research.
2. First draft of written composition.
3. Second draft of written composition.
4. Final paper.

Review: Training Coordinator evaluation on a pass/fail basis.

Supplemental References:

1. Skin Structure and Fetal Formation References:
    - Ten papers by Dr. William Babbler;
    - Skin Structure by Mary Beeton;
    - Friction Skin Growth by Mary Beeton.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: PATTERN INTERPRETATION AND CLASSIFICATION

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

NONE

UNIT ESTIMATED TIME

10 Days

GOAL

The trainee will become familiar with the standard terminology and accepted definitions used in fingerprint classification and identification.

OBJECTIVES

1. The trainee will demonstrate a comprehension of pattern type terminology and assignment of pattern type to fingerprints as well as a basic knowledge of the Henry and National Crime Information Center (NCIC) classification systems by the successful completion of a written criterion test with a score of no less than 80%.

LESSON 1 – Terminology and Definitions

Estimated Time: 3 Days

Purpose: To comprehend the standard terminology used in fingerprints as well as the generally accepted definitions of the fingerprint patterns.

Introduction: Friction ridge skin is arranged in patterns which range in complexity. Overall patterns may be further defined according to elements within them that conform to particular shapes. Various terms have been assigned to the elemental shapes as well as overall pattern configurations. This terminology, while not universally standard, establishes the language of fingerprint examinations.

There are three major pattern types and each of these can be further classified into subsets. Definitions for these have been established and are so prevalent within the profession that any practitioner must submit them to memory.

Lecture: Basic Terminology

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in discussions.
4. Practical exercises.
5. Successfully pass the criterion test for this module.

Criterion Test: Pattern Types and Nomenclature

Required Reading:

1. U.S. Dept. of Justice, Federal Bureau of Investigation. (1983). *Fingerprint training manual* (Rev. 7-87 ed., pp. 1-63). Washington, DC: Author.

2. U.S. Dept. of Justice, Federal Bureau of Investigation. (1985). Types of Patterns and Their Interpretation. In *The Science of fingerprints: Classification and uses.* (Rev. 12-84. ed., pp. 5-63). Washington, DC: Author.

3. U.S. Dept. of Justice, Federal Bureau of Investigation. (1985). Questionable Patterns. In *The Science of fingerprints: Classification and uses*. (Rev. 12-84. ed., pp. 64-79). Washington, DC: Author.

4. As assigned by the training coordinator.

LESSON 2 – Assigning Pattern Type

Estimated Time: 5 Days

Purpose: To acquire the ability to correctly classify fingerprints by pattern type.

Introduction: Classification of fingerprints by pattern types is a component of the basic terminology as well as a skill necessary for subsequent analysis.

Lecture: Pattern Type Rules

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in discussions.
4. Practical exercises.
5. Successfully pass the criterion test for this module.

Criterion Test: Pattern Types and Nomenclature

LESSON 3 – Classification Systems

Estimated Time: 2 Days

Purpose: To acquire a basic understanding of the historical basic knowledge of the Henry and NCIC Classification Systems including the ability to interpret the NCIC classification code.

Lecture: Classification Systems

Exercises:

1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in discussions.
4. Practical exercises.
5. Successfully pass the criterion test for this module.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: FINGERPRINT RECORDING

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

LP-IV A-1

UNIT ESTIMATED TIME

3 Days

GOAL

The trainee will attain the necessary skills to record accurate fingerprints, palm prints, and major case prints.

OBJECTIVES

1. The trainee will accurately record the fingerprints, palm prints, and major case prints of at least four individuals based upon training coordinator evaluation on a pass/fail basis.

2. The trainee will attain sufficient skill to record classifiable post mortem fingerprints by several methods which will be evaluated by the training coordinator on a pass/fail basis.

LESSON 1 – Recording Fingerprints, Palm Prints, and Major Case Prints

Estimated Time: 2 Days

Purpose: To acquire the necessary skills to obtain legible and accurate inked recordings of the entire palmar surface of friction ridge skin.

Introduction: Fingerprint recording may be done for several reasons but the most common type of recording encountered by the latent print examiner is that taken of an individual in association with a criminal charge. This type of fingerprint card contains reproductions of the friction ridge skin area on the distal finger section used for classification and search in a criminal record file. While adequate for classification purposes and subsequent establishment of prior criminal history, such recordings encompass a relatively small portion of the available friction ridge skin area contained on the inside of the hands. Fortunately, about 60% of latent print impression evidence are deposits from these distal joint areas and thus a majority of latent prints can be compared with the submission of a standard fingerprint card.

Palm prints are recordings of the area between the wrist and digits which may also include the phalangeal portions of the fingers and the outside edge of the palm. Major case prints are recorded to produce standards of all papillary skin of the hands including the extreme sides and tips of the fingers.

While examiners are seldom involved in the fingerprint, palm print, or major case print recording process, they should be familiar with the procedures required to obtain full, legible standards in case the demand does arise or requests for instructional assistance are made. Without adequate standards, the best processing procedures, evidence preservation methods, and thorough comparison procedures are often futile.

Lecture: Methods of Fingerprint Recording

Exercises:
1. Read the assigned materials.
2. Attend all lectures.
3. Actively participate in discussions.
4. Practical application.

Review: Training coordinator evaluation.

Required Reading:
1. Cutro, B., Sr. (2011). Recording Living and Postmortem Friction Ridge Exemplars. In A. McRoberts & D. McRoberts (Eds.), *The fingerprint sourcebook* (pp. 1-18). Washington, DC: U.S. Dept. of Justice, Office of Justice Programs, National Institute of Justice.

2. U.S. Dept. of Justice, Federal Bureau of Investigation, Criminal Justice Information Services Division. (2010, March 17). Recording Legible Fingerprints. Retrieved September 11, 2015.

3. U.S. Dept. of Justice, Federal Bureau of Investigation, Criminal Justice Information Services Division. (2013). Capturing Legible Fingerprints. Retrieved September 11, 2015.

4. As assigned by the training coordinator.

LESSON 2 – Postmortem Recording of Friction Ridge Skin

Estimated Time: 1 Day

Purpose: To attain sufficient skill to record legible postmortem impressions.

Introduction: Deceased persons are identified by various methods ranging from visual examination to dental or bone radiographs. Fingerprint identification of deceased individuals is often used when accidental or deliberate damage to facial features occurs, when decomposition affects appearance, when mass disasters can prohibit individual identity, when criminal death is involved, or when an identification is questionable. Generally, post mortem fingerprint recording is done by investigators and the latent print examiner may be involved only in the comparison of the post mortem prints to previously recorded standards or latent impressions developed from personal articles associated to the suspected deceased. Actual recording of inked prints at a morgue may be rare but each examiner should be

familiar with the procedure. More likely, requests for postmortem recording will occur when efforts to obtain usable fingerprints have failed due to extensive damage or advanced decomposition. Rather than a scene procedure, the best results are generally achieved in the laboratory examining the hands severed from the deceased. Various methods have been designed to obtain satisfactory recorded impression, and no one method is applicable to the possible conditions encountered. Method of death, environmental conditions, and degree of decomposition can alter the effectiveness of procedures. Those described in this section shall deal with the premise of submitted severed hands. Individuals with a suspected identity and for which standards are available require only a recording of sufficient friction ridge skin area to confirm an identification. Those whose identity is completely unknown, those with no fingerprints on file, and those eliminated from suspected identity require a full, ten finger recording for AFIS searching.

Lecture: Fingerprinting the Deceased

Exercises:

1. Black Powder and Tape Method.
2. Paper Strip Method.
3. Mikrosil Method.

Required Reading:

1. Cutro, B., Sr. (2011). Recording Living and Postmortem Friction Ridge Exemplars. In A. McRoberts & D. McRoberts (Eds.), *The fingerprint sourcebook* (pp. 1-18). Washington, DC: U.S. Dept. of Justice, Office of Justice Programs, National Institute of Justice.

2. U.S. Dept. of Justice, Federal Bureau of Investigation, Criminal Justice Information Services Division. (2010, March 17). Recording Legible Fingerprints. Retrieved September 11, 2015.

3. U.S. Dept. of Justice, Federal Bureau of Investigation, Criminal Justice Information Services Division. (2013). Capturing Legible Fingerprints. Retrieved September 11, 2015.

4. As assigned by the training coordinator.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: IMPRESSION COMPARISON

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

LP-VA-1

UNIT ESTIMATED TIME

150 Days[1]

GOAL

The trainee will attain the ability to analyze, compare, and evaluate details from latent and known friction ridge skin impressions in order to determine if the impressions do or do not share a common source.

OBJECTIVES

1. The trainee will acquire the ability to recognize how the features of friction ridge skin structure are expressed in all types of impressions.

2. The trainee will acquire the ability to analyze friction ridge skin impressions to determine their value for comparison.

3. The trainee will attain the skills to analyze the details of friction ridge skin impressions and determine the effects of deposition circumstances such as pressure distortion, lateral movement, color reversal, artifacts of recording matrix, overlays, and other factors that contribute to the appearance of the impression.

4. The trainee will attain the skills to recognize orientation and possible location of latent print impressions on the hand or foot.

5. The trainee will develop the ability to weigh the similarities and differences between impressions to accurately determine whether they did or did not originate from a common source.

LESSON 1 – Quantitative-Qualitative Analysis of Friction Ridge Skin

Estimated Time: 10 Days

Purpose: To determine the suitability of a latent print for comparison and to acquire skills in the analysis portion of the ACE-V process.

Introduction: Examination of latent prints is properly conducted using the scientific method. There are various ways to describe this process but most include a sequential series of steps. These are often expressed as:

- stating a clear, falsifiable question
- forming two or more hypotheses, i.e., possible answers to the question
- generating predictions based on the alternate hypotheses

[1] General latent print visualization procedures will be performed in conjunction with additional units of instruction and application in photography as well as impression analysis, comparison, and evaluation exercises.

- gathering data: collecting information by observation or experiment to support or refute the hypotheses
- reaching a conclusion in which one hypothesis is supported and others refuted.

Latent print examination follows the scientific method in the form of a methodology called ACE-V: Analysis, Comparison, Evaluation, and Verification. In a latent print comparison the question asked is always: were the latent print and the known print made by the same friction ridge skin? The competing hypotheses are always: yes, the latent print and the standard have a common origin or no, they do not have a common origin. Predictions are based on observations of the features of both prints. If they have a common origin, similarities will be observed. If they do not have a common origin, dissimilarities will be seen. The analysis phase consists of a detailed examination of the latent print. First, the quantity and quality of the information in the latent print is analyzed to determine if the question posed is answerable; i.e., is there sufficient information in the latent print for it to be of value in answering the question? This is also called suitability: is the latent print suitable for comparison? If it does not contain sufficient quantity and quality of information, the process ends and the question cannot be answered.

Determination of suitability includes analysis of all of the features of the latent print. The examiner notes the amount or area of detail present and the clarity of that detail, which often varies within a single impression. The examiner also notes all other factors present: areas of smudging, pressure distortion, lateral distortion due to movement during deposition, artifacts that may be due to the medium or the substrate, color reversal, creases, scars, and all other details present. The examiner analyzes these data and makes the determination of suitability. If the print is suitable, the information the examiner has collected will be used in the next stage of the process. For marginal prints, this analysis may be a difficult decision that requires considerable examination and thought. For higher quality latents, the decision of suitability may occur quickly but the analysis should be just as thorough but also may require considerable time as all of the details and information within the print are thoroughly examined.

The analysis should occur without reference to the standard. By analyzing the data of the unknown latent print without referring to the known standard, the examiner guards against preconceived notions of data in the latent print. The known or standard print is also subject to analysis to determine its quality. Typically the standard is produced under controlled conditions with the purpose of obtaining a clear, high quality image. Thus, the examination of the standard for suitability is generally an easy decision. However, with various ways to obtain standards, from traditional printer's ink to live-scan devices, as well as electronic methods of providing a hard copy of the standards, the examiner should carefully analyze the data in the standard. Any anomalies due to the creation of the standard should be noted prior to the comparison phase of the process.

There can be disagreement among examiners on the suitability of a latent print. Trainees will strive to attain the general level of judgment that is typical of well-trained, experienced latent print examiners. This process includes gradual and continual improvement over time and will be a particular focus of the first year of training. As the trainee gains experience, she or he will continue to develop skills in this area with increasing confidence and efficiency.

Lectures: ACE-V, The Scientific Method Of Latent Print Examination
The Q_1-Q_2 Curve: Understanding the Relationship of Quantity and Quality in Suitability Determination

Required Reading:

1. Ashbaugh, D. (1999). The Identification Process. In *Quantitative-qualitative friction ridge analysis: An introduction to basic and advanced ridgeology* (pp. 87-148). Boca Raton, FL: CRC Press.

2. Ashbaugh, D. (1999). Poroscopy and Edgeoscopy. In *Quantitative-qualitative friction ridge analysis: An introduction to basic and advanced ridgeology* (pp. 149-163). Boca Raton, FL: CRC Press.

3. Moenssens, A. (1971). Comparison of Fingerprints. In *Fingerprint techniques* (pp. 252-293). Philadelphia, PA: Chilton Book.

4. Olsen, R., Sr. (1978). *Scott's Fingerprint mechanics* (pp. 24-52). Springfield, IL: Thomas.

5. As assigned by the training coordinator.

LESSON 2 – Similarities and Discrepancies

Estimated Time 20 Days

Purpose: To provide the trainee with skills and information to perform latent print comparisons.

Introduction: The second phase, comparison, is the observation of two separate images, the known and the unknown impressions, for the purpose of recognizing what is the same or what is different between them. No two impressions from the same area of friction ridge skin will be exactly alike in all aspects due to the inherent elasticity of the skin and the inevitable distortion resulting from pressure differentiation during contact. Even under the most controlled conditions, some variation in any two reproductions will occur. Therefore, comparison is not concerned with denoting exact duplication in the two reproductions but the act of recognizing what variation is the result of distortion and what is the indication the two impressions came from different sources.

Recognizing what constitutes variation in images from a single source and what is demonstration of separate sources requires high levels of skills, especially when minimal information is available or when distortion is pronounced. Clarity may indicate what degree of variation is the result of distorted images from a single source or what is actually differences due to two different sources. More extreme instances of distortion will conceal or obfuscate minute third level detail, and cause second level detail to display greater variation. An ability to distinguish between variation of distortion and variation caused by two sources is demanding and difficult but is an essential element in the identification process.

In the evaluation stage of the process, all of the data gathered are weighed and a conclusion is rendered. The examiner decides if the information presented supports the conclusion that the two impressions were produced by different sources or if they share a common source.

Lecture: Ridgeology Redux

Required Reading:

1. Beeton, M. (2002, February 18). Friction Ridge Identification Process - Proposed Scientific Methodology. Retrieved September 8, 2015, from http://www.clpex.com/Articles/TheDetail/1-99/TheDetail28.htm

2. Champod, C., Lennard, C., Margot, P., & Stoilovic, M. (2004). The Friction Ridge Identification Process. In *Fingerprints and other ridge skin impressions* (pp. 15-40). Boca Raton, FL: CRC Press.

3. As assigned by the training coordinator.

LESSON 3 – Complex Latent Print Comparisons

Estimated Time: 20 Days

Purpose: To provide the trainee with skills and information to perform complex latent print comparisons.

Lectures: The Q_1-Q_2 Curve: Understanding the Relationship of Quantity and Quality in the Determination of Sole Source Origin
Cognitive Science in Latent Print Analysis
Confounding factors: Distortion, Overlays, Third Level Details, and the Value of Adjacent Impressions

Required Readings:

1. Ashbaugh, D. (1982). Poroscopy. *Identification News*, 32(11), 3-8.

2. Busey, T., & Vanderkolk, J. (2005). Behavioral and electrophysiological evidence for configural processing in fingerprint experts. *Vision Research*, 45(4), 431-448. doi:10.106/j.visres.2004.08.021

3. Busey, T., & Loftus, G. (2007). Cognitive science and the law. Trends in Cognitive Sciences, 11(3), 111-117. doi:10.1016/j.tics.2006.12.004

4. Dror, I., & Charlton, D. (2006). Why Experts Make Errors. *Journal of Forensic Identification*, 56(4), 600-616.

5. As assigned by the training coordinator.

LESSON 4 – Application of Analysis, Comparison, and Evaluation

Estimated Time: 100 Days[2]

Purpose: To provide the trainee with practical application of methodology used in the identification process.

Exercises:
1. Read the assigned materials.
2. Attend all lectures.
3. Practical exercises of progressively more difficult comparisons of unknown to known impressions.
4. Successfully complete the criterion practical for this module.

Criterion Practical: Completion of a series of progressively more complex comparison exercises in the allotted time period with no erroneous identifications and no more than two false negatives per exercise in all exercises except the final exercise. The final exercise must be completed with no errors of any kind.

[2] Lesson 4 will be completed in conjunction with other units of instruction.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: PHOTOGRAPHY

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

LP-IVB-1, Appendix II, Appendix VII

UNIT ESTIMATED TIME

10 Days[3]

GOAL

The trainee will attain sufficient skills to accurately preserve visualized latent prints, to utilize photography to improve contrast or clarity, to record casework findings and to prepare visual aid presentations for courtroom demonstration.

OBJECTIVES

1. The trainee will demonstrate the ability and skill to correctly photograph latent prints visualized by all latent print procedures as evaluated by the training coordinator on a pass/fail basis.

2. The trainee will demonstrate the ability and skill to perform photography techniques and digital image processing in a manner which produces properly preserved latent prints visualized by all latent print procedures as evaluated by the training coordinator on a pass/fail basis.

3. The trainee will utilize all acquired skills and abilities to preserve all visualized latent prints during the remainder of training as evaluated by the training coordinator on a pass/fail basis.

4. The trainee will attain the ability and skill to prepare a courtroom presentation that adequately demonstrates examination methodology as evaluated by the training coordinator on a pass/fail basis.

LESSON 1 – Introduction to Digital Photography : Writing with Light

Estimated Time: 2 Days

Purpose: To understand the properties of light as applied to digital photography and to produce properly exposed pixel-based images using digital cameras.

Introduction: Proper photographic preservation of revealed latent prints is an essential and critical element in the successful application of many visualization procedures. Photography is often the only means by which the results of a procedure can be documented and preserved. Photography also provides a chronicle of examination results from each procedure in sequential processing. Although photography may be utilized to improve the clarity or contrast of visualized latent prints obtained by any procedure, its primary

[3] Photography will be performed in conjunction with latent print visualization procedures, section specific courtroom training, and digital imaging.

use is to preserve latent prints visualized by chemical or luminescent procedures.

Proper execution of photographic procedures requires a comprehensive understanding of aperture and shutter control, utilization of various lighting methods, use of appropriate filters, and good image processing techniques. Enlarged images may be used for analysis as well as demonstrative purposes in courtroom testimony.

Digital cameras capture light focused by a lens onto a piece of electronic equipment called a sensor which then converts the light into an electrical signal. Each pixel on the sensor contains a light sensitive photo diode which measures the brightness of light. Light is controlled by an iris attached to the lens which is adjusted according to aperture expressed in terms of *f* stops, and by a shutter which determines how long the lens permits light to be transmitted. Different aperture and shutter speed combinations will yield the same intensity of light, but selection of the proper combination is determined by several factors such as required depth of field and object movement.

Lectures: Light and Imaging
Large Format Photography

Exercises: 1. Practical exercises in proper film exposure for contrast.

LESSON 2 – Light Filtration

Estimated Time: 1 Day

Purpose: To attain the ability and skills required to intensify or decrease certain colors present in images by use of appropriate light filtration.

Introduction: Color may be present in a latent print image as the result of the processing procedure or may be an inherent part of the substrate.. In some instances, the gray equivalent to a particular color may provide insufficient contrast between the latent print and the background. Color filters are used to increase contrast.

Higher quality photographic filters are manufactured according to strict specifications regarding wave length transmission. Most photographic filters are composed of gelatin blended with specific dyes which permit certain frequency light to pass through while blocking all other frequencies. Specific properties of each color filter are often expressed according to a Wratten numbering system or equivalent. The Wratten numbering system ensures that the light transmission properties of a particular filter are consistent with any other of the same number.

Color filters are placed between the object and the lens in designed filter holders. Since color filters transmit only a portion of the light, adjustments to the exposure are required to increase the aperture or decrease the shutter speed. Each Wratten filter specifies the amount of adjustment required.

Lecture: Filter Use in Photography

Exercises:
1. Practical exercises to enhance color images.
2. Practical exercises to reduce background color.

LESSON 3 – Luminescence Photography

Estimated Time: 2 Days

Purpose: To attain the skills required to preserve luminescent images.

Introduction: Conventional photography depends upon lighting to illuminate the object. Luminescence photography records the light emitted from a latent print rather than light reflected from the image. Luminescence is the result of applied dyes or stains stimulated by a specialized light source. Light sources may include UV, laser, or an Alternate Light Source.

Exercises:
1. Practical exercises in photographing luminescent prints.

LESSON 4 – Specialized Lighting

Estimated Time: 2 Days

Purpose: To attain necessary skills in using unbalanced, oblique, and transmitted lighting in photography.

Introduction: For many objects, direct balanced lighting produces the best results. Unusual circumstances, however, may require alternative illumination to obtain the desired image. Unbalanced lighting positioned at various angles will create a degree of shadow which may improve an image or reduce glare. Oblique lighting in which the light is directed nearly parallel to the object produces maximum shadow. Transmitted light may be used on transparent or translucent objects. Other light sources, including fiber optics, LASER, or forensic light sources, may also be utilized to improve contrast and clarity.

Lecture: Light Manipulation

Exercises:
1. Practical exercises using unbalanced and oblique lighting.
2. Practical exercises using transmitted lighting.

LESSON 5 – Court Charts

Estimated Time: 1 Day

Purpose: To attain the skills required to produce visual aids for courtroom presentation.

Introduction: The use of properly prepared charted enlargements of the latent and inked prints increases the impact of testimony and illustrates fingerprint methodology in an effective manner. Maximum effectiveness of a court chart combines informative graphics and an exhibit which encourages full attention.

Demonstration: Preparing Charted Enlargements

Exercises:

1. Preparation of a court chart.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: DIGITAL IMAGING

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

LP-IVB-1, Appendix II, Appendix VII

UNIT ESTIMATED TIME

22 Days[1]

GOAL

The trainee will attain sufficient skills to preserve any visualized latent prints properly, to utilize photography to improve contrast or clarity, to record all necessary documentation concerning casework findings, to utilize the digital worksheet, and to prepare visual aid presentations for courtroom demonstration via digital imaging using the Foray Digital Workplace system.

OBJECTIVES

1. The trainee will demonstrate the ability to capture, store, and preserve all visualized latent prints via digital imaging, as evaluated by the training coordinator on a pass/fail basis.

2. The trainee will demonstrate the ability and skill to use appropriate techniques to process digital images for analytical and documentary purposes, as evaluated by the training coordinator on a pass/fail basis.

3. The trainee will utilize all acquired skills and abilities to preserve via digital imaging all visualized latent prints during the remainder of training as evaluated by the training coordinator on a pass/fail basis.

4. The trainee will demonstrate the ability and skill to document case findings utilizing the digital worksheet, as evaluated by the training coordinator on a pass/fail basis.

5. The trainee will attain the ability and skill to prepare a demonstrative exhibit utilizing digital imaging for courtroom testimony.

LESSON 1 – Acquiring Digital Images

Estimated Time: 5 Days

Purpose: To attain the skills needed to accurately capture digital images of latent prints.

Demonstration:
1. Using digital SLR cameras with various light sources.
2. Flatbed scanner use.

[1] Digital Imaging will be performed in conjunction with latent print visualization procedures, photography, and section specific courtroom training.

Exercises:
1. Practical exercises using digital SLR cameras, various light sources, and flatbed scanners.

Supplemental Reference:
1. As assigned by the training coordinator.

LESSON 2 – Digital Workplace

Estimated Time: 5 Days

Purpose: To attain the skills needed to thoroughly utilize the Foray Digital Workplace system for the storage and retrieval of casework images and the digital worksheet.

Exercises:
1. Practical exercises using the acquisition, storage, and retrieval functions of the Foray Digital Workplace system.

Supplemental Reference:
1. As assigned by the training coordinator.

LESSON 3 – Image Processing Techniques

Estimated Time: 5 Days

Purpose: To attain the skills and understanding of the methods of image processing that are available and permissible using Adobe Photoshop.

Exercises:
1. Practical exercises processing a series of progressively more challenging latent print images.

Supplemental Reference:
1. As assigned by the training coordinator.

LESSON 4 – Digital Worksheet

Estimated Time: 2 Days

Purpose: To attain the skills and the understanding necessary to use the digital worksheet as designed by the Illinois State Police.

Exercises:
1. Practical exercises utilizing the digital worksheet for casework documentation.
2. Practical exercises acquiring processed latent print images into the digital worksheet.

LESSON 5 – Creation of Court Exhibits

Estimated Time: 5 Days

Purpose: To attain the skills needed to create an effective court presentation using a presentation system such as Microsoft PowerPoint.

Exercises:

1. Preparation and presentation of a courtroom exhibit using Microsoft PowerPoint in a mock court setting.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: GENERAL LATENT PRINT DETECTION AND VISUALIZATION TECHNIQUES

Reviewed by:

Michael A. Cox
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Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

LP-I-A, LP-II-A, LP-II-B

UNIT ESTIMATED TIME

30 Days[4]

GOAL

The objectives of this section are to instruct the trainee in approved methods of evidence processing for the detection and visualization of latent print impressions. The trainee will learn the appropriate preservation techniques for the visualized impressions and attain the ability to assess the results of the techniques used. The trainee will attain the ability to choose the appropriate sequence of processing techniques. Upon completion of this training unit the trainee will have an understanding of all processing protocols currently in use by the ISP Forensic Sciences Command Latent Print Section.

OBJECTIVES

1. The trainee will demonstrate satisfactory understanding of factors which contribute to the proper selection of appropriate processing techniques for the many different types of substrates encountered in latent print evidence. Evaluation of this understanding will be demonstrated by completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate working knowledge of processing procedures, their interdependence, and how they relate to the sequential processing protocol. Demonstrated competency will be based upon training coordinator observations and review on a pass/fail basis.

3. The trainee will demonstrate complete understanding of all aspects of the process including an understanding of any chemical or physical elements involved. Demonstrated competency will be based upon successful preparation and application of reagents to be determined by training coordinator observation and review on a pass/fail basis.

4. The trainee will demonstrate satisfactory knowledge of preservation procedures using photography and lifting. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

GENERAL PROCESSING

LESSON 1 – Residue Composition and Surface Types (Matrix)

Estimated Time: 1 Day

[4] General latent print visualization procedures will be performed in conjunction with additional units of instruction and application in photography as well as impression analysis, comparison and evaluation exercises.

Purpose: To comprehend the various natural components which may be present in latent prints and to evaluate the retention of latent print residue on varying surface types.

Introduction: Visualization of transferred residue from friction ridge skin in the form of a latent print requires an understanding of the naturally present composition of eccrine perspiration. The nearby location of sebaceous glands, particularly in the areas of the face and hair, often results in transferred residue which contains various sebaceous material. While often the exact composition of the transferred impression is unknown, an understanding of likely components of the residue matrix forms the basis for visualization procedures.

Any transferred impression placed on a surface is affected by the characteristics of the substrate. Residue placed upon a nonporous substrate will remain on the surface while residue placed on a porous substrate will be absorbed. Selection of the proper visualization procedure is influenced by the characteristics of the substrate, the anticipated component of the residue matrix, and the sensitivity of the visualization procedure.

Lecture: Residue Composition and Deposit

Exercise:
1. Practical exercises creating latent prints.

Lecture: The Principle of Sequential Processing Procedures

Required Reading:
1. Champod, C., Lennard, C., Margot, P., & Stoilovic, M. (2004). *Fingerprints and Other Ridge Skin Impressions* (pp. 105-110). Boca Raton, FL: CRC Press.
2. Olsen, R., Sr. (1978). *Scott's Fingerprint Mechanics* (pp. 111-125, 271-273). Springfield, IL: Thomas.
3. As assigned by the training coordinator.

LESSON 2 – Visual Exam/Inherent Luminescence

Estimated Time: 3 Days

Purpose: To attain necessary skill to conduct a non-destructive examination of evidence using inherent luminescence and to attain proficiency in the preservation of luminescent latent prints.

Introduction: The use of lasers and alternate light sources in conjunction with various chemical procedures and dyes has proven very effective in visualizing latent impressions. Substances found in latent print residue may luminesce when illuminated by the proper wavelength of light and viewed with the appropriate filters. Natural components of perspiration, particularly vitamin B complexes, may be cause of this reaction, but the quantity of such

components varies in each individual. Various contaminants such as cosmetics may become part of latent print residue and may inherently luminesce as well. Additionally, certain materials such as styrofoam and galvanized or zinc plated metal are observed to consistently produce impressions that will luminesce without the application of chemical processing or dyes. This inherent luminescence allows for examination of items that may be altered or destroyed by other procedures.

Lecture: Non-Destructive Processing Porous/Nonporous – Inherent Luminescence

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Dalrymple, B., Duff, J., & Menzel, E. (1977, January). Inherent Fingerprint Luminescence - Detection by Laser. *Journal of Forensic Identification, 22*(1), 106-115.

2. Menzel, E. (1980). *Fingerprint Detection with Lasers* (pp. 47-62). New York, NY: M. Dekker.

3. As assigned by the training coordinator.

LESSON 3 – Cyanoacrylate Ester Fuming

Estimated Time: 4 Days

Purpose: To become proficient in the proper application of cyanoacrylate ester fuming of nonporous items.

Introduction: Cyanoacrylate esters are the active ingredients in the super bond adhesives and are generally available according to the type of alcohols used in manufacturing. Most cyanoacrylates are methyl or ethyl esters. Regardless of type, the esters volatilize into long chain molecules with a positive electrical charge. In atmosphere of relatively high humidity, the cyanoacrylate ester molecules are attracted to fingerprint residue and polymerize upon the deposit.

Properties of the polymer are dependent upon the type of cyanoacrylate ester used. Both ethyl and methyl esters produce a visible white coating. Ethyl ester polymers are softer and less durable while methyl ester polymers can usually only be removed with solvents. However, the durable, hard property of the methyl ester appears to inhibit dye applications especially with Rhodamine 6G.

Loctite products contain a cyanoacrylate ethyl ester and have proved to be quite effective for fuming. Loctite 495 Super Bonder provides a liquid useful for heat acceleration procedures while Hard Evidence is a gel which reacts to exposure to air. Any product containing ethyl ester generally will be more effective when subsequent laser dye applications are indicated. Cyanoacrylate fuming is highly effective with nonporous items made of plastics or metal.

Lecture: Physical Processing – Cyanoacrylate Ester Fuming

Exercise: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Demonstrate correct application procedures on a variety of nonporous substrates that might be encountered in casework.
2. Demonstrate correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Lee, H., & Gaensslen, R. (2001). *Advances in fingerprint technology* (2nd ed., pp. 117-127) (H. Lee & R. Gaensslen, Eds.). Boca Raton, FL: CRC Press.

2. Lennard, C., & Margot, P. (1988). Sequencing of reagents for the improved visualization of latent fingerprints. *Journal of Forensic Identification*, 38(5), 197-210.

3. Voss-de Haan, P. (2006). Physics and fingerprints. *Contemporary Physics*, 47(4), 209-230. doi:10.1080/00107510600893986

4. As assigned by the training coordinator.

LESSON 4 – Powders and Particulates

Estimated Time: 3 Days

Purpose: To become proficient in the application of various powders and particulates for latent print visualization.

Introduction: Fingerprint powders and particulate developers are very fine particles with an affinity for moisture throughout a wide range of viscosity. Palmar sweat, grease, oil, and most contaminants that coat the surface of friction ridge skin possess sufficient moisture and viscosity to attract and bind the fine particles together. Contact between friction ridge skin and a nonporous surface will sometimes result in a transfer of the moisture to the surface. All fingerprint powders and particulate developers are indiscriminate in adhesion to moisture; i.e., powder will adhere to all moisture on a surface, not just latent print residue.

Carbon is the most effective constituent of latent print powders. Black powders and particulate developers which contain carbon will consistently produce the best results. Other colored powders and particulate developers may be required due to the substrate encountered, but should be restricted to absolute necessity.

Magnetic powders are powder-coated, fine iron filings subject to magnetic attraction. These adhere to moisture to a lesser degree than carbon powders, but can be applied with less destructive force to the surface. Magnetic powders cannot be effectively used on ferrous metal surfaces.

Particulate developers are substances which produce extremely fine particle residue upon burning. Material with a high hydrocarbon content such as camphor, pine knots, or crumbled masking tape burn slowly and release soot in large quantities. Fine particulate carbon soot adheres extremely well to more viscous moisture, especially when heat from the flame softens the residue. When the substrate is very dark in color, white or light-colored soot may be produced by burning magnesium ribbon.

Most commercial black fingerprint powders have a high carbon base. According to the manufacturer's particular formula and production methods, the carbon base may be from a variety of sources, including lamp black, bone, or wood charcoal. Ground carbon alone cannot match the adhesion ability of fine particle carbon soot, but commercial powders contain milled carbon of highly uniform size and shape along with additional ingredients to preserve the milled condition and retard air moisture absorption.

Lecture: Powders and Particulates

Exercise: To obtain and demonstrate the appropriate skills required for the use of these procedures the trainee will complete the following exercises:

1. Demonstrate correct application procedure on a variety of nonporous substrates that might be encountered in casework. Use each of the different types of powders and particulates that are made available to the trainee. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.

2. Demonstrate the ability to successfully make lifts from a variety of substrates as well as utilize all different types of lift tapes and backings.

Required Reading:

1. Cowger, J. (1983). The Evidence Print. In *Friction ridge skin: 8Comparison and identification of fingerprints* (pp. 71-109). Boca Raton, FL: CRC.

2. Lee, H., & Gaensslen, R. (2001). *Advances in fingerprint technology* (2nd ed., pp. 107-113) (H. Lee & R. Gaensslen, Eds.). Boca Raton, FL: CRC Press.

3. Olsen, R., Sr. (1978). Latent Fingerprint Powder Techniques. In *Scott's Fingerprint mechanics* (pp. 209-235). Springfield, IL: Thomas.

4. Waldoch, T. (1993). The Flame Method of Soot Deposition for the Development of Latent Prints on Non-Porous Surfaces. *Journal of Forensic Identification*, 43(5), 463-465.

5. As assigned by the training coordinator.

LESSON 5 – Ardrox

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of ardrox to surfaces previously processed with cyanoacrylate ester fuming and to attain proficiency in the preservation of luminescent latent prints.

Lecture: Chemical Processing

Exercise: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. McCarthy, M. (1990). Evaluation of Ardrox as a Luminescent Stain for Cyanoacrylate Processed Latent Impressions. *Journal of Forensic Identification*, 40(2), 75-80.

2. As assigned by the training coordinator.

LESSON 6 – Rhodamine 6G

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of Rhodamine 6G to surfaces previously processed with cyanoacrylate ester fuming and to attain proficiency in the preservation of luminescent latent prints.

Lecture: Chemical Processing Nonporous – Rhodamine 6G

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Masters, N. (1990). Rhodamine 6G: Taming the Beast. *Journal of Forensic Identification*, 40(5), 265-270.

2. Menzel, E. (1983). A Guide to Laser Latent Fingerprint Development Procedures. *Identification News*, 33(9), 7, 10-13.

3. Menzel, E. (1980). *Fingerprint detection with lasers*. New York, NY: M. Dekker.

4. As assigned by the training coordinator.

LESSON 7 – Iodine Fuming

Estimated Time: 3 Days

Purpose: To attain the skills necessary for the effective application of iodine to porous surfaces and to attain proficiency in the preservation of iodine detected latent prints.

Introduction: Iodine is a sensitive indicator of various fatty oils which are often present in latent print residue. Iodine is absorbed by the oily material which assumes a reddish-brown color. While absorption is quite rapid and can be most

pronounced, no chemical change occurs to either substance. When exposure to the iodine ceases, the oily material releases the iodine molecules slowly. The color begins to fade and after several hours, the iodine may be completely dissipated. Return exposure will most often repeat the process while maintained exposure prevents dissipation. Generally iodine dissipates with no trace of exposure or damage to the article.

Iodine is effective with relatively fresh oily deposits, but for those older than two weeks, the reaction may not occur or be too faint for recognition. A chemical breakdown of the oily material appears to inhibit absorption. Iodine is normally not destructive and may detect deposits with insufficient amino acids for effective ninhydrin reaction. The application of 7,8-benzoflavone may be used to intensify weak iodine discolorations of latent print residue.

Iodine is toxic and very corrosive to nearly all metals. It can be used to process nearly all types of surfaces, but is normally used with porous items.

Lecture: Non-Destructive Processing Porous/Nonporous – Iodine Fuming

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Cowger, J. (1983). *Friction ridge skin: Comparison and identification of fingerprints* (pp. 93-96). Boca Raton, FL: CRC Press.

2. Lee, H., & Gaensslen, R. (2001). *Advances in fingerprint technology* (2nd ed., pp. 115-117) (H. Lee & R. Gaensslen, Eds.). Boca Raton, FL: CRC Press.

3. Olsen, R., Sr. (1978). *Scott's Fingerprint mechanics* (pp. 243-256). Springfield, IL: Thomas.

4. As assigned by the training coordinator.

LESSON 8 – 7,8-Benzoflavone

Estimated Time: 2 Days

Purpose: To attain proficiency in the application of 7,8-benzoflavone to porous surfaces previously processed with iodine and to attain the necessary skill for the preservation of detected latent prints.

Introduction: Iodine fuming of oily material may produce faint or incomplete reactions due to the age of the latent or the uneven distribution of oil upon the skin at the time of contact. Additional exposure to iodine may fail to intensify such reactions. 7,8-benzoflavone acts as a catalyst which bonds iodine to the detected oily matter and effects a color change from reddish-brown to an intense blue-black. Often added detail is revealed and previously visible impressions are more distinct. The addition of 7,8-benzoflavone negates the transitory characteristics of iodine-developed impressions and also allows for subsequent processing with ninhydrin, zinc chloride, and/or physical developer. However, the addition of 7,8-benzoflavone does alter the item and should not be used if the intrinsic value of the substrate is an important factor.

Lecture: 7, 8-Benzoflavone

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Mashiko, K., & Ishizaki, M. (1977). Latent Fingerprint Processing Iodine 7,8-Benzoflavone Method. *Identification News*, 27(11), 3-5.

2. As assigned by the training coordinator.

LESSON 9 – Ninhydrin

Estimated Time: 4 Days

Purpose: To attain proficiency in the application of the ninhydrin procedure for visualization of latent prints on porous surfaces.

Introduction: Ninhydrin or 1,2,3-triketohydrindene, is an extremely sensitive indicator of alpha-amino acids, certain proteins, peptides, and polypeptides which are normally present in palmar sweat. Ninhydrin also reacts with blood proteins and can be used for the enhancement of latent prints that contain blood. The chemical reaction between ninhydrin and these substances produces violet to blue-violet coloring called Ruhemann's Complex or Ruhemann's Purple. Although ninhydrin may be used on any surface, routine processing is restricted to porous items which have not subsequently become water-soaked or which do not contain inherent animal products. Since the amino acids are absorbed into the porous surface, visualization may occur after a considerable time interval between deposit and examination.

Ninhydrin is a powder which must be dissolved in a solvent-carrier to ensure maximum penetration of the surface and to promote a complete reaction of all amino acids present. Once in solution, ninhydrin may be applied as an aerosol or by swabbing the surface, but the most effective and safest method is by immersion of the item into the reagent. The effectiveness of the reaction is greatly influenced by the proper selection of the solvent-carrier, the concentration of the reagent, and the pH of the solution. In addition, maximum formation of Ruhemann's Complex is determined by the environment in which the item is processed and subsequently maintained until visualization occurs. Temperature and relative humidity are factors in this reaction.

Lecture: Chemical Processing of Porous Items – Ninhydrin

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all reagents involved in this procedure including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate correct application procedures on a variety of porous substrates that might be encountered in casework.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Petruncio, A. (2000). A Comparative Study for the Evaluation of Two Solvents for Use in Ninhydrin Processing of Latent Print Evidence. *Journal of Forensic Identification*, 50(5), 462-469.

2. Yamashita, B., & French, M. (2011). Latent Print Development. In D. McRoberts & A. McRoberts (Eds.), *The Fingerprint Sourcebook* (pp. 14-18). Washington, DC: U.S. Department of Justice, Office of Justice Programs, National Institute of Justice.

3. As assigned by the training coordinator.

LESSON 10 – Zinc Chloride

Estimated Time: 1 Day

Purpose: To attain proficiency in the use of zinc chloride to enhance ninhydrin developed latent prints.

Introduction: Zinc chloride and certain other metal salts react with Ruhemann's Complex to produce a coordination complex marked by a color change that can be stimulated to fluorescence with light of the appropriate wavelength. Zinc chloride produces a color change from purple to orange/red. Absorption peak is around 490 nm with emission around 560 nm. Fluorescence is weak, but may be increased by cooling to very low temperature with the use of liquid nitrogen.

This procedure is indicated only when ninhydrin developed latent prints need additional contrast. It reacts with the products of ninhydrin processing and will not produce a latent that was not present after ninhydrin processing. Thus, it is not routinely indicated for all nonporous items. It is potentially destructive to some surfaces. The use of liquid nitrogen to increase luminescence makes photography problematic.

Lecture: Chemical Processing of Porous Items – Zinc Chloride

Exercise: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate correct application procedures on a variety of porous substrate that might be encountered in casework.
3. Demonstrate correct use of all instrumentation involved within this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Champod, C., Lennard, C., Margot, P., & Stoilovic, M. (2004). *Fingerprints and other ridge skin impressions* (pp. 120-124). Boca Raton, FL: CRC Press.

2. Herod, D., & Menzel, E. (1982). Laser Detection of Latent Fingerprints: Ninhydrin Followed by Zinc Chloride. *Journal of Forensic Sciences*, 27(3), 513-518.

3. Menzel, E. (1980). Laser Detection of Latent Fingerprints. In *Fingerprint detection with lasers* (pp. 45-78). New York, NY: M. Dekker.

4. Menzel, E. (1983). A Guide to Laser Latent Fingerprint Development Procedures. *Identification News*, 33(9), 7, 10-13.

5. As assigned by the training coordinator.

LESSON 11 – Physical Developer

Estimated Time: 4 Days

Purpose: To attain proficiency in the application of physical developer.

Introduction: Physical developer is a product of British Home Office research devised specifically for the examination of wetted or water-soaked porous items. This procedure is a method which utilizes silver nitrate in an unstable ferrous/ferric redox solution in combination with a detergent solution. Unlike the conventional silver nitrate procedure which reacts with the chlorides of palmar sweat, physical developer deposits freed silver from the solution on any sebaceous material that may be present in a latent print residue. Although this procedure was developed for water-soaked items, it should be used on any porous item, whether water-soaked or not.

Physical developer is an immersion process of high sensitivity in which the reagent penetrates the porous material to detect any lipids which may be present. Physical developer should be routinely used after ninhydrin processing and often develops latents that were not visualized by ninhydrin; however, it cannot be used after conventional silver nitrate processing.

Physical developer requires special care and exact adherence to procedures. Some glassware and utensils must be dedicated to the procedure and reagent contamination must be avoided. Several chemicals must be purchased from sole source vendors due to required purity. In spite of these obstacles, the results often obtained from physical developer can be so productive that it must be included when full evidence exploration of porous items is desired.

Lecture: Chemical Processing of Porous Items – Physical Developer

Exercise: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of porous substrates that might be encountered in casework.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Cantu, A., & Johnson, J. (2001). Silver Physical Development of Latent Prints. In H. Lee & R. Gaensslen (Eds.), *Advances in fingerprint technology* (2nd ed., pp. 241-274). Boca Raton, FL: CRC Press.

2. Phillips, C., Cole, D., & Jones, G. (1990). Physical Developer: A Practical and Productive Latent Print Developer. *Journal of Forensic Identification*, 40(3), 135-147.

3. As assigned by the training coordinator.

LESSON 12– Silver Nitrate

Estimated Time: 1 Day

Purpose: To attain proficiency in the application of silver nitrate on selected porous items.

Introduction: Silver nitrate reacts with sodium and potassium chloride in palmar sweat to form silver chloride, a compound more photosensitive than silver nitrate. This procedure is particularly destructive in both general chemical reaction and the amount of water immersion required. Silver nitrate does not yield consistently high success on porous items, is expensive, and prohibits effective laser examinations. Therefore, it should be avoided when processing routine paper or porous items. Yet with certain surfaces, such as raw or unfinished wood, it can be effective.

Lecture: Chemical Processing of Porous Items – Silver Nitrate

Exercise: To obtain and demonstrate the appropriate skills required for the use of this procedure, the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on selected porous substrates that might be encountered in casework.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Olsen, R., Sr. (1978). *Scott's Fingerprint Mechanics* (pp. 291-306). Springfield, IL: Thomas.

2. As assigned by the training coordinator.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: SPECIALIZED LATENT PRINT DETECTION AND VISUALIZATION TECHNIQUES

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

LP-III-A, LP-III-B, LP-III-C

UNIT ESTIMATED TIME

8 Days

GOAL

Special circumstances include items in which the matrix is known or suspected to be blood, the surface is adhesive, or the surface was wet when recovered. The trainee will acquire the skills to recognize these conditions and make the appropriate processing choices. The trainee will demonstrate the skills needed for proper application of these procedures. This will be accomplished through practical exercises and by a final written criterion test covering all processing protocols.

OBJECTIVES

1. The trainee will demonstrate satisfactory understanding of factors which contribute to the proper selection of appropriate processing methods for specialized circumstances. Evaluation of this understanding will be by completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate working knowledge of processing procedures, their interdependence, and how they relate to the sequential processing protocol. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

3. The trainee will demonstrate a satisfactory understanding of all aspects of the process including an understanding of any chemical or physical elements involved. Demonstrated competency will be based upon successful preparation and application of reagents to be determined by training coordinator observation and review on a pass/fail basis.

4. The trainee will attain a practical working knowledge of preservation procedures. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

LESSON 1 – Small Particle Reagent

Estimated Time: 1 Day

Purpose: To become proficient in the application of Small Particle Reagent in the visualization of latent prints on wet or previously wetted nonporous items.

Introduction: Small particle reagent was devised and refined by the British Home Office as an effective procedure for processing wet surfaces. Water dissolves the water soluble components of residue, but sebaceous materials and other non-soluble components of residue may remain and be used to visualize

ridge detail. Molybdenum disulfide particles are suspended in a surfactant solution and are attracted to these components to visualize ridge detail.

Lecture: Physical Processing – Small Particle Reagent

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.
4. Demonstrate the ability to successfully make lifts from a variety of substrates as well as utilize all different types of lift tapes and backings.

Required Reading:

1. Lee, H., & Gaensslen, R. (2001). *Advances in fingerprint technology* (2nd ed., pp. 113-115) (H. Lee & R. Gaensslen, Eds.). Boca Raton, FL: CRC Press.

2. Onstwedder, J., & Gamboe, T. (1989). Small Particle Reagent: Developing Latent Prints on Water-Soaked Firearms and Effect on Firearms Analysis. *Journal of Forensic Sciences*, 34(2), 321-327.

3. As assigned by the training coordinator.

LESSON 2 – Amido Black

Estimated Time: 1 Day

Purpose: To attain proficiency in the application of amido black to nonporous surfaces which may contain latent prints in blood protein.

Introduction: Amido black or naphthalene black 10B is a protein indicator particularly sensitive to those proteins present in blood. While other procedures for the enhancement of blood impressions are available, they may pose serious health hazards or display a reaction for short durations. Amido black is a safer, permanent procedure which can be used on porous and or nonporous surfaces. Amido black does prevent subsequent serological examination and therefore may only be used after serological examination of the evidence; however, amido black does not interfere with DNA examination using PCR technology.

Lecture: Blood Protein Enhancement Porous/Nonporous – Amido Black

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate correct application procedures on a variety of nonporous substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Grieve, D., & McCarthy, M. (1989). Preprocessing with Cyanoacrylate Ester Fuming for Fingerprint Impressions in Blood. *Journal of Forensic Identification*, 39(1), 23-31.

2. Lee, H., & Gaensslen, R. (2001). *Advances in fingerprint technology* (2nd ed., pp. 140-146) (H. Lee & R. Gaensslen, Eds.). Boca Raton, FL: CRC Press.

3. As assigned by the training coordinator.

LESSON 3 – Coomasie Staining Solution

Estimated Time: 1 Day

Purpose: To attain proficiency in the application of Coomasie to nonporous surfaces which may contain latent prints in blood protein.

Introduction: Coomassie Brilliant Blue 8250 is a protein stain which is sensitive to the proteins in blood and palmar sweat. Coomassie may be used to enhance blood impression on porous or nonporous items, although its use is generally limited to nonporous items. Blood impressions do not require heat fixing of the proteins although residue must be dry prior to application. No serological analysis can be conducted after the staining procedure; however, Coomassie does not interfere with DNA examination using PCR technology.

Lecture: Blood Protein Enhancement Porous/Nonporous – Coomasie Staining Solution

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. Use each of the previously prepared chemical preparations. All application

procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Norkus, P., & Noppinger, K. (1986). New Reagent for the Enhancement of Blood Proteins. *Identification News*, 36(4), 5, 15.

2. As assigned by the training coordinator.

LESSON 4 – Crowle's Staining Solution

Estimated Time: 1 Day

Purpose: To attain proficiency in the application of Crowle's stain to nonporous surfaces which may contain latent prints in blood protein.

Introduction: Crowle's staining solution is a protein indicator which reacts with proteins in blood and palmar sweat. Crowle's can be used for enhancement of blood prints on both porous and nonporous items, although the procedure is generally used on nonporous items. Crowle's solution is similar in reaction to Coomassie but contains no organic solvents. No serological analysis can be conducted after the staining procedure; however, Crowle's does not interfere with DNA examination using PCR technology.

Lecture: Blood Protein Enhancement Porous/Nonporous – Crowle's Staining Solution

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. Use each of the previously prepared chemical preparations. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Norkus, P., & Noppinger, K. (1986). New Reagent for the Enhancement of Blood Proteins. *Identification News*, 36(4), 5, 15.

2. As assigned by the training coordinator.

LESSON 5 – Gentian Violet

Estimated Time: 1 Day

Purpose: To attain proficiency in the application of gentian violet to the sticky side of tapes.

Introduction: Adhesive surfaces require specialized processing. One method for such surfaces is Gentian Violet, also called crystal violet. Gentian violet (crystal violet) is a sensitive stain which reacts with epithelial cells and other portions of latent print residue transferred upon surface contact. The presence of sebum appears to serve as an excellent transfer medium for sloughed epidermal cells and, as a result, gentian violet is usually effective on surfaces which readily hold the deposited sebum, such as the adhesive side of tapes. Cell transfer can occur even when no indentation of the adhesive is noted. The high sensitivity of gentian violet produces an immediate reaction upon skin contact; therefore, leak proof gloves are required for examinations.

Gentian violet is applied as an aqueous solution or a phenol solution. Comparison tests have demonstrated that more effective staining is produced with phenol; however, due to the frequency of accidental staining of the skin, the high health risk associated with phenol and skin contact should be avoided. Aqueous gentian violet is a viable procedure and greatly reduces potential health concerns.

Lecture: Sticky Side of Tape Processing – Gentian Violet

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. Use each of the previously prepared chemical preparations. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Arima, T. (1981). Development of Latent Fingerprints on Sticky Surfaces By Dye Staining or Fluorescent Brightening. *Identification News*, 31(2), 9-10.

2. As assigned by the training coordinator.

LESSON 6 – Sticky Side Tape Powder Procedure

Estimated Time: 1 Day

Purpose: To attain proficiency in the application of Sticky-Side Powder to adhesive surfaces.

Introduction: The use of powder suspensions to develop impressions on the sticky side of tape has proven to be an effective alternative to the gentian violet procedure. The use of powder suspensions to maximize contrast is the preferred procedure on dark colored tapes lacking the availability of vacuum metal deposition.

Lecture: Sticky Side of Tape Processing – Sticky Side Tape Powder Procedure

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of nonporous substrates that might be encountered in casework. Use each of the previously prepared chemical preparations. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Champod, C., Lennard, C., Margot, P., & Stoilovic, M. (2004). *Fingerprints and other ridge skin impressions* (pp. 161-162). Boca Raton, FL: CRC Press.

2. Gray, M. (1996). Sticky-side Powder Versus Gentian Violet: The Search for the Superior Method for Processing the Sticky Side of Adhesive Tape. *Journal of Forensic Identification*, 46(3), 268-272.

3. Kimble, G. (1996). Powder Suspension Processing. *Journal of Forensic Identification*, 46(3), 273-280.

4. As assigned by the training coordinator.

LESSON 7 – ThermaNin

Estimated Time: 1 Day

Purpose: To attain proficiency in the application of ThermaNin to thermal papers.

Introduction: ThermaNin can be used on any porous material but it has been validated by the Illinois State Police specifically for use on various types of thermal papers including, but not limited to: lottery tickets; parking, gas, and restaurant receipts; bus tickets; movie tickets; boarding passes; and prescription bottle labels. Normally, processing is confined to thermal papers that have not subsequently become water-soaked or do not contain inherent animal proteins.

Lecture: Thermal paper processing – ThermaNin

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of thermal paper substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Ponschke, M., & Hornickel, M. (2016, May/June). A Limited Validation and Comparison of 1,2-Idanedione and ThermaNin for Latent Print Development on Thermal Paper. *Journal of Forensic Identification, 66*(3), 242-258.

2. As assigned by the training coordinator.

LESSON 8 – 1, 2-Indanedione

Estimated Time: 1 Day

Purpose: To attain proficiency in the application of 1,2-indanedione to thermal papers.

Introduction: First synthesized by a research group at the University of Pennsylvania in 1996, 1,2-indanedione reacts with amino acid constituents frequently found in latent impressions. While no color change accompanies this reaction, latent impressions will fluoresce under green [532 nanometer (nm)] light. 1,2-Indanedione can be used on any porous material and has been validated by the Illinois State Police specifically for use on various types of thermal papers including, but not limited to: lottery tickets; parking, gas, and restaurant receipts; bus tickets; movie tickets; boarding passes; and prescription bottle labels. Normally, processing is confined to thermal papers that have not subsequently become water-soaked or do not contain inherent animal proteins.

Lecture: Thermal paper processing - 1,2-Indanedione

Exercises: To obtain and demonstrate the appropriate skills required for the use of this procedure the trainee will complete the following exercises:

1. Correctly prepare all chemical preparations involved in this procedure, including any variations as they appear in the Latent Print Procedures Manual.
2. Demonstrate the correct application procedures on a variety of thermal paper substrates that might be encountered in casework. All application procedures will be demonstrated including any variations as they appear in the Latent Print Procedures Manual.
3. Demonstrate the correct use of all instrumentation involved with this procedure including equipment used in the appropriate preservation of all developed impressions.

Required Reading:

1. Ponschke, M., & Hornickel, M. (2016, May/June). A Limited Validation and Comparison of 1,2-Idanedione and ThermaNin for Latent Print Development on Thermal Paper. *Journal of Forensic Identification, 66*(3), 242-258.

2. As assigned by the training coordinator.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: MISCELLANEOUS PROCESSING PROCEDURES

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

LP-IVC-1

UNIT ESTIMATED TIME

5 Days

GOAL

The trainee will attain a familiarity with various limited application procedures as well as recent developments in new or revised latent print processing techniques.

OBJECTIVES

1. The trainee will participate in a discussion of selected procedures.

2. The trainee will become aware of the availability of additional information and other resources by compiling a written list of references to be evaluated by the training coordinator on a pass/fail basis.

LESSON 1 – Miscellaneous Processing

Estimated Time: 1 Day

Purpose: To become familiar with rarely used procedures and to understand when their application may be appropriate.

Introduction: Various procedures have been established which provide improved performance of certain types of evidence or evidence subjected to unusual circumstances. General knowledge of the sources of rarely used and newly discovered processing techniques is required for a latent print examiner to remain current in the field of latent print processing. Rules governing the use of such novel techniques should be clearly understood.

Lecture: Miscellaneous Processing Procedures

Exercises:
1. Participation in group discussion of selected processing techniques.

Required Reading:
1. As assigned by the training coordinator.

LESSON 2 – Current Literature Issues

Estimated Time: 4 Days

Purpose: To become familiar with reliable sources of current topics in Latent Print examination.

Introduction: As with every science, new studies in the field of latent prints are published with some frequency in peer-reviewed journals. The latent print examiner must remain current of the most recent information. The trainee will be able to assess the quality of the information presented.

Exercises:

1. The trainee will analyze, evaluate, and discuss current papers from referred journals.

Required Reading:

1. As assigned by the training coordinator.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: SECTION SPECIFIC COURTROOM TRAINING

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

All procedures

UNIT ESTIMATED TIME

20 Days[1]

GOAL

The trainee will acquire the facility to express proper evidence handling, chain of custody, laboratory procedures, examination methodology and findings according to established courtroom protocols. This goal will be accomplished by a series of mock trials involving simulated and actual case scenarios addressing specific aspects of latent print examination.

OBJECTIVES

1. The trainee will present truthful, technically accurate, understandable and believable testimony in a mock trial environment following all established protocols for expert witnesses based upon training coordinator or peer review evaluation on a pass/fail basis.

2. The trainee will demonstrate an ability to describe evidence handling, chain of custody, laboratory procedures and findings as determined by training coordinator or peer review evaluation on a pass/fail basis.

3. The trainee will attain the ability to demonstrate convincingly the methodology used to determine individuality by use of photographically enlarged visual aids as determined by training coordinator or peer review evaluation on a pass/fail basis.

LESSON 1 – Effective Latent Print Testimony

Estimated Time: 15 Days

Purpose: To attain specific skills in providing expert latent print testimony as a supplement to basic courtroom demeanor.

Lecture: Qualifying the Science in the Post-Daubert Era

Exercises:
1. Practical exercises in qualification testimony.
2. Mock Trial 1 and review.
3. Mock Trial 2 and review.
4. Mock Trial 3 and review.
5. Mock Trial 4 and review.
6. Final Mock Trial (juried).

[1] Mock trials at regular intervals during the training program. Required preparation time for mock trials is not included.

Supplemental Reference:

1. As assigned by the training coordinator.

LESSON 2 – Analysis and Discussion of Specific Court Decisions

Estimated Time: 5 Days

Purpose: To attain familiarity with relevant court decisions that affect latent print testimony.

Lecture: Foundation Issues in Latent Print Testimony

Exercises:

1. Court cases with particular significance to Latent Print Examination will be discussed. The trainee will present an analysis and oral report on a specific court case or cases. Successful completion of the assignment will be judged by the training coordinator on a pass/fail basis.

Supplemental Reference:

1. As assigned by the training coordinator.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: SEARCHING BIOMETRIC DATABASES

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

LP-IVB-2, LP-Appendix V

UNIT ESTIMATED TIME

25 Days

GOAL

The trainee will attain knowledge and skills in approved methods for the use of the Illinois State Police Automated Fingerprint Identification System (AFIS) and the Federal Bureau of Investigation's (FBI) Next Generation Identification (NGI) system. Upon completion of this training unit the trainee will have an understanding of all protocols currently in use by the ISP Forensic Sciences Command Latent Prints Section for AFIS and NGI cases. The trainee will obtain and demonstrate the skills needed for the selection, preparation, and evaluation of images and all required technical and administrative protocols associated with AFIS and NGI. This will be accomplished through practical exercises to demonstrate the appropriate skills have been obtained.

OBJECTIVES

1. The trainee will demonstrate a complete understanding of factors which contribute to the proper selection of fingerprints for the entry into AFIS and NGI. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

2. The trainee will demonstrate the knowledge and skills needed for correct core/axis selection and tracing and demonstrate an understanding of the importance of the accuracy of the core/axis placement. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

3. The trainee will demonstrate a complete understanding of all AFIS and NGI search capabilities and processing functions available to latent print examiners for casework. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

4. The trainee will demonstrate a fundamental understanding of the AFIS and NGI search process including the functions of the Bureau of Identification at Joliet and the Criminal Justice Information Services (CJIS) Division at the FBI. Demonstrated competency will be based upon training coordinator observation and review on a pass/fail basis.

5. The trainee will demonstrate through practical exercises, practical examinations and/or tests/quizzes competence in all aspects of the AFIS and NGI processing protocols.

LESSON 1 – Overview of AFIS

Estimated Time: 1 Day

Purpose: To gain an understanding of the purpose and overall operation of AFIS.

Introduction: The Bureau of Identification of the Illinois State Police maintains approximately 6 million fingerprint cards (also called ten-print cards). AFIS stores these cards electronically and organizes them so that they can be retrieved. Everyday about 300 new cards are added to the system. As they are added each card is compared to cards already on file to determine if a record for that person already exists. The main purpose of AFIS is to store and control these records. Latent, or unknown prints, from a crime scene can be searched against the cards in the system to see if the identity of the latent can be determined.

Lecture: Automated Fingerprint Identification System (AFIS)

Exercises:

1. The trainee will locate and review all AFIS submission guidelines in the appropriate Illinois State Police policy or procedure manual.

References:

1. Illinois State Police Command Directives.
2. Illinois State Police Latent Print Procedures Manual.

LESSON 2 – Evaluation of Latent Prints for AFIS Submission

Estimated time: 1 Day

Purpose: To understand the criteria for AFIS suitability.

Introduction: There are several criteria for an AFIS search of latent prints. The submitting agency must request an AFIS search, there must be no current suspect or the suspect must have been eliminated as the source of the print, any person who may have legitimately been the source of the latent print must have been eliminated, and the latent print must be of sufficient quality.

Lecture: AFIS Suitability Criteria

Exercises:

1. Practical exercises in judging AFIS suitability of latent prints.

References:

1. Komarinski, P. (2005). *Automated Fingerprint Identification Systems (AFIS)*, (Chapters 1-5). Amsterdam: Elsevier Academic.

LESSON 3 – Preparation of Latent Prints for AFIS Search

Estimated time: 4 Days

Purpose: To understand and demonstrate the skills needed to prepare latent prints for AFIS search.

Introduction: Preparation for AFIS search includes choices of pattern type, axis orientation, core location, minutiae selection, and other search parameters. A thorough knowledge of the significance of each of these factors is essential for maximizing the capabilities of AFIS. Documentation of the AFIS process is also important and must be included in the case notes. A clear understanding of these basics is necessary but experience will add to the trainee's skills throughout the training period.

Exercises:

1. Practical exercises in the preparation of latent prints for AFIS search, searches of mock cases, and documentation of all work.

LESSON 4 – Best Practices for AFIS Use

Estimated time: 14 Days

Purpose: To understand and demonstrate the skills needed to maximize success in AFIS searches.

Introduction: Each AFIS case presents a unique set of circumstances and there are often several appropriate ways to conduct AFIS searching. Experience with a variety of cases will demonstrate factors that contribute to the selection of best practices. The trainee will vary the search parameters in each case, analyze and compare search results, and discuss the results with the training coordinator.

Exercises:

1. Additional exercises in AFIS searching of mock cases.

Reference:

1. Senese, F. (2007). *Understanding ISP Database for AFIS Searches*. Lecture presented in PowerPoint.

LESSON 5 - Searching the FBI's Next Generation Identification (NGI) System

Estimated time: 5 Days

Purpose: To understand the overall operation of the NGI system, to understand and demonstrate the skills needed to determine the criteria for NGI suitability, and to understand and demonstrate the skills needed to prepare latent prints for an NGI search.

Introduction: Formerly known as the Integrated Automated Fingerprint Identification System (IAFIS), the NGI system was developed to expand the FBI's biometric identification capabilities to include facial, iris, and tattoo recognition in addition to fingerprint and palm print searches. With approximately 75 million individual fingerprint cards and approximately 12 million palm prints cards in the database from local, state, tribal, federal, and some international agencies, NGI has become a useful tool in searching latent prints. The requirements for searching a latent print in NGI vary slightly than those for searching in AFIS and therefore require additional skills to maximize search success.

Exercises:

1. Practical exercises in the preparation of latent prints for NGI searching, searches of latent prints in NGI from mock cases, and documentation of all work.

Reference:

1. As assigned by the training coordinator.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

MODULE: SUPERVISED CASEWORK

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

All procedures

UNIT ESTIMATED TIME

295 Days

GOAL

The trainee will utilize all knowledge, skills and abilities acquired from previous instruction to comply with casework demands under varying levels of supervision, including proper evidence handling, documentation, report writing and quality assurance requirements.

OBJECTIVES

1. The trainee will successfully complete a comprehensive written criterion test on all evidence examination procedures with a score of no less than 80%.

2. Under direct supervision, the trainee will successfully complete a minimum of twenty simulated cases according to all standards, controls, and quality assurance requirements based upon the training coordinator evaluation on a pass/fail basis.

3. Under direct supervision, the trainee will successfully complete a series of lift-only cases according to all standards, controls, and quality assurance requirements based upon training coordinator evaluation on a pass/fail basis.

4. Under direct supervision, the trainee will successfully complete a series of routine evidence examination cases according to all standards, controls, and quality assurance requirements based upon training coordinator evaluation on a pass/fail basis.

5. Under limited supervision, the trainee will successfully complete a more complex series of cases according to all standards, controls, and quality assurance requirements based upon training coordinator evaluation on a pass/fail basis.

6. The following standards must be met to successfully compete this module: no erroneous identifications or exclusions; all ridge detail that depicts a suitable latent print has been properly preserved; all ISP sequential processing protocols were followed; and all latent prints that the training coordinator deems unquestionably suitable for comparison have been called suitable by the trainee. In addition, all standards listed in Command Directive TRN 14 must be met.

LESSON 1 – Casework Requirements

Estimated Time: 5 Days

Purpose: To attain the knowledge and skills of proper evidence handling, casework documentation and report wording.

Introduction: Prior instruction in latent prints procedures provides the tools needed to conduct accurate and thorough examinations. The ability to visualize

latent prints successfully and to perform competent analysis, comparison and evaluation of revealed impressions does not assure all legal requirements will be met. Accurate and thorough examinations depend upon strict adherence to approved practices in evidence handling and casework documentation. Demonstration that all applicable standards and controls were met is essential. Conclusions and findings must be expressed in written reports so that they are understandable and accurately detail the examination results. In addition to satisfying all legal requirements, casework protocols must all comply with Forensic Sciences Command policies.

Lecture: Evidence Handling, Note Taking and Report Writing in CALMS

Exercises:
1. Written exercise on ISP policies and procedures related to latent print examination.
2. Written exercise on case documentation.

References:
1. Illinois State Police CALMS User's Manual.
2. Forensic Sciences Command Directives.
3. Facility Operations Manual.
4. CALMS Demo CD, Illinois State Police Training Program, 2003.

LESSON 2 – Simulated Casework

Estimated Time: 55 Days

Purpose: To demonstrate the synthesis of all the skills thus far learned in this program in the completion of mock casework.

Introduction: The use of non-probative, simulated evidence enables the trainee to coordinate all acquired knowledge, skills and abilities into a unified examination. The trainee will outline a course of action based upon the characteristics of the evidence and the case related questions involved. Once the course of action is determined, the trainee will outline the sequence of activities and conduct the examination according to all applicable standards, controls and quality assurance requirements. All examination procedures, including evidence handling, casework documentation and draft report writing will be reviewed and discussed.

Exercises:
1. A minimum of twenty simulated cases will be completed and reviewed.

LESSON 3 – Probative Casework (Lift-only)

Estimated Time: 30 Days

Purpose: To attain the skills necessary to conduct an accurate and thorough examination of casework involving analysis, comparison, and evaluation of latent lift cases.

Introduction: Skills required for accurate and thorough analysis, comparison, and evaluation of latent prints are improved by repetition and experience. Casework provides realistic circumstances to develop these skills. The trainee will conduct examinations under direct supervision with continued instruction, discussion, and review.

Exercises: Selected casework performed under direct supervision and review.

LESSON 4 – Probative Casework (Combination)

Estimated Time: 35 Days

Purpose: To attain the skills necessary to conduct an accurate and thorough examination of casework involving evidence processing as well as latent lift evidence.

Exercises:
1. Selected casework performed under direct supervision and review.

LESSON 5 – Probative Casework (Increasing Complexity)

Estimated Time: 170 Days

Purpose: To attain the skills necessary to conduct an accurate and thorough examination of increasingly more complex casework involving evidence examination as well as analysis, comparison, and evaluation of recovered latent prints evidence.

Exercises: Routine casework performed under supervision and review.

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

APPENDIX A: TRAINING CHECKLIST

Reviewed by:

Sheila A. Daugherty
Training Coordinator

Anastasia V. Petruncio
Training Coordinator

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INITIAL FORENSIC SCIENCE TRAINING CHECKLIST
LATENT PRINTS

Trainee: _____ Coordinator: _____

Training Start Date: _____ Training End Date: _____

Module	Completion Date	Trainee Initials	Coordinator Initials
General Forensic Science			
Ethics in Forensic Science			
Historical References to Personal Identification			
Anatomy and Physiology of Friction Ridge Skin			
Pattern Interpretation and Classification			
Fingerprint Recording			
Impression Comparison			
Photography			
Digital Imaging			
General Latent Print Detection and Visualization Techniques			
Specialized Latent Print Detection and Visualization Techniques			
Miscellaneous Processing Techniques			
Section Specific Courtroom Training			
Searching Biometric Databases			
Supervised Casework			

If a module was not completed, mark it as "NC" ("Not completed").

ILLINOIS STATE POLICE

LATENT PRINT TRAINING MANUAL

APPENDIX B: AUTHORIZATIONS BASED ON SCOPE

Reviewed by:

Michael A. Cox
Training Coordinator

Approved by:

Sandra N. Brown
Acting Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

AUTHORIZATIONS BASED ON SCOPE

Field of Testing: Forensic Testing Forensic Scientist: _____
Category: Latent Prints

Sub Catergory: Development

Analytical Technique	Authorized
1.2 Screening Tests: Color	
1.3 Screening Tests: Other Chemical Tests	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: Comparison

Analytical Technique	Authorized
4.5 Physical Examination: Pattern Recognition	
4.6 Physical Examination: Friction Ridge Analysis	
5.1Microscopy: Optical	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: Database; AFIS, NGI

Analytical Technique	Authorized
4.4 Physical Examination: Population Database Comparison	
6.4 General Laboratory Procedures: General Laboratory Techniques	

These are the areas under which I am authorized to conduct casework.

_____
Forensic Scientist / Date

_____
Training Coordinator / Date

_____
Director of Training / Date

DNA INDEXING FORENSIC SCIENTIST TRAINING MANUAL

TABLE OF CONTENTS

INTRODUCTION TO THE DNA INDEXING TRAINING MANUAL

The DNA Indexing training program has been designed to teach the Forensic Scientist the skills necessary for the DNA analysis of offender samples. Good working habits, technical skills, and the theory and methodology of the procedures and instrumentation necessary will be covered. Also included in this training are quality assurance and DNA guidelines which provide the framework for ensuring the high quality of DNA testing.

The DNA Indexing training program is designed to complement the DNA training program with some overlap in topic material. Subject matter to include safety, courtroom demeanor, and clean technique are covered in the DNA training program. There will be some overlap of materials, but it is all designed to build upon the knowledge base of the forensic aspect of DNA analysis. In addition, instructions for the trainer/facilitator and general orientation of new employees (i.e., topics such as: organization structure, chain of command, chemical hygiene plan, blood borne pathogen, general laboratory safety, ethics and security) are outlined in the Training Directives Manual. An individual in the DNA program may start at a training level position under direct supervision for a period that may exceed one year in duration. After the first year the position is considered a journeyman position which will expand upon the beginning level duties.

The individual in this position may be in the process of the DNA training program. The Forensic Scientist I will be required to maintain favorable public relations with user agencies and to testify in court concerning procedures and results of any DNA Indexing analysis.

For the Forensic Scientist that will be entering the DNA Indexing training program as part of an in-service training, goals are set by position description and depending where the analyst is in their career, expectations are high for self-direction and motivation. The analyst, as part of in-service training, has been performing at a level that exceeds beginning/introductory tasks. The analyst has been a viable partner to the success of the biology/ DNA unit and introductions to the DNA Indexing Laboratory will be minimal.

In keeping with the educational goals of the training program, it is essential that each individual, whether they are in a trainee status or are participating in an in-service training program, devote his or her full efforts to studies and assignments. Progress will be evaluated through assignments, trainee demonstration, written quizzes and tests, oral tests, practical tests, and proficiency samples. Training is divided into modules which will be covered in distinctive blocks of time. The goals and objectives to be covered during each module will be listed at the beginning of each chapter. Trainees who fail to maintain an acceptable level of academic progress will be appropriately counseled. Trainees who fail to remedy their academic standing after counseling shall be recommended for elimination from the training program following Academic Criteria in the CD.

In order to evaluate progress, an evaluation of performance will be made at appropriate intervals using CMS 201. For the individual in trainee status, monthly evaluations for six months will be performed to ensure both the supervisor and the trainee are aware of expectations, progress, and goals set for the trainee. For the individual in in-service status, quarterly evaluations will be performed. Good communication is essential to a successful training program; trainees are encouraged to offer input into their training program.

GENERAL OBJECTIVES

The general objectives include the following:

1. Teach the trainee the theories and techniques of DNA testing conducted in the Illinois State Police DNA Indexing Laboratory.

2. Teach the trainee to perform the proper procedures in the receipt, preservation, and analysis of samples.

3. Prepare the trainee for DNA court testimony.

4. Teach the trainee to maintain quality controls utilized in DNA testing.

5. Teach the trainee to technically and administratively document all paperwork properly and to develop acceptable proofing skills to ensure all files are properly maintained.

6. Have the trainee review literature in order to develop and maintain expertise relative to DNA analyses.

7. Have the trainee develop and maintain good working relations with laboratory staff and outside agencies.

8. Insure that the trainee meets all requirements specified in the relevant standards for analysts conducting DNA analysis for accreditation.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: PROGRAM OVERVIEW

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

1 Day

GOAL

To achieve the necessary general knowledge of the DNA Indexing Program.

OBJECTIVES

1. The trainee will demonstrate a general understanding of DNA Indexing Program by successfully passing an oral quiz. Successful completion will be determined by the trainer on a pass/fail basis.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the DNA Indexing Program.

Lectures: Indexing Program Overview – PowerPoint presentation

- Combined DNA Index System (CODIS) Hierarchy
- Offender Sample Receipt and Analysis Process
- Hit Verification and Reports
- Hit Confirmation

Exercise:

1. Read assigned materials.
2. Review lecture material.

Required Reading:

1. Portions of DNA Indexing Procedures Manual.
2. As assigned.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: CRIMINAL JUSTICE

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

4 Days

GOAL

To understand the terminology and definitions used in the criminal justice system and to specify the role of the forensic scientist.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the knowledge related to the criminal justice system by passing a written criterion test with a score no less than 80%.

LESSON 1

Estimated Time: 4 Days

Purpose: To familiarize the trainee with the terminology used in the Federal and State Criminal Justice System.

Lectures:
The Principles of the Criminal Justice System
Science of Identification

Exercise:
1. Read assigned materials.
2. Complete the Criminal Justice Study Guide.

Required Reading:

Moenssens, Andres, et al 1986 – Foundations Press, New York,
1. Scientific Evidence in Criminal Cases, pp. 2-73.
2. How to be an Effective Witness – A Guide for Witnesses in Criminal Cases.
3. Tuthill, Harold, The Philosophy and Principles of Identification, 1987, pp. 1-10, 45-58, 63-79.
4. On Being A Scientist, National Academy of Science, 1989, National Academy Press, pp. 1-22.

Supplemental References:
1. Black's Law Dictionary, 5th ed., 1979, West Publishing Co.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: INTRODUCTION TO DNA

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

1 Day

GOAL

To achieve the necessary knowledge and thorough understanding of DNA as it relates to forensics.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA as it relates to forensics by successfully passing a written criterion test with a score of no less than 80%. This criterion test may be given in conjunction with the topics covered under DNA extraction.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with DNA as it relates to forensics.

Lectures: Introduction of DNA – Overview of Topics

What is DNA
Where DNA is Found
Structure
- Nucleotide, purine, pyrimidine, A-G-C-T, gene, locus, chromosome
- nomenclature

Function
ISP DNA procedures, past and present
- Restriction Fragment Length Polymorphism (RFLP)
- Past PCR based methods – DQA1, Polymarker (PM), D1S80
- Short Tandem Repeats (STR)
- Mitochondrial (DNA)

Exercise:
1. Read assigned materials.
2. Review lecture material.

Required Reading:
1. Relevant scientific literature.

2. Relevant ISP Validation studies.

3. NRC I, Chapters 1 and 2.

4. NRC II, Chapters 1 and 2.

5. As assigned.

Supplemental References:

1. Relevant scientific literature.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: CLEAN TECHNIQUE

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual.

UNIT ESTIMATED TIME

2 Days

GOAL

To understand the importance of and the practice of clean technique used during DNA procedures.

OBJECTIVES

1. The trainee will demonstrate competency in the use of clean technique by completing a practical criterion test with a score of no less than 100%.

2. The trainee will demonstrate sufficient knowledge and skills required for proper clean technique. Successful completion will be determined by training coordinator observation on a pass/fail basis.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the clean technique procedures.

Lectures: Clean Technique – Overview of Topics

Decontamination of the Laboratory and Individual Work Areas
Cleaning Procedures of Laboratory Equipment
Clean Technique – Sample Processing
Policies for Amplification Set Up and Post PCR Product Processing Rooms

Exercise:

1. Read assigned materials.
2. Prepare general laboratory and individual work areas for sample analysis.

Required Reading:

1. Portions of the DNA Indexing Procedures Manual.

2. As assigned.

Supplemental References:

1. Relevant scientific literature.

ILLINOIS STATE POLICE

DNA INDEXING
TRAINING MANUAL

MODULE: REAGENT PREPARATION/CHEMICAL USE

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual.

UNIT ESTIMATED TIME

1 Day

GOAL

To achieve the necessary knowledge, skill and ability to properly prepare reagents for the DNA Indexing Laboratory.

OBJECTIVES

1. The trainee will demonstrate sufficient knowledge and skill required for proper reagent preparation and tracking during all phases of the DNA training. Successful completion will be determined by participation and training coordinator observation on a pass/fail basis.

2. The trainee will be aware of the safety hazards and requirements of safe handling for DNA chemicals and reagents. Successful completion will be determined by participation and training coordinator observation on a pass/fail basis.

3. The trainee will demonstrate a comprehensive understanding of proper reagent preparation/chemical use by successfully passing a written criterion test with a score of no less than 80%. This criterion test may be given in conjunction with the topics covered under quality assurance and DNA guidelines.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the procedures to prepare DNA laboratory reagents.

Lectures: Reagent Preparation
Documentation and Labeling Requirements of Prepared Reagents and Manufacturer Reagents/Chemicals
Safety Considerations for Hazardous Chemicals

Exercise:
1. Read assigned materials.
2. Identify and become familiar with hazardous chemicals found in "Safety Considerations" sections of the DNA Indexing Procedures Manual.
3. Review location of MSDS sheets.
4. Review reagent receipt and quality control tracking
5. Prepare reagents.

Required Reading:

1. MSDS sheets for hazardous chemicals.
2. As assigned.

Supplemental References:

1. Relevant scientific literature.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: SAMPLE RECEIPT

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual.

UNIT ESTIMATED TIME

2 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully perform offender sample receipt using the DNA Indexing procedures.

OBJECTIVES

1. The trainee will demonstrate competency in the DNA Indexing sample receipt procedures. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with offender sample receipt methods.

Lectures: Introduction to Sample Receipt – Overview of Topics and Demonstration

DNA Indexing Sample Collection Kit
Kit Submission/Receiving
Kit Processing
- Check in/Sample Receipt
- Data Entry
- Personal Identification File
- Sample Storage

Sample Redraws
Sample Duplicates
Sample Rejects

Exercise:
1. Read assigned materials.
2. Review lecture materials.
3. Perform sample receipt.

Required Reading:
1. Portions of DNA Indexing Procedures Manual.
2. As assigned.

Supplemental Reference:

1. Relevant scientific literature.

2. Collection Kit specifications.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: SAMPLE FILES

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual.

UNIT ESTIMATED TIME

1 Day

GOAL

To achieve the knowledge, skill and ability to successfully file offender sample documentation using the DNA Indexing procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA Indexing Sample Files by successfully passing a written quiz with a score of no less than 80%.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with offender sample files.

Lectures: Introduction to Sample Files – Overview of Topics and Demonstration

- Personal Identification Files
- Laboratory Analysis Files
- Sample Verification Files

Exercise:

1. Read assigned materials.
2. Review lecture material.

Required Reading:

1. Portions of DNA Indexing Procedures Manual.
2. As assigned.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: DNA QUALITY ASSURANCE STANDARDS

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

2 Days

GOAL

To achieve the necessary knowledge and develop thorough understanding of the history and background of the Illinois State Police Forensic Sciences Command quality assurance (QA) standards.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of the DNA QA standards by successfully passing a written criterion test with a score of no less than 80%.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the QA standards for DNA analysis.

Lectures:
SWGDAM
OSAC
FBI Quality Assurance Standards for Convicted Offender DNA Databasing Laboratories
NDIS Procedures
FBI Quality Assurance Audit for Forensic DNA and Convicted Offender DNA Databasing laboratories
National Research Council, DNA Technology in Forensic Sciences, 1992
National Research Council, Evaluation of Forensic DNA Evidence, 1996

Exercise:
1. Read assigned materials.
2. Review lecture material.
3. Complete DNA guidelines study guide.

Required Reading:
1. TWDGAM Guidelines (1989, 1991, 1995).
2. FBI Quality Assurance Standards for Convicted Offender DNA Databasing Laboratories.
3. NRC I, Chapter 4.

4. NRC II, Chapter 3.
5. NDIS Procedures (current version).
6. As assigned.

Supplemental Reference:

1. Relevant scientific literature.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: QUALITY ASSURANCE PROCEDURES

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual.

UNIT ESTIMATED TIME

3 Days

GOAL

To achieve the necessary knowledge, skills and ability to perform quality assurance procedures used in the DNA Indexing Laboratory.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA Indexing quality assurance procedures by successfully passing a written criterion test with a score of no less than 80%.

LESSON 1

Estimated Time: 3 Days

Purpose: To familiarize the trainee with the DNA Indexing quality assurance procedures.

Lectures: Introduction to Quality Assurance – Overview of Topics

- Goals and Objectives
- Organization and Management
- Personnel Qualifications and Training
- Sample Handling and Facility Requirements
- Sample Control
- Validations
- Analytical Procedures
- Equipment Calibration, Maintenance, and Monitoring
- Proficiency Testing
- Corrective Action
- Documentation
- Reviews
- Safety Audits

Exercise:

1. Read assigned materials.
2. Review lecture material.

Required Reading:

1. Portions of DNA Indexing Procedures Manual.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: SAMPLE PREPARATION, STORAGE PRESERVATION

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual
STaCS User's Manual

UNIT ESTIMATED TIME

5 Days

GOAL

To achieve the knowledge, skill and ability to perform sample receipt and data entry.

OBJECTIVES

1. The trainee will become familiar with kit submission, sample receipt and data entry.

2. The trainee will demonstrate the ability to perform sample receipt and data entry. Successful completion will be determined by training coordinator observation on a pass/fail basis.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with kit submission, sample receipt and data entry.

Lectures: Illinois Compiled Statutes Section 730 ILCS 5/5-4-3
- Kit Submission
- Kit Receipt
- Sample Storage
- Data Entry
- Rejects
- Filing PID Files

Exercise:
1. Read assigned materials.
2. Review lecture material.

Required Reading:
1. Portions of DNA Indexing Procedures Manual.

2. 730-ILCS 5/5-4-3 and Administrative Rules.

3. As assigned.

LESSON 2

Estimated Time: 2 Days

Purpose: Observe sample receipt and data entry.

LESSON 3

Estimated Time: 1 Day

Purpose: Demonstrate ability to perform sample receipt and data entry.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: DNA EXTRACTION

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual

UNIT ESTIMATED TIME

16 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully extract DNA from offender samples utilizing the DNA Indexing extraction procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA extraction by successfully completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate competency in extraction procedures by completing a practical criterion test with a score of no less than 100%.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the extraction of DNA.

Lectures: DNA Extraction – Overview of Topics
- Types of Extraction
  - Robotic
  - Manual
  - Direct Amp
- Reagent Components and Function of Reagents
- Controls During Extraction/Isolation
- Safety and Contamination Issues

Exercise:
1. Read assigned materials.
2. Review lecture material.
3. Prepare materials for lessons 2 and 3.

Required Reading:
1. Portions of DNA Indexing Procedures Manual.
2. ISP DNA Indexing Validation studies.
3. Instrument manuals.

4. Promega.

Supplemental Reference:

1. Relevant scientific literature.

2. As assigned.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with extraction of DNA from swabs using the Promega Casework DNA IQ method.

Lecture: Laboratory Demonstration – Casework DNA IQ Method

Exercises:

1. Read assigned materials.
2. Prepare extraction reagents.
3. Perform extractions.

Required Reading:

1. DNA Indexing Procedures Manual.

2. As assigned.

3. MaxPrep and Maxwell 16 Manual.

Supplemental Reference:

1. Relevant scientific literature

LESSON 3

Estimated Time: 10 Days

Purpose: To familiarize the trainee with extraction of DNA using manual procedures.

Lecture: Lab Demonstration – Extraction of DNA Using Organic Method

Exercises:

1. Read assigned materials.
2. Prepare extraction reagents.
3. Perform extractions.
4. Track samples in LIMS.

Required Reading:

1. DNA Indexing Procedures Manual.

2. As assigned.

LESSON 4

Estimated Time	14 Days
Purpose:	To familiarize the trainee with Direct Amplification procedures.
Lecture:	Lab Demonstration-Direct Amplification Pretreatment
Excercises:	1. Read assigned materials. 2. Pretreat swabs 3. Complete appropriate tracking in LIMS
Required Reading:	1. DNA Indexing Procedure Manual
Supplemental Reference:	1. Relevant scientific literature.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: DNA QUANTITATION

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual

UNIT ESTIMATED TIME

2 Days

GOAL

To achieve the necessary knowledge, skill and ability to successfully perform DNA quantitation using the DNA Indexing quantitation procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA quantitation by successfully completing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate competency in the DNA Indexing quantitation procedures by completing a practical criterion test with a score of no less than 100%.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with DNA quantitation theory and methodology.

Lectures: DNA Quantitation – Overview of Topics

- Purpose of Quantitation
- Yield Gel
- Limitations
- Standards/Controls
- Safety
- Interpretation of Results
- Documentation

Exercise:

1. Read assigned materials.
2. Review lecture material.

Required Reading:

1. Portions of DNA Indexing Procedures Manual.

Supplemental Reference:

1. Relevant scientific literature.

2. As assigned.

LESSON 2

Estimated Time: 1/2 Day

Purpose: To familiarize/review the trainee with DNA quantitation using the yield gel method.

Lecture: Laboratory Demonstration

Exercises:
1. Read assigned materials.
2. Perform yield gel.
3. Interpret results and document on appropriate worksheets.

Required Reading:
1. Portions of DNA Indexing Procedures Manual.
2. As assigned.

Supplemental Reference:
1. Relevant scientific literature

LESSON 3

Estimated Time: 1/2 Day

Purpose: To familiarize the trainee with dilution calculations in preparation for amplification.

Lectures: Preparation of Dilutions
Target Amount of DNA

Exercises:
1. Read assigned materials.
2. Prepare dilutions based on yield gel results.

Required Reading:
1. DNA Indexing Procedures Manual.
2. As assigned.

Supplemental References:
1. Relevant scientific literature.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: PCR AMPLIFICATION

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual

UNIT ESTIMATED TIME

5 Days

GOAL

To achieve the necessary knowledge, skill and ability to perform PCR amplification using the DNA Indexing amplification procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of PCR amplification by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate competency in the DNA Indexing amplification procedures. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

LESSON 1

Estimated Time: 2 Days

Purpose: To familiarize the trainee with PCR amplification theory and methodology.

Lectures: Introduction to PCR – Overview of Topics

- PCR – Indexing/Casework
- Multiplexing
- PCR Process
- PCR Inhibitors
- Amplification Kits
- Standards/Controls
- Contamination Issues
- Documentation
- ISP Thermal Cycler Amplification Conditions/Programs

Exercise:

1. Read assigned materials.
2. Review lecture material.

Required Reading:

1. DNA Indexing Procedures Manual.

2. Amplification Kit inserts.

3. Validation studies- Current amplification kit and parameters.

Supplemental Reference:

1. Relevant scientific literature.
2. Thermal Cycler operational manuals.
3. As assigned.

LESSON 2

Estimated Time: 3 Days

Purpose: To familiarize the trainee with the procedure for PCR amplification.

Lecture: Laboratory Demonstration – PCR Amplification Procedure

Exercises:

1. Read assigned materials.
2. Perform PCR amplification.

Required Reading:

1. DNA Indexing Procedures Manual.
2. As assigned.

Supplemental Reference:

1. Relevant scientific literature

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: STR ANALYSIS/ CAPILLARY ELECTROPHORESIS

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual

UNIT ESTIMATED TIME

39 Days

GOAL

To achieve the necessary knowledge, skill and ability to perform STR analysis using the DNA Indexing STR analysis procedures.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of DNA Indexing STR analysis and capillary electrophoresis by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate sufficient knowledge and skill in the DNA Indexing STR analysis procedures by completing training exercises for reproducibility/precision and sensitivity; and will submit written reports. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

3. The trainee will demonstrate competency in the maintenance and plate set up procedures by completing a practical criterion test with a score of no less than 100%.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with STR analysis/capillary electrophoresis theory and methodology.

Lectures:
STR Analysis/Capillary Electrophoresis
Sample Plate Preparation
Genetic Analyzers
Capillary Electrophoresis Process Genetic Analyzer
- Fill Capillary
- Detection
- Laser Excitation
- CCD Camera
- Computer Analysis of Data
- Benefits

Materials/Components
- Capillary Array

- Polymer
- Internal Lane Standard
- Allelic Ladder
- Instrument Parts

Software

- Data Collection
- Data Analysis

Spectral
Spatial
Filter Set
Computer Maintenance

Exercise:
1. Read assigned materials.
2. Review lecture material.
3.

Required Reading:
1. Portions of DNA Indexing Procedures Manual.
2. ISP DNA Indexing Validation studies.
3. Instrument Manuals.
4. Amplification Kit Manuals.

Supplemental Reference:
1. Relevant scientific literature.
2. As assigned.

LESSON 2

Estimated Time: 5 Days

Purpose: To familiarize the trainee with sample preparation and CE maintenance.

Lecture:
Laboratory Demonstration – Maintenance
Laboratory Demonstration – AB Data Collection
- Instrument Set Up/Manual Control Functions
- Sample Sheet
- Injection List
- Import Sample List

Sample Preparation

Exercises:
1. Read assigned materials.
2. Practice maintenance and procedures.

3. Prepare amplified samples and prepare the CE. Minimum number of runs to be determined by training coordinator.

Required Reading:

1. Portions of DNA Indexing Procedures Manual.
2. As assigned.

Supplemental Reference:

1. Relevant scientific literature

LESSON 3

Estimated Time: 3 Days

Purpose: To familiarize the trainee with data analysis procedures for STR analysis.

Lecture: Laboratory Demonstration -, OSIRIS

Exercises:

1. Read assigned materials.
2. Practice data analysis procedures, minimum number of projects to analyze to be determined by training coordinator.

Required Reading:

1. Portions of DNA Indexing Procedures Manual.
2. As assigned.

Supplemental Reference:

1. Relevant scientific literature.

LESSON 4

Estimated Time: 10 Days

Purpose: To familiarize the trainee with spectral matrix creation and interpretation.

Lectures: Evaluation of Matrix

- Matrix Table
- Positive Control
- Fluorescent Pull Up

Matrix Procedure
Report Criteria for Write Up of Exercises

Exercises:

1. Read assigned materials.
2. Review SWGDAM validation guidelines (developmental, internal).
3.

Review Quality Assurance Standards for Convicted Offender DNA
4. Databasing Laboratories, FBI.
5. Perform training exercises on Capillary Electrophoresis units. Turn in write ups.

Required Reading:

1. Portions of DNA Indexing Procedures Manual.
2. Relevant DNA Indexing Validation Studies.
3. As assigned.

Supplemental Reference:

1. Relevant scientific literature.

LESSON 5

Estimated Time: 10 Days

Purpose: To familiarize the trainee with reproducibility and precision.

Lectures:
Reproducibility/Precision Exercise
Peak Determination and Artifacts
- Fluorescent Artifact
- Stutter
- Fluorescent Pull Up
- Incomplete A Nucleotide Addition

Rerun Requirements

Exercises:

1. Read assigned materials.
2. Perform training exercises.
3. Turn in write up.

Required Reading:

1. Portions of DNA Indexing Procedures Manual.
2. As assigned.

Supplemental Reference:

1. Relevant scientific literature.

LESSON 6

Estimated Time: 10 Days

Purpose: To familiarize the trainee with the sensitivity limits (high and low) and the optimum DNA target for amplification.

Lecture:	Sensitivity Overview: - High Target Amount - Low Target Amount
Exercises:	1. Read assigned materials. 2. Perform sensitivity validation exercises. 3. Turn in write up.
Required Reading:	1. Portions of DNA Indexing Procedures Manual.
Supplemental References:	1. Relevant scientific literature.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: DNA INTERPRETATION AND VERIFICATIONS

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual

UNIT ESTIMATED TIME

6 Days

GOAL

To achieve the necessary knowledge, skill and ability to interpret DNA profiles and accurately report data obtained for verification purposes.

OBJECTIVES

1. The trainee will demonstrate a comprehensive understanding of STR interpretation as it relates to offender databasing by successfully passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate sufficient knowledge and skill in offender sample STR interpretation, and verification procedures by completing interpretation and verification procedures by completing interpretation on mock verification exercises and submitting acceptable documentation. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

LESSON 1

Estimated Time: 6 Days

Purpose: To familiarize the trainee with interpretation, statistics, and population genetics as applied to forensic databasing.

Lectures:

Interpretation

A. Peak Definition
B. Evaluation of Electropherogram
   - Inhibition/Degradation Effects
   - Single Source
   - Mixtures
C. Technical Review – Documentation on Review Table or in OSIRIS

Statistics/Population Genetics
Statistics Programs Utilized by ISP and ISP Procedures

Exercises:

1. Read assigned materials.
2. Review lecture material.
3. Complete interpretation on mock verifications.
4. Generate letters for sample verifications.

Required Reading:

1. Portions of DNA Indexing Procedures Manual.
2. NRC I, Chapter 3.
3. NRC II, Chapter 5.
4. As assigned.

Supplemental Reference:

1. Relevant scientific literature.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: ACCESS TO DATA

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual

UNIT ESTIMATED TIME

2 Days

GOAL

To achieve the knowledge, skill and ability to understand the policies for access to offender data and information.

OBJECTIVES

1. The trainee will demonstrate competency in DNA Indexing data access and information procedures by passing a written quiz with a score of no less than 80%.

LESSON 1

Estimated Time:	2 Days
Purpose:	To familiarize the trainee with policies and procedures for access to offender data and information.
Lectures:	Introduction to Access of Data and Information – Overview of Topics General Access to Samples and Data Participation in the Index Expungement
Exercises:	1. Read assigned materials. 2. Review lecture material.
Required Reading:	1. Portions of DNA Indexing Procedures Manual. 2. 730 ILCS 5/5-4-3 and Administrative Rules.
Supplemental Reference:	1. Relevant scientific literature. 2. As assigned.

ILLINOIS STATE POLICE

DNA INDEXING
TRAINING MANUAL

MODULE: COMBINED DNA INDEX SYSTEM (CODIS)

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual

UNIT ESTIMATED TIME

5 Days

GOAL

To achieve the knowledge, skill and ability to perform CODIS procedures.

OBJECTIVES

1. The trainee will demonstrate sufficient knowledge and skill required for performing CODIS procedures. Successful completion will be determined by training coordinator observation on a pass/fail basis.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the use of CODIS.

Lecture: CODIS

Exercises:

1. Read assigned materials.
2. Review lecture material.
3. Complete CODIS exercise(s).
   - Import files
   - Import minimum of two batches of samples analyzed in-house.
   - Import minimum of two batches of samples from contractor.

Required Reading:

1. DNA Indexing Procedures Manual.
2. NRC 1, Chapters 5 and 6.
3. NRC II, Chapter 5, relevant sections.

Supplemental Reference:

1. Relevant scientific literature.
2. NDIS Procedures Manual, QAS section.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: COURTROOM TRAINING/LEGAL ISSUES

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

5 Days

GOAL

To achieve the knowledge, skill and ability to successfully perform courtroom testimony and to become familiar with the legal aspects of offender sample DNA analysis.

OBJECTIVES

1. The trainee will become familiar with the legal aspects of offender sample DNA databasing. Successful completion will be determined by training coordinator evaluation on a pass/fail basis.

2. The trainee will demonstrate effective DNA expert witness testimony that is simple, concise, and accurate by successfully completing at least one DNA Indexing mock trial. Successful completion will be determined by training coordinator observation on a pass/fail.

LESSON 1

Estimated Time: ½ Day

Purpose: To familiarize the trainee with the legal aspects of DNA court testimony and the procedures for discovery.

Lectures:
Legal Aspects of DNA Databasing
Court Decisions and Statute Challenges
Discovery Procedures and Databasing Laws

Exercises:
1. Read assigned materials.
2. Review lecture material.

Required Reading:
1. Portions of Command Directives Manual.
2. NRC 1, Chapters 6 and 7.
3. NRC II, Chapter 6.

Supplemental Reference:

1. Relevant scientific literature.

LESSON 2

Estimated Time: 4 ½ Days

Purpose: To prepare for DNA court testimony and successfully complete mock trial.

Lectures: Qualifying Questions
Direct Questions

Exercises:

1. Read assigned materials.
2. Prepare a set of DNA qualifying court questions.
3. Prepare a set of DNA direct court questions.
4. Participate in practice sessions for cross examination testimony.
5. Participate in practice sessions for DNA court testimony.
6. Mock Trial.

Required Reading:

1. As assigned.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: NON-PROBATIVE SAMPLE ANALYSIS

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual

UNIT ESTIMATED TIME

10 Days

GOAL

To achieve the knowledge, skill and ability by way of practical experience for conducting offender sample analysis and adhering to the DNA Indexing procedures.

OBJECTIVES

1. The trainee will demonstrate sufficient knowledge and skill required to conduct DNA analysis of offender samples. Successful completion will be determined by training coordinator observation on a pass/fail basis and by obtaining the correct DNA types.

2. The trainee will demonstrate sufficient knowledge and skill required to complete a thorough review on his/her own analysis and the technical review of his/her peers analysis.

LESSON 1

1. A minimum number of samples must be analyzed; any additional samples assigned will be determined by training coordinator.

2. The trainee must technically review a minimum number of samples. Additional samples may be assigned as determined by training coordinator.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

MODULE: SUPERVISED SAMPLE ANALYSIS

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

PROCEDURAL REFERENCE

DNA Indexing Procedures Manual

UNIT ESTIMATED TIME

1 Month

GOAL

To achieve the knowledge, skill and ability to conduct offender sample DNA analysis adhering to the DNA Indexing procedures.

OBJECTIVES

1. The trainee will demonstrate the knowledge and skill required to conduct DNA analysis of offender samples in an independent manner according to the DNA Indexing Procedures Manual. Successful completion will be determined by training coordinator observation on a pass/fail basis.

    A. The trainee will demonstrate the knowledge and skill required to complete a thorough technical review on his/her own analysis and the analysis of his/her peers.

    B. The trainee will develop and demonstrate the knowledge and skill required to effectively manage in a productive manner all facets of offender sample analysis, which includes, but is not limited to, analysis/interpretation/letter generation and CODIS import, participating in the quality control/quality assurance procedures in the laboratory, responding to legal/discovery issues, and other duties required for offender sample management.

    C. The trainee will maintain favorable public relations with user agencies and testify in court concerning the procedures and results of their offender sample DNA analysis.

LESSON 1

1. A minimum number of samples must be completed. Additional samples may be required if the trainee demonstrates a difficulty with any aspect of casework including, but not limited to, interpretation, analytical work, productivity, case management, and excessive technical review points.

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

APPENDIX A-1: TRAINING CHECKLIST

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INITIAL FORENSIC SCIENCE TRAINING CHECKLIST
DNA INDEXING

Trainee: _____ Coordinator: _____

Training Start Date: _____ Training End Date: _____

Module	Completion Date	Trainee Initials	Coordinator Initials
Program Overview			
Criminal Justice			
Introduction to DNA			
Clean Technique			
Reagent Preparation / Chemical Use			
Sample Receipt			
Sample Files			
DNA Quality Assurance Standards			
Quality Assurance Procedures			
Sample Preparation, Storage, Preservation			
DNA Extraction			
DNA Quantitation			
PCR Amplification			
STR Analysis / Capillary Electrophoresis			
Data Interpretation and Verifications			
Access to Data			
Combined DNA Index Systems			
Courtroom Training/Legal Issues			
Non-Probative Sample Analysis			
Supervised Sample Analysis			

If a module was not completed, mark it as "NC" ("Not completed').

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

APPENDIX A-2: AUTHORIZATIONS BASED ON SCOPE

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

AUTHORIZATIONS BASED ON SCOPE

Field of Testing: Forensic Testing Forensic Scientist: _____
Category: Biology

Sub Catergory: Biological Screening

DNA Analysis for CODIS Databasing	Authorized
6.4 General Laboratory Procedures: General Laboratory Techniques	
7.1.1 Genetic Analysis: DNA-PCR: Autosomal STR – PowerPlex 16	
7.1.2 Genetic Analysis: DNA—PCR: YSTR – PowerPlex Y23	
7.2 Genetic Analysis: Data Analysis	
7.3 Genetic Analysis: Population Database	
8.1 Electrophoresis: Capillary	

These are the areas under which I am authorized to conduct casework.

_____
Forensic Scientist / Date

_____
Training Coordinator / Date

_____
Director of Training / Date

ILLINOIS STATE POLICE

DNA INDEXING TRAINING MANUAL

APPENDIX B: BIBLIOGRAPHY

Reviewed by:

Ashley Y. Flack
DNA Indexing Technical Leader

Approved by:

William E. Demuth II
Director of Training

DNA Training Bibliography

Isolation Readings:

1. Adams, D. E., Presley, L. A., Baumstark, A. L., Hensley, K. W., Hill, A. L., Anoe, K. S., Campbell, P. A., Mclaughlin, C. M., Budowle, B., and Giusti, A. M., "Deoxyribonucleic Acid (DNA) Analysis by Restriction Fragment Length Polymorphisms of Blood and Other Body Fluid Stains Subjected to Contamination and Environmental Insults." Journal of Forensic Sciences, 1991, Vol. 36, No. 5, pp. 1284-1298.

2. Baechtel, F. S., "Recovery of DNA from Human Biological Specimens." Crime Laboratory Digest, October 1998, Vol. 15, No. 4, pp. 95-96.

3. Bar, W., Kratzer, A., Machler, M., Schmid, W., "Postmortem Stability of DNA." FSI, 1988, Vol. 89, pp. 59-70.

4. Beroldingen, C. H., Sensabaugh, G. F., "Forensic DNA Analysis." Tieline, Vol. 12, No. 1, pp. 28-43.

5. Brauner, P., Gallili, N., "A Condom - The Critical Link in a Rape." Journal of Forensic Science, 1993, Vol. 38, No. 5, pp.1233-1236.

6. Budowle, B., Baechtel, F. S., Adams, D. E., "Validation with Regard to Environmental Insults of the RFLP Procedure for Forensic Purposes." FBI Internal Publication.

7. Chen, J., Kobilinsky, L., Wolosin, D., Shaler, R., Baum, H., "A Physical Method for Separating Spermatozoa from Epithelial Cells in Sexual Assault Evidence." Journal of Forensic Sciences, 1998, Vol. 43, No. 1, pp. 114-118.

8. Fowler, J. C., Burgoyne, L. A., Scott, A. C., and Harding, H. W., "Repetitive Deoxyribonucleic Acid (DNA) and Human Genome Variation: A Concise Review Relevant to Forensic Biology." Journal of Forensic Sciences, 1988, Vol. 33, pp. 1111-1126.

9. Frank, W. E., Llewellyn, B. E., "A Time Course Study on STR Profiles Derived from Human Bone, Muscle, and Bone Marrow." Journal of Forensic Sciences, 1999, Vol. 4, pp. 778-782.

10. Gautreau, C., Rahuel, C., Cartron, J., Lucotte, G., "Comparison of Two Methods of High Molecular Weight DNA Isolation from Human Leucocytes." Analytical Biochemistry, 1983, Vol. 134, pp. 320-324.

11. Griese, J. S., Linder, S., "DNA Extraction for PCR: Phenol/Chloroform vs. Chelex – A Comparative Study." Advances in Forensic Haemogenetics, Vol. 5, pp. 167-169.

12. Hockmeister, M. N., Budowle, B., Baechtel, F. S., "Effects of Presumptive Test Reagents on the Ability to Obtain Restriction Fragment Length Polymorphism Patterns from Human Blood and Semen Stains." Journal of Forensic Sciences, 1991, Vol. 36, No. 3, pp. 656-661.

13. Hockmeister, M. N., Budowle, B., Borer, U. V., Dirnhofer, R., "Effects of Nonoxinol-9 On The Ability to Obtain DNA Profiles from Postcoital Vaginal Swabs," Journal of Forensic Sciences, 1993, Vol. 38, No. 2, pp. 442-447.

14. Hockmeister, M. N., Budowle, B., Borer, U. V.,Eggmann, U., Comey, C. T., Dirnhofer, R., "Typing of Deoxyribonucleic Acid Extracted from Compact Bone from Human Remains," Journal of Forensic Sciences, 1991, Vol. 36, No. 6, pp. 1649-1661.

15. Honma, M., Yoshii, T., Ishlyama, L., Mitania, K., Kominami, R., Muramatsu, M., "Individual Identification from Semen by the Deoxyribonucleic Acid Fingerprint Technique," Journal of Forensic Sciences, 1989, Vol. 34, No. 1, pp. 222-227.

16. InMan, K. P., Brewer, L. M., Horne, M. E., Pierson, M. L., "DNA Extraction by Organic and Non-Organic Procedures from Bloodstains Dried on Cotton Cloth and Filter Paper," Presentation American Academy of Forensic Sciences, February 21, 1991.

17. Laber, T. L., Giese, S. A., Iverson, J. T., Liberty, J. A., "Validation Studies on the Forensic Analysis of Restriction Fragment Length Polymorphism on LE agarose Gels Without Ethidium Bromide: Effects of Contaminants, Sunlight, and the Electrophoresis of Varying Quantities of Deoxyribonucleic Acid," Journal of Forensic Sciences, 1994, Vol. 39, No. 3, pp. 707-730..

18. Laber, T., O'Connor, J. M., Iverson, J. T., Liberty, J. A., Bergman, D. L., "Evaluation of Four Deoxyribonucleic Acid Extraction Protocols for DNA Yield and Variation in Restriction Fragment Length Polymorphism Sizes Under Varying Gel Conditions," Journal of Forensic Sciences, 1992, Vol. 37, No. 2, pp. 404-424.

19. Lee, H. C., Gaensslen, R. E., Guman, M. B., Berka, K. M., Keith, T. P>, Phillipps, P., "The Effect of Presumptive Test, Latent Fingerprint and Some Other Reagents and Materials on Subsequent Serological Identification, Genetic Marker and DNA Testing in Bloodstains," Journal of Forensic Identification, 1999, Vol. 39, No. 6, pp. 339-357.

20. Lienert, K., Fowler, C. S., "Analysis of Mixed Human/Microbial DNA Samples: A Validation Study of Two PCR AMP-FLP Typing Methods," BioTechniques, 1992, Vol. 13, No. 2, pp. 276-281.

21. Marmur, J. "A Procedure for the Isolation of Deoxyribonucleic Acid from Micro Organisms." J. Mol. Biol., 1961, No 3, pp. 208-218.

22. McNally,L., Shaler,R., Baird,M., Balazs,I.,DeForest,P., Kobininsky,L. "Evaluation of Deoxyribonucleic Acid Isolated from Human Bloodstains Exposed to Ultraviolet Light, Heat, Humidity, and Soil Contamination." Journal of Forensic Sciences, 1989, Vol 34, No 5, pp. 1059-1069.

23. McNally,L., Shaler,R., Baird,M., Balazs,I.,DeForest,P., Kobininsky,L. " The Effects of Environment and Substrata on Deoxyribonucleic Acid: The Use of Casework Samples from New York City." Journal of Forensic Sciences, 1989, Vol 34, No 5, pp. 1070-1077.

24. Montagna, C.P., "The Recovery of Seminal Components and DNA from the Vagina of a Homicide Victim 34 Days Postmortem." Journal of Forensic Sciences, Vol 41, No 4, pp. 700-702.

25. Ross.A.M., Harding,H.J. "DNA Typing and Forensic Science." Forensic Science International, 1989, Vol 41, pp. 187-203.

26. Roy, R., Burghoff,R., Steffens, D. "Detection of STR, D1S80, and Gender Alleles From Body Fluids Collected on IsoCode Foam Collectors and Paper Based Devices." Crime Laboratory Digest, 1997, Vol 24, No 1, pp. 4-9.

27. Scherczinger, C.A., Bourke, M. T., Ladd, C., Lee, H.C. "DNA Extraction from Liquid Blood Using QIAMP." Journal of Forensic Sciences, 1997, Vol 42, No 5, pp. 893-896.

28. Stein, C., Kyeck, S., Henssge, C. "DNA Typing of Fingerprint Reagent Treated Biological Stains." Journal of Forensic Sciences, 1996, Vol 41, No 6, pp. 1012-1017.

29. Walls, C., “Effects of Latent Print Technology on PCR DNA Analysis.” Unknown Publication.

30. Walsh, P.S., Metzger,D.A., Higuchi,R. “Chelex 100 as a Medium for Simple Extraction of DNA for PCR Based Typing from Forensic Material.” BioTechniques, 1991, Vol 10, No 4, pp. 506-513.

31. Walsh, P.s., Varlaro, J. , Reynolds, R. “A Rapid Chemiluminescent Method for Quantitation of Human DNA. Nucleic Acids Research, Vol 20, No 19, pp. 5061-5065.

32. Waye, J.S., Michaud, D., Bowen, J.H., Fourney, R.M. “Sensitive and Specific Quantification of Human Genomic Deoxyribonucleic Acid in Forensic Science Specimens: Casework Examples.” Journal of Forensic Sciences, 1991, Vol 36, No 4, pp. 1198-1203.

33. Waye, J. S., Presley, L. A., Budowle, B., Shutler, G. G., and Fourney, R. M. “A Simple and Sensitive Method for Quantifying Human Genomic DNA in Forensic Specimen Extracts.” BioTechniques, 1989, Vol 7, No 8, pp. 852–865.

34. Webb, M.T., Williams, N.J., Sutton, M.D. “Microbial DNA Challenge Studies of Variable Number Tandem Repeat Probes Used for DNA Profiling Analysis.” Journal of Forensic Sciences, 1993, Vol 38, No 5, pp. 1172-1175.

35. Whitehead, Thomas P., Thorpe, G.G, Carter, T.N, Groucutt, C, Kricka, L.J. “Enhanced Luminescence Procedure for Sensitive Determination of Peroxidase Labeled Conjugates in Immunoassay.” Nature , 1983, Vol 305, No 8, pp. 158-159.

36. Zeugin, J.A., Hartley, J.L. “Ethanol Precipitation of DNA: Focus on Ethanol Precipitation.” Unknown publication.

Amplification Readings:

1. Bell, J. “The Polymerase Chain Reaction.” Immunology Today, 1989, Vol 10, No 10.

2. Brownstein, M.J., Carpten, J.D., Smith,J.R. “Modulation of Non Templated Nucleotide Addition by Taq DNA Polymerase: Primer Modifications that Facilitate Genotyping.” Biotechniques, 1996, Vol 20, No 6, pp. 1005-1010.

3. Haff. L.A. “Minimizing PCR Amplification Failures: Good Operating Practices.” Amplifications a Perkin Elmer publication, pp. 15-16.

4. Hodgson, J. “The Whys and Wherefores of DNA Amplification.” Biotechnology, 1993, Vol 11, pp. 940-942.

5. Magnuson, V.L., Ally, D.S., Nylund, S.J., Karanjawala, Z.E., Rayman, J. B., Knapp, J.I., Lowe, A.L., Ghosh, S., Collins, F.S. “Substrate Nucleotide Determined Non Templated Addition of Adenine by Taq DNA Polymerase Implications for PCR Based Genotyping and Cloning.” Biotechniques, 1996, Vol 21, No 4, pp. 700-709.

6. Keohavong,P., Thilly, W.G., “Fields of DNA Polymerases in DNA Amplification.” Proc. Natl. Acad. Sci. USA, 1989, Vol 86, pp. 9253-9257.

7. Krawczak, M., Reiss, J., Schmidtke,J., Rosler,U. “Polymerase chain reaction: replication errors and reliability of gene diagnosis.” Nucleic Acids Research, 1989, Vol 17, No 6, pp. 2197-2201.

8. Marx, J. “Multiplying Genes by Leaps and Bounds.” Science, 1988, Vol 240, pp. 1408-1410.

9. Mezei, L.M. “Effect of Oil Overlay on PCR Amplification.” Amplifications a Perkin Elmer publication, pp. 11-14.

10. Mullis, K.B. “The Unusual Origin of the Polymerase Chain Reaction.” Scientific American, 1990, April, pp. 56-65.

11. Oste, C. “Polymerase Chain Reaction.” Biotechniques, 1988, Vol 6 pp. 162-167.

12. Reynolds, R., Sensabaugh, G., and Blake, E. “Analysis of Genetic Markers in Forensic DNA Samples Using the Polymerase Chain Reaction.” Analytical Chemistry, 1991, Vol 63, No 1, pp.2-15.

13. Rodu, B. “Molecular Biology in Medicine The Polymerase Chain Reaction: The Revolution Within.” The American Journal of the Medical Sciences, 1990, Vol 299, No 3, pp. 210-216.

14. Roux, C., Gill, K. Sutton, J. Lennard, C. “A Further Study to Investigate the Effect of Fingerprint Enhancement Techniques on the DNA Analysis of Bloodstains.” JFI, 1999, Vol 49, No 4, pp. 357-376.

15. Scherczinger CA, Ladd, C, Bourke, M.T., Adamowics MS, Johannes PM, Scherczinger R, Beesley T, Lee HC. “A Systematic Analysis of PCR Contamination.” JFS, 1999, Vol 44, No 5, pp. 1042-1045.

16. Tindall, K.R., Kunkel, T.A., “Fidelity of DNA Synthesis by the Thermus Aquaticus DNA Polymerase.” Biochemistry, 1988, Vol 27, pp. 6008-6013.

17. Vosberg, H.P. “The Polymerase Chain Reaction: An Improved Method for the Analysis of Nucleic Acids.” Human Genetics, 1989, No 83, pp. 1-15.

18. Wages, J.M., Fowler, A.K. “Amplification of Low Copy Number Sequences.” Amplifications a Perkin Elmer publication, 1993, Issue 11, pp. 1-3.

19. Walsh, P..S., Erlich, H. A., Higuchi, R. “Preferential PCR Amplification of Alleles: Mechanisms and Solutions.” OCR Methods and Applications, 1992 Vol 1, pp. 241-250.

20. White, T.J., Arnheim, N., Erlich, H.A. “The Polymerase Chain Reaction.” Technical Focus. Unknown publication date and page numbers.

21. Williams, J.F., Anderson, M. S. “Understanding Temperature Dynamics in PCR Reaction Tubes.” Amplifications a Perkin Elmer publication, unknown date pp. 14-15.

Capillary Electrophoresis Reading List:

1. LaFountain, M., Schwartz, M., Cormier, J., Buel, E. “Validation of Capillary Electrophoresis for Analysis fo the X-Y Homologous Amelogenin Gene.” Journal of Forensic Science, 1998, Vol 43, No 6, pp. 1188-1194.

2. Landers,J.P. Handbook of Capillary Electrophoresis CRC Press, Second Edition.

3. Landers,J.P., Oda, R.P., Spelsberg, T.C., Nolan, J.A., Ulfelder, K.J. “Capillary Electrophoresis: A Powerful Microanalytical Technique for Biologically Active Molecules.” BioTechniques, 1993, Vol 14, No 1, pp. 98-111.

4. McCord, B.R., Buel, E. Capillary Electrophoresis in Forensic Biology. Presentation Paper.

STR Readings:

1. Alford R.L., Hammond, H. A., Coto, I. , Caskey C.T. "Rapid and Efficient Resolution of Parentage by Amplification of Short Tandem Repeats". American Journal of Human Genetics, 1994, Vol 55, pp. 190-195.

2. An Introduction to Capillary Electrophoresis. BioRad publication.

3. Budowle, B., Moretti, T. R., Keys, K. M., Koons, B. W., and Smerick, J. B. "Validation Studies of the CTT STR Multiplex System." Journal of Forensic Sciences, 1997, Vol 42, No. 4, pp.701–707.

4. Buel,E., Schwartz,M.B., LaFountain, M.J., "Capillary Electrophoresis STR Analysis: Comparison to Gel Based Systems." Journal of Forensic Sciences, 1998, Vol 43, No 1, pp. 164-170.

5. Butler, J. M. "Forensic DNA Typing: Biology and Technology Behind STR Markers." Academic Press, San Diego, California, 2001.

6. Chakraborty, R. "Statistical Interpretation of DNA Typing Data", American Journal of Human Genetics (1991) 49(4):895-897, 899–903.

7. Chakraborty, R. and Kidd, K. K. "The Utility of DNA Typing in Forensic Work", *Science* (1991) 254:1735–1739.

8. Clayton, T.M., Whitaker, J.P., Sparkes, R., Gill, P. "Analysis and Interpretation of Mixed Forensic Stains Using DNA STR Profiling." FSI, 1998, Vol 91, pp. 55-70.

9. Crouse, C. A., Rogers, S., Amiott, E., Gibson, S., and Masibay, A. "Analysis and Interpretation of Short Tandem Repeat Microvariants and Three-banded Allele Patterns Using Multiple Allele Detection Systems", Journal of Forensic Sciences (1999) 44:87–94.

10. Crouse, C. A. and Schumm, J. "Investigation of Species Specificity Using Nine PCR-Based Human STR Systems." Journal of Forensic Sciences, 1995, Vol 40, pp. 952–956.

11. Edwards, A., Civitello, A., Hammond, H., and Caskey, C. T. "DNA typing and genetic mapping with trimeric and tetrameric tandem repeats", American Journal of Human Genetics (1991) 49:746–756.

12. Evett,I.W, Gill, P.D., Lambert, J.A., "Taking Account of Peak Areas when Interpreting Mixed DNA Profiles." Journal of Forensic Sciences, 1998, Vol 43, No 1, pp. 62-69.

13. Finis, C.J., "Megaplex STR Analysis from a Single Amplification: Validation of the PowerPlex 16 System." Profiles in DNA, January 2001, Promega publication.

14. Frank, W.E., Llewellyn, B.E., Fish, P.A., Riech, A.K., Marcacci, T.L., Gndor, D.W., Parker, D., Carter, R.R., Thibault, S.M. "Validation of the AmpFlSTR Profiler Plus PCR Amplification Kit for Use in Forensic Casework." Journal of Forensic Sciences, 2001, Vol 46, No 3, pp. 642-646.

15. Fregeau, C.J., Fourney, R.M. "DNA Typing with Fluorescent Tagged Short Tandem Repeats: A Sensitive and Accurate Approach to Human Identification." Biotechniques, 1993, Vol 15, No 1, pp. 100- 119.

16. Gill, P., Kimpton,C,DAloja,E.D., Anderson, J.F., Bar,W., Brinkmann,B., Holgersson,S., Johnsonn, V., Kloosterman, A.D., Lareu, M.V., Nellemann, L., Pfitzinger, H., Phillips, C.P., Schmitter, H., Schneider, P.M., Stenersen, M. "Report of the European DNA Profiling Group (EDNAP) Towards Standardization of Short Tandem Repeat (STR) Loci." FSI , 1994, Vol 65, pp. 51-59.

17. Gill, P., Sparkes, R., Kimpton, C. "Development of Guidelines to Designate Alleles Using an STR Multiplex System." FSI, 1997, Vol 89, pp. 185-197.

18. Giusti, A. M., Baird, M., Pasquale, S., Balasz, I., and Glassberg, G. "Application of deoxyribonucleic acid (DNA) polymorphisms to the analysis of DNA recovered from sperm", Journal of Forensic Sciences (1986) 31:409–417.

19. Hague, X.Y., Litt, M. "Study of the Origin of Shadow Bands Seen When Typing Dinucleotide Repeat Polymorphisms by the PCR." Human Molecular Genetics, 1993, Vol 2, No 4, pp. 411-415.

20. Hammond, H. A., Jin, L., Zhong, Y., Caskey, C. T., and Chakraborty, R. "Evaluation of 13 short tandem repeat loci for use in personal identification applications", American Journal of Human Genetics (1994) 55:175–189.

21. Higuchi, R., von Beroldingen, C. H., Sensabaugh, G. F., and Erlich, H. A. "DNA Typing from Single Hairs", Nature (1988) 332:543–546.

22. Hochmeister, M. N., Budowle, B., Eisenberg, A., Borer, U. V., and Dirnhofer, R. "Using Multiplex Pcr Amplification and Typing Kits for the Analysis of Dna Evidence in a Serial Killer Case", Journal of Forensic Sciences (1996).

23. Ishino,Y., Mineno, J., Inoue, T., Fujimiya, H., Yamamoto, K., Tamura, T., Homma, M. , Tanaka, K. , Kato, I., "Practical Applications in Molecular Biology of Sensitive Fluorescence Detection by a Laser Excited Fluorescence Image Analyzer." BioTechniques, 1992, Vol 13, No 6.

24. Johnson, I.D., "Introduction to Fluorescence Techniques." Molecular Probes publication.

25. Kimpton, C., Fisher,D., Watson, S., Adams, M. Urquhard,A., Lygo, J. , Gill, P. "Evaluation of An Automated DNA Profiling System Employing Multiplex Amplification of Four Tetrameric STR Loci." Int. J. Leg. Med., 1994.

26. Lins, A. M., Sprecher, C. J., Puers, C., and Shumm, J. W. "Multiplex Sets for the Amplification of Polymorphic Short Tandem Repeat Loci B Silver Stain and Fluorescent Detection." BioTechniques, 1996. Vol 20, pp. 882–889.

27. Lygo, J. E., Johnson, P.E., Holdaway, D.J., Woodroffe, S., Whitaker, J.P., Claton, T.M., Kimpton, C.P., Gill, P. "The Validation of Short Tandem Repeat (STR) Loci For Use in Forensic Casework." Int. J. Legal Med., 1994, Vol 107, pp. 77-89.

28. Recent Advances in Fluorescence Labeling, Detection, and Visualization. BioRad publication.

29. Robertson,J., Sgueglia, A, Badger, C., Juston, A, Ballantyne, J. "Forensic Applications of a Rapid , Sensitive, and Precise Multiplex Analysis of the Four Short Tandem Repeat Loci HUMVWF31A/HUMTH01, HUMF13A1, and HUMFES/FPS." Electrophoresis, 1995, Vol 16, pp. 1568-1576.

30. Sprecher, S.J., Puers, C., Lins, A.M., Schumm, J.W., "General Approach to Analysis of Polymorphic Short Tandem Repeat Loci." BioTechniques, 1996, Vol 20, No 2.

31. Wallin, J.M., Buoncristiani, M.R., Lazaruk, K. D., Fildes, N. , Holt, C.L., Walsh, P.S., "TWGDAM Validation of the AmpFLSTR Blue PCR Amplification Kit for Forensic Casework Analysis." Journal of Forensic Science, 1998, Vol 43, No 4.

32. Walsh, P. S., Fildes, N. J., and Reynolds, R. "Sequence Analysis and Characterization of Stutter Products at the Tetranucleotide Repeat Locus vWA." Nucleic Acids Research, 1996, Vol 24, pp. 2807–2812.

Population Statistics Readings:

1. Balding, D.J., Donnelly, P. "Evaluating DNA Profile Evidence When the Suspect is Identified Through a Database Search." Journal of Forensic Sciences, 1996, Vol 41, No 4, pp. 603-607.

2. Budowle, B., Giusti, A. M., Waye, J. S., Baechtel, F. S., Fourney, R. M., Adams, D. E., Presley, L. A., Deadman, H. A., and Monson, K. L. "Fixed-bin Analysis for Statistical Evaluation of Continuous Distributions of Allelic Data From VNTR Loci for Use in Forensic Comparisons." American Journal of Human Genetics, 1991, Vol 48, No 5, pp. 841–855.

3. Budowle, B., Moretti, T., Baumstark, A.L., Defenbaugh, D.A., Keys, K.M. "Population Data on the Thirteen CODIS Core Short Tandem Repeat Loci in African Americans, U.S. Caucasians, Hispanics, Bahamians, Jamaicans, and Trinidadians." Journal of Forensic Sciences, 1999, Vol. 44, No 6, pp. 1277-1286.

4. Chakraborty, R. "Sample Size Requirements for Addressing the Population Genetic Issues of Forensic Use of DNA Typing." Human Biology, 1992, Vol 64, No 2, pp. 141–159.

5. Devlin, B., Risch, N., and Roeder, K. "Comments On the Statistical Aspects of the NRC's Report on DNA Typing." Journal of Forensic Sciences, 1994, Vol 39, No 1, pp. 28–40.

6. Huston, K.A. "Statistical Analysis of STR Data." Profiles in DNA, 1998, Promega Publication.

7. Lander, E. "Invited Editorial: Research on DNA Typing Catching Up with Courtroom Application." Am. J. Hum. Genet., 1991, Vol 48, pp. 819-823.

8. Lander, E. S. and Budowle, B. "DNA Fingerprinting Dispute Laid to Rest." Nature, 1994, Vol 371, pp. 735–738.

9. Lewontin, R. C. and Hartl, D. L. "Population Genetics in Forensic DNA Typing." Science, 1991, Vol 254, pp. 1745–1750.

Quality Assurance Readings:

1. Committee on DNA Forensic Science, National Research Council. "DNA Technology in Forensic Science". National Academy Press, Washington, DC, 1992.

2. Committee on DNA Forensic Science, National Research Council. "An Update: The Evaluation of Forensic DNA Evidence". National Academy Press, Washington, DC, 1996.

3. DNA Advisory Board. "Quality Assurance Standards for Convicted Offender DNA Databasing Laboratories." Forensic Science Communications [Online] (July 2000).

4. DNA Advisory Board. “Quality Assurance Standards for Forensic DNA Testing Laboratories.” Forensic Science Communications [Online] (July 2000).

5. Technical Working Group on DNA Analysis Methods. “Guidelines For a Quality Assurance Program for DNA Analysis.” Crime Laboratory Digest , 1995, Vol 22, pp. 21–43

6. Technical Working Group on DNA Analysis Methods. “Guidelines For a Quality Assurance Program for DNA Analysis.” Crime Laboratory Digest, 1991, Vol 18, pp. 44–75.

The Microscopy manual is not in use. The Statewide Training Program has no Training Coordinator for this discipline and no trainees have been trained using this manual since April 1, 2010.

A Training Coordinator or "Acting" Training Coordinator will review and revise the manual prior to implementing training for Microscopy. The Director of Training will ensure all approved revisions are made in the manual.

The Questioned Documents manual is not in use. The Statewide Training Program has no Training Coordinator for this discipline and no trainees have been trained using this manual since May 1, 2010.

A Training Coordinator or "Acting" Training Coordinator will review and revise the manual prior to implementing training for Questioned Documents. The Director of Training will ensure all approved revisions are made in the manual.

TABLE OF CONTENTS
TRACE CHEMISTRY

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: GAS CHROMATOGRAPHY

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for Gas Chromatography are (TC-II) for fire debris and (TC-VB-2) for paint analysis.

UNIT ESTIMATED TIME

14 Days

GOAL

To achieve the necessary knowledge, skills and abilities associated with the use of gas chromatography in the identification, classification, and comparison of organic substances submitted to the Trace Chemistry section.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the knowledge required for gas chromatography analysis by passing written criterion test with a score of no less than 80%.

2. The trainee will demonstrate practical knowledge and skills in the operation of the gas chromatograph by successfully performing a variety of practical exercises. These demonstrations will include the following:
   A. A working knowledge of the gas chromatograph hardware with a demonstration of correct installation of column and adjustment of parameters for baseline separation of adjacent peaks.
   B. A working knowledge of the gas chromatograph software by generating a complete and accurate method for the analysis of an organic mixture.
   C. The ability to identify, classify and compare substances using the gas chromatography technique by correctly identifying, classifying or comparing a series of unknowns to be evaluated by the training coordinator on a pass/fail basis.

3. The trainee will explain and perform preventative maintenance, troubleshooting and quality assurance measures related to gas chromatography analysis. This will be evaluated as part of the written criterion test which requires a passing score of no less than 80% and a pass/fail evaluation of the practical measures.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the theory of gas chromatography.

Lectures: Theory of Gas Chromatography Separations
Parameters That Effect Separations
Injectors – Types and Function
Columns – Types, Function, and Variables
Detectors – Types and Function
Carrier Gas Glows

Exercises:

1. Complete Part A of the Gas Chromatography Study Guide.
2. Complete Part A assignments in Gas Chromatography.
3, Complete the instrument tutorial on the Theory of Gas Chromatography
4. Pass the theory portion of the criterion test.

Recommended Reading:

1. Trace Chemistry Resource Manual on Gas Chromatography.

2. Willard, Hobard, H., Merritt, Lynne L., Dean, John L., Settle, Frank A., Instrumental Methods of Analysis, 7th Edition, Wadsworth Publishing Co., 1988, pp. 513-574.

3. Buffington, R., and M. Wilson, Detectors for Gas Chromatography – A Practical Primer, Hewlett-Packard Co., 1987, pp. 1-15.

4. Hyver, K. J., and P. Sandra, High Resolution Gas Chromatography, 3rd Edition, Hewlett-Packard Co., 1989, Chapters 1 & 2.

LESSON 2

Estimated Time: 1 Day

Purpose: The trainee will perform the proper set up of the Gas Chromatograph (GC) column and parameters to meet the requirements for Trace Chemistry analysis of ignitable liquids.

Lecture: How To Adjust and Monitor the Variables for GC Operation

Exercises:

1. The trainee will install a column, check flow through column and perform leak checks.
2. The trainee will set each of the temperature zones based on information provided by the training coordinator.
3. The trainee will set the flow rates with values provided by the training coordinator.
4. The trainee will set the column flow rate based upon the unretained peak.
5. The proper completion of Exercises #1-#4 will be the basis of a pass/fail score on the practical quiz.

Recommended Reading:

1. The instrument instruction manuals where applicable.

LESSON 3

Estimated Time: 1 Day

Purpose: The trainee will successfully demonstrate a working knowledge of the software of the current gas chromatograph.

Lectures: How to Establish and Edit a Method
How to Enhance Data File Presentations
Demonstrate the Gas Chromatography Software

Exercises:
1. The trainee will set up the software to run a sample under the conditions stated in the Arson method.
2. The trainee will run a sample of gasoline and obtain baseline separation of the five peak group. An example of this separation is available from the training coordinator.
3. The trainee will run the straight chain Hydrocarbon standard until the peaks have a retention time variation no greater than .08 from values provided by the training coordinator. This will be a pass/fail practical quiz.

Recommended Reading:
1. Instrument instruction and software manuals.

LESSON 4

Estimated Time: 5 Days

Purpose: The trainee will demonstrate his/her knowledge, skills and ability to use the Gas Chromatograph for comparison and classification of organic mixtures.

Lectures: Basic Classification of Petroleum Product Patterns
Sample Injection Techniques

Exercises:
1. The trainee will be provided a set of unknown samples by the training coordinator. The trainee will perform the Gas Chromatography analysis and provide a comparison or classification as requested by the training coordinator. This will be evaluated on a pass/fail basis.
2. Complete Part B of the Gas Chromatography Study Guide.

LESSON 5

Estimated Time: 2 Days

Purpose: The trainee will demonstrate that he/she can explain and perform preventive maintenance, troubleshooting and quality assurance measures related to Gas Chromatography (GC) analysis.

Lectures: Normal Routine Maintenance on the GC
How to Isolate and Correct Problems with the GC
Quality Assurance Measures Required for GC Analysis

Exercises:
1. Complete Part C of the Gas Chromatography Study Guide.
2. Complete Part B assignments in Gas Chromatography.
3. The training coordinator will provide practical examples of problems with the GC. This will be an oral quiz with a pass/fail score.

4. The trainee will pass a written criterion test with a score no less than 80%.

Recommended Reading:

1. Trace Chemistry Resource Manual.
2. Restek Troubleshooting Chart.
3. Instrument Instruction Manuals.
4. Trace Chemistry Procedures Manual, TC-App II, pp. 2-7.

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: MASS SPECTROMETRY

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for Mass Spectrometry are (TC-II) for fire debris and (TC-III) for explosives analysis.

UNIT ESTIMATED TIME

20 Days

GOAL

To achieve the necessary knowledge, skills and abilities associated with the use of mass spectrometry in the identification of organic substances submitted to the Trace Chemistry section.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the knowledge required for mass spectrometry by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate practical knowledge and skills in the operation of the mass spectrometer by successfully performing a variety of practical exercises. These demonstrations will include the following:
   A. Generate a complete and accurate method for the analysis of an ignitable liquid to demonstrate general working knowledge of the mass spectrometry software.
   B. Employ the Mass Spectrometer technique to identify a series of unknowns correctly with a practical criterion test score of 100%.
   C. Perform ion extraction to correctly classify peaks with the Total Ion Chromatogram (TIC) according to PM section TC-II-IV.

3. The trainee will demonstrate a basic understanding of the interpretation of a mass spectrum by passing a written criterion test with a score of no less than 80%.

LESSON 1

Estimated Time: 5 Days

Purpose: To familiarize the trainee with the various types of mass spectrometers and how they operate with emphasis on the Agilent Mass Selective Detector.

Lecture: Types of Mass Spectrometers and How They Operate

Exercises:
1. Read the assigned materials and complete the instrument tutorial on the theory of mass spectrometry.
2. Complete Part A of the Mass Spectrometry Study Guide.
3. Complete Part A assignments in Mass Spectrometry.
4. Successfully complete written quizzes on a pass/fail basis.

Recommended Reading:

1. Quadrupole Mass Spectrometry, VG Micromass Publication 02-439May 1977.

2. The Quadrupole Mass Filter: Basic Operating Concepts, Miller, Phillip E., Denton, M. Bonner, Journal of Chem Ed, Vol 63, No 7, July 86, pp. 617-622.

3. Instrumentation for Mass Spectrometry, ACS Video Course, 1992.

LESSON 2

Estimated Time: 3 Days

Purpose: The trainee will successfully demonstrate to the training coordinator a working knowledge of the software of the current mass spectrometers.

Lecture: Use of Current Software

Exercise:

1. The trainee will install a column, check flow through column and perform leak checks.
2. The trainee will set each of the temperature zones based on information provided by the training coordinator.
3. The trainee will set the flow rates with values provided by the training coordinator.
4. The trainee will set the column flow rate based upon the unretained peak.
5. The proper completion of Exercises #1-#4 will be the basis of a pass/fail score on the practical quiz.

Recommended Reading:

1. The instrument instruction manuals where applicable.

LESSON 3

Estimated Time: 2 Days

Purpose: The trainee will successfully demonstrate a working knowledge of the operation of the current mass spectrometer.

Lecture: Mass Spectrometer Hardware

Exercises:

1. Complete Part B of the Mass Spectrometry Study Guide.
2. Complete Part B assignments in Mass Spectrometry.
3. Set up a method to separate a test mixture given by your training coordinator.
4. Run the test mixture and obtain results applying Lesson2 criteria.

Required Reading:

1. The instrument instruction manuals where applicable.

LESSON 4

Estimated Time: 2 Days

Purpose: The trainee will successfully demonstrate a working knowledge of the preventive maintenance, troubleshooting of the current Mass Spectrometer, and Quality Assurance measures.

Lectures:
Evaluation of Autotune Parameters
Routine Preventive Maintenance
Troubleshooting Guidelines
Quality Assurance Requirements

Exercises:

1. Complete Part C of the Mass Spectrometry Study Guide.
2. Complete Part C assignments in Mass Spectrometry.
3. Perform a routine autotune and print out and evaluate the results. Identify and document any discrepancy.
4. Perform the following maintenance procedures:
   - check and repair any air/gas leaks. Verify with MS Spectra.
   - change septa
   - change liner
   - change column

Required Reading:

1. The instrument instruction manuals where applicable.

LESSON 5

Estimated Time: 3 Days

Purpose: To initiate the trainee to basic mass spectrum interpretation and its application to trace chemistry analysis.

Lecture: Basic Mass Spectral Interpretation

Exercises:

1. Using information obtained from the reading, assign structures to spectra obtained from the training coordinator.
2. Compare literature/library spectra to those obtained from the current instrument and explain any differences.
3. Explain a spectra in terms understood by a layman.
4. Complete Part D of the Mass Spectrometry Study Guide.
5. Complete Part D assignments in Mass Spectrometry.
6. Trainee will identify peaks selected by the training coordinator from a stored data file.

Required Reading:

1. Watson, J. Throck, "Introduction to Mass Spectrometry," pp. 156-172, 1985.

2. Yinon, Jehuda, "Forensic Mass Spectrometry," Chapter 1, pp. 1-50, 1987.

3. McLafferty, F. W., "interpretation of Mass Spectra," 4th Edition, 1993.

LESSON 6

Estimated Time: 2 Days

Purpose: The trainee will successfully perform ion extractions to chemically classify peaks within a mixture.

Lecture: The Use and Selection of Mass Ions for Classification

Exercises:

1. Document the mass ions to be used for the following classes of chemical compounds:
   - Alkanes
     Cycloparaffins and alkenes
     Aromatics
     Indanes
     Napthalenes
     Terpenes
2. Use a macro or manually search the data files provided by the training coordinator for the classes of compounds given in Exercise #1. Print the ion extracted profile for each.

Required Reading:

1. Instrument software manuals.

2. Trace Chemistry Procedures Manual TC-II-IV.

LESSON 7

Estimated Time: 3 Days

Purpose: To perform M. S. analysis of Trace Chemistry samples and complete criterion test.

Lecture: None

Exercises:

1. The trainee will perform MS analysis of unknown Trace Chemistry samples provided by the training coordinator.
2. The trainee will correctly identify and classify the compounds from #1. (Practical Criterion Test).
3. The trainee will provide documentation to support compliance to the Quality Assurance requirements.

4. The trainee will pass a criterion test on the theoretical knowledge of Mass Spectrometry and the interpretation of Mass Spectra.

Required Reading: None

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIR)

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for Fourier Transform Infrared Spectroscopy (FTIR) are (TC-IIIC-3) for explosives and (TC-VB-3) for paint analysis.

UNIT ESTIMATED TIME

20 Days

GOAL

To achieve the necessary knowledge, skills and abilities associated with the use of FITR in the identification of organic and inorganic substances submitted to the Trace Chemistry section.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the knowledge required for FTIR by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate practical knowledge and skills in the operation of the FTIR by successfully performing a variety of practical exercises. These demonstrations will include the following:
   A. Generate a complete and accurate method for standard and micro samples to demonstrate general working knowledge of the FTIR software.
   B. Perform sample preparation techniques for solid, liquid, vapor, and micro samples and verify the correct application of the techniques by producing a set of identifiable IR spectra.
   C. Employ the FITR procedure to identify a series of unknowns correctly with a practical criterion test score of 100%.

3. The trainee will demonstrate a basic understanding of the interpretation of an IR spectrum by passing a written criterion test with a score of no less than 80%.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the theory and interactions of infrared radiation.

Lectures: Terminology Related to Electromagnetic Radiation in General and Infrared Radiation in Particular.
Application of Hooke's Law
Factors That Effect IR Absorption

Exercises:
1. Read assigned material.
2. Complete Part A of the FTIR Study Guide.
3. Complete Part A assignments in FTIR.
4. Pass the portion of the written criterion test that deals with subject matter covered in Lesson1.

Recommended Reading:

1. Trace Chemistry Resource Manual for FTIR.

2. Brezinksi, D., An Infrared Spectroscopy Atlas for the Coatings Industry, 4thEd., Vol. 1, Federation of Societies for Coatings Technology, 1991, pp. 1-100.

3. Hill, R. R., Rendell, D., The Interpretation of Infrared Spectra A Programmed Introduction, 1975, Heyden & Son Ltd., pp. 3-35.

LESSON 2

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the theory of infrared spectrometers, the FTIR microscope, and the attenuated total reflectance (ATR) accessory.

Lectures:
The Theory of Fourier Transform Infrared Spectrometer (FTIR)
The Components of the FTIR Spectrometer
The Components and Operation of the FITR Microscope. The Affect of Aperture Size.
The Theory and Use of the Attenuated Total Reflectance (ATR) Accessory

Exercises:

1. Read assigned material.
2. Complete Part B of the FTIR Study Guide.
3. Complete Part B assignments in FTIR.
4. Pass the portion of the written criterion test that deals with the subject matter covered in Lesson 2.

Recommended Reading:

1. Trace Chemistry Resource Manual for FTIR.

2. See Reference Lesson 1, #2.

3. Williams, R., Spectroscopy and the Fourier Transform An Interactive Tutorial, 1996, VCH Publishers, Inc.

4. George, B., McIntyre, P., Infrared Spectroscopy Analytical Chemistry Open Learning, 1987, John Wiley & Sons, pp. 81-114.

5. Willard, H., Merritt, L., Dean, J., Settle, F., Instrumental Methods of Analysis, 7th Ed., Wadsworth Publishing Co., Belmont, CA, 1988, pp. 287-316.

6. Tutorial provided with instrument software.

LESSON 3

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the software used on the FTIR spectrometer.

Lectures: Demonstrate the Software
Settings Required for the Operation of FTIR Microscope. The Use of External Mirror.
Relationships of Scans and Sensitivity, Resolution and Sampling Rate
The Use of the Libraries

Exercises:

1. Set up a method and perform an FTIR analysis of polystyrene in the standard sample chamber. Print out results.
2. Set-up a method and perform an FTIR analysis of polystyrene using the FTIR microscope. Print out results.
3. Complete Part C of the FTIR Study Guide.
4. Pass the portion of the written criterion test that deals with the subject matter covered in Lesson 3.

Required Reading:

1. The instrument software manual and on-line tutorial.
2. Trace Chemistry Resource Manual for FTIR.

LESSON 4

Estimated Time: 5 Days

Purpose: The trainee will successfully demonstrate working knowledge, skills and abilities for proper sample preparation and operation of the FTIR spectrometer.

Lectures: Demonstrate Different Methods of Sample Preparation to Include: Vapors, Liquids, KBr Disks, Thin Films, and Compressed Samples
Explain the Importances of Sample Thickness, Fringing, and Diffraction
Safety Precautions with Liquid Nitrogen.

Exercises:

1. The training coordinator will provide the samples. The trainee will use the appropriate technique to place the sample in the IR beam. This will include, but not limited to: gas cell, liquid cell, KBr powder disks, salt plates, compression with salt plates, compression with diamond windows, 3M cards, and thin films on salt plates. Provide data to support your proper use of the techniques.
2. Solid samples from Exercise #1 will also be run on the FTIR microscope.
3. Complete Part D of the FTIR Study Guide.
4. Pass the portion of the written criterion test that deals with the subject matter covered in Lesson 4.

Required Reading:

1. Trace Chemistry Resource Manual for FTIR.
2. See Reference Lesson 1, #2.
3. George, B., McIntyre, P., Infrared Spectroscopy Analytical Chemistry Open Learning, 1987, John Wiley & Sons, pp. 116-160.

LESSON 5

Estimated Time: 2 Days

Purpose: The trainee will recognize the qualities of a good IR spectrum and explain the theory of the interactions that resulted in the bands. The trainee will demonstrate proper interpretation.

Lectures:
Review IR Radiation and Chemical Bond Interaction
Review Factors That Must Be Considered in Band Interpretation
Relationship of Transmittance and Absorbance
Information That Can Be Derived from the IR Spectrum
The Use of IR Spectrum for Classification

Exercises:

1. Complete Part E of the FTIR Study Guide.
2. Complete Part C assignments in FTIR.
3. The training coordinator will provide IR spectra for interpretation. The trainee will obtain a passing grade on this written quiz. It is
4. based on a pass/fail; system.
   Pass the portion of the witness criterion test that deals with the subject matter covered in Lesson 5.

Required Reading:

1. Trace Chemistry Resource Manual for FTIR.
2. See Reference Lesson 1, #2.
3. Hill, R. R., Rendell, D., The Interpretation of Infrared Spectra A Programmed Introduction, 1975, Heyden & Son Ltd.
4. George, B., McIntyre, P., Infrared Spectroscopy Analytical Chemistry Open Learning, 1987, John Wiley & Sons, pp. 279-381.
5. Stuart, B., Analytical Chemistry by Open Learning: Modern Infrared Spectroscopy, 1996.
6. Saferstein, A., Forensic Science Handbook, Vol. 1, 2, 3, Regents/Prentice Hall, Englewood Cliffs, New Jersey, 1982, 1988, 1993.

LESSON 6

Estimated Time: 10 Days

Purpose: To perform FTIR analysis of samples and complete written criterion test.

Lectures:
General Quality Assurance Requirements for FTIR Analysis
Qualities to Check When Two Sample Spectra Are Compared
Classification vs. Individualization
Review of Group Frequencies
Review Sampling Techniques

Exercises:

1. Complete Part F of the FTIR Study Guide.
2. The trainee will perform FTIR analysis of unknown samples provided by the training coordinator.
3. The trainee will correctly identify, classify or compare based upon the request in #2. This is a practical criterion test.
4. The trainee will provide documentation to support compliance to the quality assurance requirements.
5. The trainee will pass the written criterion test on the subject matter covered in Lessons 1-6.

Required Reading:

1. Trace Chemistry Procedures Manual, "Fourier Transform Infrared Spectrometer (FTIR)," TC-IIIC-3.

2. Trace Chemistry Procedures Manual, "Fourier Transform Infrared Spectrometer (FTIR)," Analysis, TC-VB-3, pp. 1-8.

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: X-RAY DIFFRACTION

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for X-ray Diffraction Analysis of Explosives (TC-IIIC-4) and of Sugars (TC-XIC-3). Minimum Standards & Controls (TC-App.II-pages 6 and 7).

UNIT ESTIMATED TIME

15 Days

GOAL

To achieve the necessary knowledge, skills and abilities associated with the use of X-ray Diffraction in the identification of organic and inorganic crystalline substances submitted to the Trace Chemistry section.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the knowledge of X-Ray Diffraction by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate practical knowledge and skills in the operation of the X-Ray Diffraction by successfully performing a variety of practical exercises. These demonstrations will include the following:
   A. Demonstrate and explain the function of the various components of the X-Ray Diffraction system. This will be evaluated by the trainee's placement of these components in the proper operating mode.
   B. Perform the startup and shutdown procedure and generate a complete and accurate method for analysis.
   C. Verify that the proper sample preparation technique is practiced by producing a set of identifiable x-ray diffraction patterns.
   D. Demonstrate the factors that will affect the quality of the x-ray diffraction pattern.

3. The trainee will demonstrate his/her ability to correctly perform an x-ray diffraction analysis and interpret the results with a 100% practical criterion test score on a set of unknowns.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with basic crystallography.

Lectures: Crystal Theory to include crystals, space lattice, crystal systems, bravais lattice, unit cell, and Miller indices.

Exercises:
1. Read the assigned materials.
2. Complete Part A of the X-Ray Diffraction Study Guide.
3. Complete Part A assignments in X-Ray Diffraction.

4. Pass the crystallography portion of the X-Ray Diffraction Criterion Test.
5. Solid state modeling kit familiarization.

Recommended Reading:

1. Trace Chemistry Resource Manual for X-Ray Diffraction.
2. Jenkins, R., X-Ray Diffraction, ACS Audio Course, 1998.
3. Bloss, F. D., An Introduction to Crystallography and Crystal Chemistry, Hold, Rinehart & Winston, Inc., 1971.
4. Jenkins, R. & DeVries, J., An Introduction to X-Ray Powder Diffractometry, Philips Instruments.
5. Jenkins, R. & Snyder, R. L., Introduction to X-Ray Powder Diffractometry, John Wiley & Sons, 1996.
6. Klug, H. & Alexander, L., X-Ray Diffraction Procedures, John Wiley & Sons, 1974.
7. Whiston, C., X-Ray Methods, Analytical Chemistry to Open Learning, John Wiley & Sons, 1987.

LESSON 2

Estimated Time: ½ Day

Purpose: To familiarize the trainee with the properties and generation of x-rays.

Lectures:
Electromagnetic Radiation Emphasis on Wavelength and Energy of X-Rays
Generation and Terminology Used for Continuous and Characteristic Radiation
X-rays Scattering and Absorption
X-rays Safety

Exercises:

1. Read assigned material
2. Complete Part B of the X-Ray Diffraction Study Guide.
3. Complete Part B assignments in X-Ray Diffraction.
4. Pass the X-Rays portion of the X-Ray Diffraction Criterion Test.

Recommended Reading:

1. Trace Chemistry Resource Manual for X-Ray Diffraction.
2. Jenkins, R., Methods and Practices in X-Ray Powder Diffraction, International Centre for Diffraction Data, 1993, pp. 14.1.1-14.2.12, 5.1.1-5.5.12.

LESSON 3

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the interaction of crystals and x-rays. To identify the analytical instruments' requirements to generate and record these interactions.

Lectures:
What is X-Ray Diffraction and Why Does It Occur
Bragg Equation
Factors That Affect Position of Diffraction Lines and Extinctions
Factors That Affect Intensity
Components of the Diffractometer

Exercises:
1. Read assigned material.
2. Complete Part C of the X-Ray Diffraction Study Guide. Complete Part C assignments in X-Ray Diffraction.
3. Pass the Diffraction portion of the X-Ray Diffraction Criterion Test.

Required Reading:
1. Trace Chemistry Resource Manual for X-Ray Diffraction.
2. Recommended Reading in Lesson 1.

LESSON 4

Estimated Time: 2 ½ Days

Purpose: The trainee will successfully demonstrate a working knowledge of proper sample preparation and the operation of the X-Ray Diffraction unit.

Lectures:
Qualities of Sample That Affects the Pattern e.g. Size, Moisture, Crystalline, Preferred Orientation, and Sample Placement
Demonstrate Proper Sample Preparation
Demonstrate Method and Instrument Setup
Quality Control Measures

Exercises:
1. Read assigned material.
2. Complete Part D of the X-Ray Diffraction Study Guide.
3. Obtain samples from the training coordinator and perform X-Ray Diffraction analysis.
4. Perform quality control checks.

Required Reading:
1. Trace Chemistry Procedures Manual (TC-IIIC-4), pp. 1-4.
2. Trace Chemistry Resource Manual for X-Ray Diffraction.
3. Recommended Reading in Lesson 2.

LESSON 5

Estimated Time: 5 Days

Purpose: The trainee will recognize the qualities of a good diffraction pattern, factors that affect the diffraction patterns, and criteria for identification.

Lectures:
Review Factors That Affect Line Location and Line Intensity
Criteria for Identification

How to Convert 2σ Data into D-spacings
Use of Library

Exercises:

1. Demonstrate correlation between hkl value and d-spacing.
2. Demonstrate inverse relationship between d-spacing value and 2σ value.
3. Perform X-Ray Diffraction analysis on the following types of samples:
   A. Compare NaCl, KCl
   B. Compare Gypsum, Plaster of Paris, Anhydrous $CaSO_4$
   C. Glass
   D. Compare:
      i. Quartz Plate
      ii. Sand Particle > = 25μ
      iii. Ground sand depressed in holder
      iv. Ground sand raised in holder
4. Read assigned material.
5. Complete Part E of the X-Ray Diffraction Study Guide.
6. Pass sample preparation, instrument and interpretation portion of the criterion test.

Recommended Reading.

1. Trace Chemistry Procedures Manual (TC-IIIC-4), pp. 1-4.
2. Trace Chemistry Resource Manual for X-Ray Diffraction.
3. Recommended Reading in Lesson 2.

LESSON 6

Estimated Time: 5 Days

Purpose: To perform X-Ray Diffraction analysis of samples and complete criterion test.

Lectures: None

Exercises:

1. The trainee will perform X-Ray Diffraction analysis of unknown samples provided by the training coordinator.
2. The trainee will correctly identify the compounds from #1 (practical criterion test).
3. The trainee will provide documentation to support compliance to the quality assurance requirements.
4. The trainee will pass a criterion test on the theoretical knowledge of X-Ray Diffraction and the interpretation of diffraction patterns.

Required Reading: None

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: SCANNING ELECTRON MICROSCOPY (SEM)/ ENERGY DISPERSIVE X-RAY (EDX)

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for Scanning Electron Microscopy (SEM)/ Energy Dispersive X-Ray (EDX) are (TC-VB-4) for Paint and (TC-IIIC-5) for explosives.

UNIT ESTIMATED TIME

14 Days

GOAL

To achieve the necessary knowledge, skills and abilities associated with the use of SEM/EDX for elemental analysis.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the knowledge of Scanning Electron Microscopy (SEM) by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a comprehension of the knowledge of Energy Dispersive X-Ray analysis (EDX) by passing a written criterion test with a score of no less than 80%.

3. The trainee will demonstrate practical knowledge and skills in the collection of EDX data by using the SEM/EDX to generate and record a spectrum of the elemental composition of known materials.

4. The trainee will demonstrate practical knowledge and skills in the collection of EDX data by using the SEM/EDX to generate and record a spectrum of the elemental composition of known materials.

5. The trainee will demonstrate a basic understanding of the interpretation of EDX patterns by passing an oral quiz based on a pass/fail system.

6. The trainee will demonstrate his/her ability to correctly perform SEM/EDX elemental analysis and interpret the results with a 100% practical criterion test score on a set of unknowns.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the components and operational theory of the SEM.

Lectures: Components of the SEM
Function and Operation of the Components
Parameters that are Adjusted To Enhance The Results
Detectors Used On The SEM

Exercises:

1. Read assigned material.
2. Complete Part A of the SEM/EDX Study Guide.
3. Complete Part A assignments in SEM/EDX.

Recommended Reading:

1. Trace Chemistry Resource Manual for SEM/EDX.
2. Postek, M., Howard, K., Johnson, A., McMichael, K., Scanning Electron Microscopy – A Student Handbook, 1980, Ladd Research Industries, Inc.
3. Lawes, G., Scanning Electron Microscopy and Microanalysis – Analytical Chemistry by Open Learning, 1987, John Wiley & Sons.
4. Goldstein, J., et. al., Scanning Electron Microscopy and X-Ray Microanalysis, 1981, Plenum Press.
5. *Scanning and Transmission Electron Microscopy An Introduction*, Stanley L. Flegler, John W. Heckman, Jr., Karen L. Klomparens, Oxford University Press, New York, 1993.

LESSON 2

Estimated Time: 1 Day

Purpose: To develop and demonstrate the trainee's skills to mount samples and operate the SEM/EDX to obtain sharp images on micron size particles.

Lectures:
Demonstrate Methods of Mounting Samples
Demonstrate Operation of SEM to Obtain Initial Image
Demonstrate the Image Effect as Parameters Are Adjusted
Charging and Methods to Reduce It
Instrument Maintenance

Exercises:

1. Mount samples provided by the training coordinator and demonstrate an identifiable image on the screen. Isolate two particles which are separated by #1 micron. Provide a monitor display of these particles with sharp borders and a measurable separation.
2. Demonstrate and document the effect on sample image by adjusting the following:
   A. Voltage
   B. Working Distance
   C. Spot Size
   D. Final Aperture
   E. Tilt
3. Demonstrate the changing of filament, cleaning the column and proper alignment of the filament.
4. Pass the SEM portion of the criterion test.

Recommended Reading:

1. References 1, 2, 3, & 4 from Recommended Reading in Lesson 1.

2. Instruction manual supplied with instrument.

LESSON 3

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the properties and generation of x-rays.

Lectures:
X-Rays and Other Electromagnetic Radiation
Generation and Terminology of X-Radiation
Relationship of X-Ray Energy and Wavelength
Effect of Excitation Voltage on the Generation of X-Rays
What Voltage Is Most Appropriate
X-Ray Safety

Exercises:

1. Read assigned material.
2. Complete Part B of the SEM/EDX Study Guide.
3. Complete Part B assignments in SEM/EDX.
4. Pass X-Rays portion of the criterion test.

Recommended Reading:

1. Trace Chemistry Resource Manual for SEM/EDX.

2. Energy-Dispersive X-Ray Microanalysis An Introduction, 1988, Kevex Corp.

3. Dean, J., Analytical Chemistry Handbook, 19985, McGraw-Hill, pp. 10.1-10.12.

4. Reference #2 from Recommended Reading in Lesson 1, pp. 69-74.

5. Reference #3 from Recommended Reading in Lesson 1, pp. 54-64.

6. Bertin, E., Principles and Practices of X-Ray Spectrometric Analysis, 1975, Plenum Press, pp. 6-36.

7. Methods and Practices in X-Ray Powder Diffraction, 1993, International Centre for Diffraction Data, pp. 14.1.1–14.2.12.

LESSON 4

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the theory and operation of the EDX. To demonstrate the trainee's skills in the operation and collection of EDX data.

Lectures: Components of the EDX Detector
Function and Operation of the Components
Parameters that are Adjusted to Enhance the Results
Maintenance and Method Generation
Demonstrate the Proper Use

Exercises:
1. Set up a method to collect data and perform calibration.
2. Read assigned material.
3. Complete Part C of the SEM/EDX Study Guide.
4. Complete Part C assignments in SEM/EDX.
5. Collect elemental analysis data on known samples provided by training coordinator.

Recommended Reading:
1. References 1 & 2 from Recommended Reading in Lesson 3.
2. Trace Chemistry Procedures Manual (TC-VB-4), pp. 1-6.
3. Trace Chemistry Procedures Manual (TC-IIIC-5), pp. 1-3.
4. Instrument Operation Manual from instrument vendor.
5. Reference #2 from Recommended Reading in Lesson 1, pp. 79-111.

LESSON 5

Estimated Time: 5 Days

Purpose: To have the trainee describe and demonstrate measures that are used to enhance the quality of data and the interpretation.

Lectures: Effects of Voltage, Spot Size, Dead Time, and Collection Time on the Quality of Data
Methods to Differentiate Overlapping Peaks
Statistical Determination of a Peak
Quality Assurance Requirements for SEM/EDX Analysis

Exercises:
1. Read assigned material.
2. Perform analysis of samples supplied by the training coordinator, vary voltage, spot size, and collection time and document the effect.
3. Run samples that contain the following element combinations. Explain and demonstrate how they can be differentiated:
   A. Ba, Ti
   B. S, Mo, Pb
   C. Na, Zn
   D. Cr, V
4. Demonstrate the lower level sensitivity of the instrument for heavy and light elements. Run samples provided by the training coordinator and provide documentation to support the sensitivity limit.
5. Pass the EDX portion of the criterion test.

6. Pass an oral quiz on EDX interpretation. This is based on a pass/fail system.

Recommended Reading:

1. Trace Chemistry Resource Manual for SEM/EDX.
2. Instrument Operation Manual from instrument vendor.
3. Trace Chemistry Procedures Manual (TC-App II), p. 5.

LESSON 6

Estimated Time: 5 Days

Purpose: To perform SEM/EDX analysis of samples and complete criterion test.

Lectures: None

Exercises:

1. The trainee will perform SEM/EDX analysis of unknown samples provided by the training coordinator.
2. The trainee will correctly identify the chemical elements from #1 (practical criterion test).
3. The trainee will provide documentation to support compliance to the quality assurance requirements.
4. The trainee will pass a criterion test on the theoretical knowledge of SEM/EDX analysis and the interpretation of the data.

Required Reading: None

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: FIRE DEBRIS/IGNITABLE LIQUIDS

Reviewed by:

Adrienne Bickel
Acting Trace Chemistry Training Coordinator

Approved by:

Sandra N. Brown
Laboratory Director
Training and Applications

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for Fire Debris Analysis (TC-II).

UNIT ESTIMATED TIME

160 Days

GOAL

Upon completion of this unit, the trainee will possess the necessary knowledge, skills, and abilities to be proficient in the determination and classification of an ignitable liquid in fire debris or unknown liquid.

OBJECTIVES

1. The trainee will demonstrate a comprehensive knowledge, related to petroleum, chemistry petroleum refining processes, and petroleum product distribution by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate his/her ability to explain and properly operate the GC/MS, perform the required troubleshooting, Quality Assurance (QA) measures, and interpret MS data. This will be evaluated with oral and practical quizzes on a pass/fail basis.

3. The trainee will demonstrate that he/she is knowledgeable about the ISP and American Society for Testing and Materials (ASTM) classification system for ignitable liquids. This will be accomplished with a score of no less than 80% on a written criterion test and a passing score on a practical quiz based on a pass/fail system.

4. The trainee will demonstrate the ability to classify ignitable liquids based on GC/MS data by providing documentation which support the reported findings.

5. The trainee will demonstrate his/her knowledge of the extraction techniques used in fire debris analysis and apply these methods on fire debris samples. Accomplishment will be based on a score of no less than 80% on a written criterion test and a passing score on a practical quiz based upon a pass/fail system.

6. The trainee will demonstrate his/her ability to classify ignitable liquids in the presence of substrate peaks. This will be accomplished with practical quizzes on a pass/fail basis and a practical criterion test score of 100% on the general unknowns.

7. The trainee will demonstrate his/her knowledge of documentation and QA measures by passing a written criterion test with a score of no less than 80%.

8. The trainee will demonstrate his/her knowledge and ability to recognize, collect, preserve, and submit fire debris evidence. This will be accomplished with practical quizzes on a pass/fail basis and a score of no less than 80% on a written criterion test.

9. The trainee will demonstrate his/her ability to communicate the truth in a manner that is understandable and believable by passing on a pass/fail system a mock court testimony.

10. The trainee will demonstrate that he/she uses proper procedures, evaluations and conclusions in actual casework based on verification with cosignatory of reports by an experienced forensic scientist.

LESSON 1

Estimated Time: 5 Days

Purpose: Provide the trainee with background information related to the chemistry, manufacturing process and distribution of ignitable liquids that may be encountered in fire debris analysis.

Lectures:
Review of Basic Organic Chemistry
Chemistry of Crude Oil
Petroleum Industry Classification System
Petroleum Refining Processes
Chemistry of Petroleum Cuts & Reformation
Marketing & Distribution of Petroleum Products

Exercises:
1. Complete the Chemistry Review and Petroleum and Petroleum Processes Fire Debris Analysis Study Guide.
2. Complete Part A assignments in Fire Debris Analysis.
3. Pass the Organic Chemistry and Petroleum Industry criteria test.

Recommended Reading:
1. Trace Chemistry Resource Manual for Petroleum & Refining Operations.

2. VCR Tape "Shell Refinery Process".

3. Hoffman, H. L., "Petroleum and Its Products," Riegel's Handbook of Industrial Chemistry, 8th ed, pp. 488-518, Van Nostrand Reinhold, 1983.

4. Considine, D. M. & Considine, G. D., "Petroleum," Encyclopedia of Chemistry, 4th ed., pp. 693-705, Van Nostrand Reinhold, 1984.

LESSON 2

Estimated Time: 5 Days

Purpose: The trainee will demonstrate that he/she can explain the operation of the GC/MS in terms understandable to a jury and can operate the instrument to provide the data required for fire debris analysis.

Lectures: Instrument Parameters for Fire Debris Analysis
QA Measures for the Use of GC/MS in Fire Debris Analysis
Guidelines for Interpretation of Mass Spectra Related to Fire Debris Analysis

Exercises:

1. Must have successfully completed the unit on Mass Spectrometry or demonstrated proficiency in Mass Spectrometry with passing scores on written and practical tests.
2. Complete Part B assignments in Fire Debris Analysis.
3. Successfully complete an oral quiz on the explanation of the GC/MS operation and interpretation of the data. This is a pass/fail basis.
4. Perform a GC/MS analysis of a liquid mixture of gasoline and diesel fuel. Provide ion extracted chromatograms of the alkanes, aromatics, cycolalkanes, naphthalenes and indenes.
5. Provide the same type of data requested in #5, but use a sample provided by the training coordinator. Compare result from split and splitless injections.

Recommended Reading:

1. Instrument software manual where applicable.
2. Trace Chemistry Resource Manual for GC/MS in analysis of fire debris.
3. Trace Chemistry Procedures Manual (TC-II, pp. 1-6).

LESSON 3

Estimated Time: 3 Days

Purpose: The trainee will have to acquire knowledge about the classification systems used for ignitable liquids in fire debris analysis.

Lectures: ISP Classification System
ASTM Classification System
Target Compounds
Commercial Products Within The Classification

Exercises:

1. Complete the Interpretation, Classification, and Report Wording Fire Debris Analysis Study Guide.
2. Complete Part C assignment in Fire Debris Analysis.
3. Pass the Classification criterion test.
4. Pass a practical quiz on classification of unknown patterns. This is based on a pass/fail system.

Required Reading:

1. ASTM Standard 1618, 2014, "Standard Guide for Identification of Ignitable Liquid Residue in Extracts from Fire Debris Samples by Gas Chromatography-Mass Spectrometry," ASTM International, West Conshoshocken, PA, 2014, DOI: 10.1520/E1618-14.

2. Trace Chemistry Procedures Manual (TC-II, pp. 7-15).

3. Keto, R. O., "GC/MS Data Interpretation for Petroleum Distillate Identification in Contaminated Arson Debris," Journal of Forensic Sciences, May 1995, 40, 3, 412-423.

4. Wineman, P. L., Keto, R. O., "Target Compound Method for the Analysis of Accelerant Residues in Fire Debris," Analytical Chimica Acta, March 1994, 288, 1-2, 97-110.

LESSON 4

Estimated Time: 17 Days

Purpose: The trainee must demonstrate the ability to classify ignitable liquids from GC/MS data.

Lectures: Sample Prep and Sample Introduction of Neat Ignitable Liquids
Cause & Effect of Petroleum Products Degradation

Exercises:

1. Run hydrocarbon standard and record the retention time for each straight chain hydrocarbon from C_6 to C_{22}. Retain this data file for future reference.
2. Select five (5) ignitable liquids from each major class and perform GC/MS analysis. Provide ion profiles for each samples and store in reference binder.
3. Obtain 90% and 99% evaporated samples of Gasoline, Diesel Fuel, Medium Petroleum Distillate (MPD), Light Petroleum Distillate (LPD), and Kerosene. Provide information requested in Exercise #2.
4. Obtain the following mixtures:
   50/50 Gasoline/Diesel Fuel
   50/50 Gasoline/MPD
   50/50 MPD/Diesel Fuel
   Provide information requested in Exercise #2.
5. Select three different types of turpentine solvents. Provide information requested in Exercise #2.
6. The trainee will explain and illustrate to the training coordinator the distinguishing features that are used to classify the patterns in the reference binder. Also, any pattern that cannot be classified must be shown to lack the required characteristics.

Recommended Reading:

1. Newman, R., Gilbert, M., Lothridge, K., GC-MS Guide to Ignitable Liquids, CRC Press, 1998.

2. Trace Chemistry Resource Manual of GC/MS Data from Ignitable Liquids.

LESSON 5

Estimated Time: 5 Days

Purpose: The trainee will have to acquire knowledge about the various extraction techniques used in fire debris analysis and apply them to fire debris samples.

Lectures:
Extraction Techniques of Fire Debris Samples Used in Forensic Labs
Demonstrate Each Technique
Safety Guidelines

Exercises:

1. Complete the Extractions Fire Debris Analysis Study Guide.
2. Complete Part D assignments in Fire Debris Analysis.
3. Pass the Extraction criterion test.
4. Spike 5 paint cans with 2µL of the sensitivity standard. Perform extractions with a different technique for each can.
5. Spike 5 cans with 20µL of the sensitivity standard. Perform extractions with a different technique for each can.
6. Repeat Exercise #4, but use 5 µL of a light petroleum distillate.
7. Repeat Exercise #4, but use 5 µL of gasoline.
8. Repeat Exercise #4, but use 5 µL of medium petroleum distillate.
9. Perform CG/MS analysis on each of the samples from Exercises 4-8. Explain the advantages and disadvantages of each technique.

Required Reading:

1. Trace Chemistry Procedures Manual – Method: Volatiles Recovery (TC-IIA-1-5).

2. ASTM Standard 1388, 2012, "Standard Practice for Sampling of Headspace Vapors from Fire Debris Samples," ASTM International, West Conshohocken, PA, 2012, DOI: 10.1520/E1388-12.

3. Reeve, V., et al., "Developments in Arson Analysis: A Comparison of Charcoal Absorption and Direct Headspace Injection Techniques Using Fused Silica Capillary Gas Chromatography," *Journal of Forensic Sciences*, 1986, 31, 2, 479-488.

4. ASTM Standard 1386, 2010, "Standard Practice for Separation and Concentration of Ignitable Liquid Residues from Fire Debris Samples by Solvent Extraction," ASTM International, West Conshohocken, PA, 2010, DOI: 10.1520/E1386-10.

5. ASTM Standard 1413, 2013, "Standard Practice for Separation and Concentration of Ignitable Liquid Residues from Fire Debris Samples by Dynamic Headspace Concentration," ASTM International, West Conshohocken, PA, 2013, DOI: 10.1520/E1413-13.

6. Sandercock, P. M. L., "Comparison of Passive Charcoal Adsorption with Dynamic Charcoal Adsorption Technique," *Can. Soc. Forensic Sci, J.*, 1994, 27, 3, 179-201.

7. ASTM Standard 1412, 2012, "Standard Practice for Separation and Concentration of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration," ASTM International, West Conshohocken, PA, 2012, DOI: 10.1520/E1412-12.

8. Demers-Kohls, J. F., "Evaluation of the D FLEX device for Fire Debris Analysis," *Can. Soc. Forensic Science Journal*, 1994, 27, 3, 99-123.

9. Waters, L. V., et al., "Multiple Analysis of Fire Debris Samples using Passive Headspace Concentration," *Journal of Forensic Sciences*, 1993, 38, 1, 165-183.

10. Dietz, W. R., "Improved Charcoal Packaging for Accelerant Recovery by Passive Diffusion," *Journal of Forensic Sciences*, 1991, 36, 1, 111-121.

11. Newman, R. T., et al., "The Use of Activated Charcoal Strips for Fire Debris Extractions by Passive Diffusion. Part I: The Effects of Time, Temperature, Strip Size, and Sample Concentration," *Journal of Forensic Sciences*, 1996, 41, 3, 36-370.

12. Furton, K. G., Bruna, J., "A Simple, Inexpensive, Rapid, Sensitive and Solventless Technique for the Analysis of Accelerants in Fire Debris Based on SPME," *J. High Resol. Chromatogr*, October 1995 18, 625-629.

13. Pehlps, J. L., Chasteen, C. E., Render, M. M., "Extraction and Analysis of Low Molecular Weight Alcohols and Acetone from Fire Debris Using Passive Headspace Concentration," *Journal of Forensic Sciences*, 1983, 194-206.

14. Zhang, Z., Yang, M. J., Pawliszyn, J., "Headspace Solid-Phase Microextraction," *Anal. Chem*, 1993, 65, 17, 1843-1852.

15. Zhang, Z., Yang, M. J., Pawliszyn, J., "Solid-Phase Microextraction," *Anal. Chem*, 1994, 66, 17, 844A-853A.

16. Wong, M., "Headspace Solid Phase Microextraction Technique," Validation, *ISP Trace Memo*, 96-Trace-12.

17. Wong, M., "Detection of Gasoline and Fuel Oil No. 2 Utilizing Headspace Solid-Phase Microextraction," *ISP Trace Memo*, 96-Trace-17.

LESSON 6

Estimated Time: 10 Days

Purpose: The trainee will demonstrate his/her ability to classify ignitable liquids after extraction from an evidence container.

Lectures: Approach to Classification of Unknown Pattern
Ignitable Liquids Degradation and Examples

Exercises:

1. Select two ignitable liquids from each major class and one sample from each subclass. Spike 5µL into a paint can, one can for each liquid. Extract with your technique of choice. Perform GC/MS analysis. Provide documentation to justify your classification of each sample (Set A). Place damp soil in three separate quart paint cans (Set B).
2. Place damp rags that contain mildew in three separate quart paint cans. Spike 100 microliters of gasoline in a can from Set A and a can from Set B. Likewise, spike separate cans with diesel fuel and medium petroleum distillate. Permit the cans to stay in a sealed condition at room temperature for two weeks prior to analysis. Analyze and obtain the information requested in Exercise #1.

Required Reading:

1. Newman, R., Gilbert, M., Lothridge, K., GC-MS Guide to Ignitable Liquids, CRC Press, 1998.
2. Trace Chemistry Resource binder of GC/MS data from ignitable liquids.

LESSON 7

Estimated Time: 15 Days

Purpose: The trainee must be able to distinguish patterns that are associated with pyrolysis products and substrates.

Lecture: Examples of Patterns Associated with Pyrolysis Products

Exercises:

1. The trainee will secure the following substrates. These substrates will be partially charred and placed in an evidence can.
   A. Paper Products (paper, cardboard)
   B. Polymers (plastic)
   C. Clothing
   D. Carpet
   E. Footwear and Leather Products
   F. Soil and Vegetation
   G. Padding and Stuffing Materials
   H. Wood
   I. Floor Covering
   J. Cloth Other Than Clothing
   K. Bedding and Sofa

L. Roofing Materials
M. Candles and Wax
N. Oil (non-fuel e.g. vegetable)
O. Automobile Carpet and Floor Mats

The trainee will obtain 4 different types within each group A-D.
The trainee will obtain 2 different types within each group E-O.

2. The trainee will perform extractions and GC/MS analysis on each of the samples. Document results and retain all charts in a reference binder.
3. The trainee will explain and justify to the trainer the ion profiles that may be influenced by each of these substrates.

Required Reading:

1. Trace Chemistry Resource binder of GC/MS data from substrates.

LESSON 8

Estimated Time: 8 Days

Purpose: The trainee must be able to classify ignitable liquids in the presence of interfering peaks from pyrolysis products and substrates.

Lecture: Review Examples of Patterns with Substrate/Pyrolysis Interference

Exercise:

1. The training coordinator will provide a set of ten (10) samples with different substrates and ignitable liquids. The trainee must demonstrate his/her ability to successfully classify the liquid by not getting more than three (3) incorrect answers on the initial set and 100% on the supplemental set. The supplemental set will include five (5) samples. The supplemental is not required for 100% correct on the initial set.

Required Reading:

1. Newman, R., Gilbert, M., Lothridge, K., GC-MS Guide to Ignitable Liquids, CRC Press, 1998.
2. Trace Chemistry Resource binder of GC/MS data from ignitable liquids.

LESSON 9

Estimated Time: 2 Days

Purpose: The trainee must demonstrate that he/she knows the proper documentation and quality assurance measures required for fire debris analysis.

Lectures: Documentation, Report Wording and Quality Assurance
Reasons for Negative or Inconclusive Report

Exercises:

1. The trainee will verbally present the documentation requirements for a fire debris analysis of a case sample.
2. The trainee will verbally present the quality assurance requirements for a fire debris analysis of case sample.
3. Complete Part E of the Fire Debris Analysis Study Guide.
4. Complete Part E assignments in Fire Debris Analysis.
5. Pass the documentation/QA portion of the criterion test.

Required Reading:

1. Trace Chemistry Procedures Manual (TC-App I, pp. 2-6), (TC-APP II, pp. 9-15).

LESSON 10

Estimated Time: 3 Days

Purpose: The trainee will demonstrate that he/she knows and can apply the recognition, collection, preservation and submission of fire debris evidence and applicable state statutes.

Lectures:

Fire Scene Terminology
Fire Debris Evidence Containers & Comparison Samples
Proper Sealing, Marking & Preserving Evidence
Completion of the Evidence Receipt & the Storage of Evidence
State Statutes Related to Arson
The Use of Accelerant Detection Tools at Scene
Incendiary Devices
Factors Effecting Survival of Accelerants

Exercises:

1. Complete the Law, Fire Scene, Collection, and Submission Fire Debris Analysis Study Guide.
2. Complete Part F assignments in Fire Debris Analysis.
3. Demonstrate the procedure for receiving evidence, marking, recording in log book, completion of the evidence receipt, and storage of evidence.
4. Pass the Law, Fire Scene, Collection, and Submission criterion test.

Required Reading:

1. Trace Chemistry Resource Manual for Fire Scene.
2. Trace Chemistry Resource Manual for Collection, Preservation & Submission of Evidence.
3. DeHaan, J. D., Kirk's Fire Investigation, 3rd Ed., Prentice Hall, 1991.
4. NFPA 921, Guide for Fire and Explosion Investigations, 1995 edition, National Fire Protection Association.

LESSON 11

Estimated Time: 35 Days

Purpose: The trainee must provide the correct answers for the analysis of mock fire debris evidence. This represents the general unknowns for this unit of study.

Lecture: None

Exercise:

1. A minimum of fifteen (15) mock samples will be given to the trainee. This may be distributed as ten (10) mock cases. Five (5) of these mock samples will serve as the criterion practical test and the trainee must get a score of 100% in order to pass. To pass, the findings and conclusions of the samples must be correct and all quality assurance measurements must be met.

Recommended Reading:

1. Newman, R., Gilbert, M., Lothridge, K., GC-MS Guide to Ignitable Liquids, CRC Press, 1998.

2. Trace Chemistry Resource binder of GC/MS data from ignitable liquids.

LESSON 12

Estimated Time: 2 Days

Purpose: The trainee must demonstrate the ability to testify in court about the finding and conclusions derived from his/her analysis.

Lecture: Tips on Testimony in Arson Cases

Exercises:

1. Trainee will develop a curriculum vitae.
2. Trainee will generate a list of qualifying questions.
3. The trainee will receive a passing score based on a pass/fail system for his/her testimony on a mock case.

Recommended Reading:

1. Trace Chemistry Resource Manual on Court Testimony.

LESSON 13

Estimated Time: 40 Days

Purpose: The trainee must demonstrate that he/she will provide correct analysis on actual case samples.

Lectures: Review of Ethical Responsibilities in Casework
Service to Law Enforcement Agencies
Case and Individual Activity Reports

Exercise:

1. Trainee will receive and analyze a minimum of ten (10) cases under the direct supervision of an experienced examiner. Reports will be signed by both individuals. Three (3) of these cases will serve as the criterion practical test and the trainee must get a score of 100% in order to pass. To pass, the findings and conclusions of the samples must be correct and all quality assurance measurements must be met.

Recommended Reading:

1. Forensic Sciences Command Quality Manual.

2. Forensic Sciences Command Directives Manual.

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: GLASS

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for Glass Examination and Analysis (TC-IV).

UNIT ESTIMATED TIME

129 Days

GOAL

Upon completion of this unit, the trainee will possess the necessary knowledge, skills, and abilities to be proficient in the identification and comparison of glass.

OBJECTIVES

1. The trainee will demonstrate a comprehensive knowledge of glass terminology, technology, and classification by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate his/her comprehensive knowledge, skills and abilities in the application of microscopy to forensic glass analysis. This will be accomplished with a score of no less than 80% on a written criterion test and a passing score on a practical quiz based on a pass/fail system.

3. The trainee will demonstrate his/her comprehensive knowledge, skills and abilities to identify glass to the exclusion of all other materials. This will be accomplished with a score of no less than 80% on a written criterion test and a passing score on a practical quiz based on a pass/fail system.

4. The trainee will demonstrate his/her comprehensive knowledge, skills and abilities to determine and perform a comparison of the refractive indices of glass. This will be accomplished with a score of no less than 80% on a written criterion test and a passing score on a practical quiz based on a pass/fail system.

5. The trainee will demonstrate his/her comprehensive knowledge, skills and abilities to determine and perform a comparison of the density of glass. This will be accomplished with a score of no less than 80% on a written criterion test and a passing score on a practical quiz based on a pass/fail system.

6. The trainee will demonstrate his/her comprehensive knowledge related to the analytical approach to tempered glass, safety glass, and fiber glass. This will be accomplished with a score of no less than 80% on a written criterion test.

7. The trainee will demonstrate his/her comprehensive knowledge of the application of elemental analysis in forensic glass comparisons. This will be accomplished with a score of no less than 80% on a written criterion test.

8. The trainee will demonstrate his/her comprehensive knowledge, sills, and abilities to determine and perform a comparison of the thickness of glass. This will be accomplished with a score of no less than 80% on a written criterion test.

9. The trainee will demonstrate his/her comprehensive knowledge of handling a glass fracture examination and determination of the direction of force. This will be accomplished with a score of no less than 80% on a written criterion test.

10. The trainee will demonstrate his/her comprehensive knowledge of statistical applications, documentation, QA measures, and report wording related to forensic glass examination and analysis. This will be accomplished with a score of no less than 80% on a written criterion test.

11. The trainee will demonstrate his/her comprehensive knowledge and ability to recognize, collect, preserve, and submit glass evidence. This will be accomplished with practical quizzes on a pass/fail basis and a score of no less than 80% on a written criterion test.

12. The trainee will demonstrate that he/she can apply the knowledge, skills and abilities required to perform the examination and analysis of glass with 100% accuracy on mock glass cases.

13. The trainee will demonstrate his/her ability to communicate the truth in a manner that is understandable and believable by passing on a pass/fail system a mock court testimony.

14. The trainee will demonstrate that he/she uses proper procedures, evaluations, and conclusions in a actual casework based on verification with cosignatory of reports by an experienced forensic scientist.

LESSON 1

Estimated Time: 3 Days

Purpose: Provide the trainee with background information related to glass. This will include: terminology, technology, chemistry, classifications and historical developments.

Lectures:
Terminology
Chemistry of Glass
Technology in Glass Production
Classifications
History of Glass

Exercises:
1. Complete Part A of the Glass Study Guide.
2. Complete Part A assignments in Glass.
3. Pass the glass introduction portion of the criterion test.

Recommended Reading:

1. Trace Chemistry Procedures Manual TC-IV pp. 2-6.
2. Trace Chemistry Resource Manual for glass.
3. Miller, E. T., "Forensic Glass Comparisons," in Forensic Science Handbook, ed., Richard Saferstein, Prentice-Hall, Inc., 1982.
4. Snow., R. R., "Chemistry of Glass Manufacturing" presented at the American Chemical Society's 18th Regional Meeting held in Bowling Green, Ohio.
5. Hutchins, J. R. and Harrington, R. V., "Glass" in Encyclopedia of Chemical Technology, 2nd Ed., Vol. IV, John Wiley and Sons, Inc., 1966, pp. 553-604.
6. Considine, D., "Glass" in Encyclopedia of Chemistry, 4th Ed., Van Nostrand Reinhold Co., 1984, pp. 424-430.
7. Smith, A. K., "Glass Identification Procedures," Bureau of Identification, Scientific Services, 1975.
8. Brady, G. S. and Clauser, H. R., "Glass" in Materials Handbook, McGraw-Hill Book Co., 1986, pp. 354-361.
9. "Glass Today, and What It Used To Be", The Family Handyman, Apr. 1990, p. 20.
10. Grayson, M., Encyclopedia of Glass, Ceramics, and Cement, John Wiley and Sons, 1985, pp. 462, 590.
11. Uhlann, D., Glass: Science and Technology, Academic Press, Inc., 1984, Vol. 2, (1), pp. 46, 107.
12. Brill, R., "A Note on the Scientist's Definition of Glass." Journal of Glass Studies, 1962. p. 127.
13. Warman, G., "An Introduction to Glass Technology," MPFSL Report #30, p. 43.
14. Paul, A., Chemistry of Glasses, Chapman & Hall, 1982.

LESSON 2

Estimated Time: 3 Days

Purpose: The trainee will demonstrate knowledge and skills related to the proper use of microscopes in glass examinations.

Lectures: Types and Operation of Microscopes Used in Glass Examinations
Properties of Light

Alignment of Microscopes
Care and Maintenance of the Microscopes

Exercises:

1. Complete Part B of the Glass Study Guide
2. Demonstrate to the training coordinator the microscope components, proper alignment, and preventive maintenance. A passing score on a pass/fail system is required for the practical quiz.
3. Pass microscope portion of the criterion test.

Recommended Reading:

1. Trace Chemistry Procedures Manual "Initial Examination" TC-IVA-1, pp. 1-4.
2. Trace Chemistry Resource Manual in Microscopy.

LESSON 3

Estimated Time: 5 Days

Purpose: The trainee will be able to identify glass to the exclusion of all other materials.

Lecture: Criteria for Glass Identification

Exercises:

1. Complete Part C of the Glass Study Guide.
2. Pass the glass identification portion of the written criterion test.
3. The training coordinator will provide a set of 56 samples. The trainee will document a description of each sample and determine if glass is present. This is a practical quiz with a passing score on a pass/fail system is required.

Required Reading:

1. Trace Chemistry Procedures Manual "Initial Examination" TC-IVA-1, p. 3.

LESSON 4

Estimated Time: 2 Days

Purpose: The trainee will have a comprehensive knowledge related to the analytical approach to tempered glass, safety glass and fiber glass.

Lectures: Visual Observations Characteristic of These Types of Glasses
Preparation and Optical Analysis of These Glasses
Analysis of Coating Material on Fiber Glass
Types of Safety Glass

Exercises:

1. Visually compare tempered and non-tempered glass. Verbally explain to the training coordinator the differences between these glasses.
2. Observe the shape of the glasses after breakage.

3. Complete Part F of the Glass Study Guide.
4. Pass the portion of the criterion test that deals with the subject matter covered in Lesson 4.

Recommended Reading:

1. Trace Chemistry Procedures Manual, "Glass Annealing" TC-IVB-3, pp. 1-3.

2. Walsh, KAJ, Buckleton, J. S., Triggs, C. M., A practical example of the interpretation of glass evidence, Science & Justice 1996, 36(4):213-218.

3. Edmondstone, G., The Identification of Heat Strengthened Glass in Windshields, Can Soc Forensic Sci J 1997, 30(40:181-184.

LESSON 5

Estimated Time: 1 Day

Purpose: The trainee will demonstrate that he/she has the comprehensive knowledge, skills and abilities to determine and perform a comparison of the thickness of glass

Lectures: Thickness Range for Different Types of Glass
Accuracy and Variability Related to Glass Thickness Measurements
Guidelines for Performing Glass Thickness Measurements

Exercises:

1. Experimentally determine the thickness of 5 known glass samples
2. Experimentally determine the thickness of 5 unknown glass samples. This is a pass/fail quiz. A passing grade with less than 100% correct will require additional unknown glass samples with 100% correct.
3. Experimentally compare sets of standards and unknowns provided by the training coordinator to determine which sets are a thickness match. This is a pass/fail quiz. A passing grade with less than 100% correct will require additional unknown glass samples with 100% correct.
4. Complete Part H of the Glass Study Guide.
5. Pass glass thickness portion of the written criterion test.

Recommended Reading:

1. Renshaw, G. & Clarke, P., "The Variation in Thickness of Toughened Glass from Car Windows," J. Forens. Sci. Soc. (1974), 14, #4, pp. 311-317.

2. Trace Chemistry Procedures Manual TC-IVA-1, p. 3.

LESSON 6

Estimated Time: 21 Days

Purpose: The trainee will have the comprehensive knowledge, skills and abilities to determine the refractive indices of glass and determine refractive indices variability of glass samples from the same source.

Lectures:
Becke Line
Dispersion
Double Variation Method
How to Obtain Refractive Indices (RI) of Glass
Expected Range of RI Based on Glass Type
GRIM System
Value of the Phase Contrast Microscope

Exercises:
1. Set up the microscope, monochrometer and hot stage.
2. Perform refractive index comparison of the portion of glass under compression versus the portion under tension. Explain your results to the training coordinator.
3. Perform refractive index comparison of glass removed from different sides of the plastic barrier of a piece of safety glass. Explain your results to the training coordinator.
4. Perform a refractive index analysis of fiberglass provided by the training coordinator. Explain your results to the training coordinator.
5. Perform Glass Practical #2.
6. Perform Glass Practical #3.
7. Complete Part D of the Glass Study Guide.
8. Pass refractive index portion of the written criterion test.

Recommended Reading:
1. Trace Chemistry Procedures Manual "Double Variation Procedure" TC-IVB-1, pp. 1-6.
2. Trace Chemistry Resource Manual for Glass.

LESSON 7

Estimated Time: 10 Days

Purpose: The trainee will have the comprehensive knowledge, skills and abilities to determine the density of glass and perform a comparison of the density of glass.

Lectures:
Terminology
Demonstrate Procedure
QA Measures and Safety Requirements
Sample Size and Density Variation
Use of Data Base

Exercises:
1. Set up the density measuring equipment.
2. Complete Part E of the Glass Study Guide.
3. Experimentally determine the density of 5 known glass samples.
4. Experimentally determine the density of 5 unknown glass samples.

This is a pass/fail quiz. A passing grade with less than 100% correct will require additional unknown glass samples with 100% correct.

5. Experimentally compare 5 sets of standards and unknowns to determine which sets are a density match. This is a pass/fail quiz. A passing grade with less than 100% correct will require additional unknown glass samples with 100% correct.
6. Pass density portion of the written criterion test.

Recommended Reading:

1. Trace Chemistry Procedures Manual "Density" TC-IVB-2, pp. 1-6.

2. Trace Chemistry Resource Manual for Glass.

LESSON 8

Estimated Time: 2 Days

Purpose: The trainee will have a comprehensive knowledge of the application of elemental analysis in forensic glass comparison.

Lectures: Instrumental Methods Used for Glass Elemental Analysis
Advantages and Disadvantages of the Various Methods Used for Elemental Analysis
The Importance of Elemental Analysis Compared to Other Methods of Glass Comparison

Exercises:

1. Complete Part G of the Glass Study Guide.
2. Pass elemental analysis portion of the written criterion test.

Recommended Reading:

1. Parouchais, T., Warner, I. M., Palmer, Lt., Kobus, H., The Analysis of Small Glass Fragments Using Inductively Coupled Plasma Mass Spectrometry, J. Forensic Sci 1996: 41(3):351-360.

2. Watling, R. J., Lynch, B. F., Herring, D., Use of Laser Ablation Inductively Coupled Plasma Mass Spectrometry for Fingerprinting Scene of Crime Evidence, J Anal At Spectrom 1997; 12(20;195-203.

3. Sotecklein, W., Fischer, R., Becker, S., Chadzelek, A., The Analysis of Float Glass: Characterization of Glasses from International Sources (abstract), International Workshop on the Forensic Examination of Trace Evidence, 1998 Jan 22-3; Tokyo, Japan.

4. Buscaglia, J., Aitken, CGG, Brown, K., DeForest, P. R., Kubic, T. A., The Discrimination of Window Glass Fragments by Energy Dispersive X-Ray Fluorescence Spectrometry (abstract), International Symposium on the Forensic Examination of Trace Evidence; 1998 Jan 22-23; Tokyo, Japan.

5. Andrasco, J., Forensic Comparison of Glass Fragments Based On Combination of Physical Techniques and Elemental Analysis in a Scanning Microscope (abstract),International Workshop on the Forensic Examination of Trace Evidence, 1998 Jan 22-23; Tokyo, Japan.

6. Goldmann, T., Hicks, T., Margot, P., The Analysis of Glass Fragments Using Energy Dispersive X-Ray μFluorescence (abstract), 14th Meeting of the International Association of Forensic Sciences, 1996 Aug 26-30; Tokyo, Japan.

7. Stocklein, W. Gunaratnam, L., Hicks, T., Kidfeldt G., Rindby, A., Warman J., Widstedt, I., The Analysis of Float Glass Using Elemental Analysis; Comparison of Techniques (abstract). First European Meeting of Forensic Science, 1997 Sept 17-19; Lausanne, Switzerland.

8. Stocklassa, B., Rindby, A., Applications of Micro-beam XRF in Forensic Science (abstract), International Workshop on the Forensic Examination of Trace Evidence, 1998 Jan 22-23; Tokyo, Japan.

9. Almirall, J. R., Cole, M. D., Gettinby, G., Furton, K. G., Discrimination of Glass Sources Using Elemental Composition and Refractive Index: Development of Predictive Models, Science & Justice 1998, 38(2):93-100.

10. Almirall, J., Cole, M., Furton, K., Gettinby, G., Classification and Discrimination of Forensic Glass Samples Using the Statistical Analysis of Their Elemental Composition and Refractive Index Data (abstract), 14th Meeting of the International Association of Forensic Sciences: 1996 Aug 26-30: Tokyo, Japan.
11. Curran, J. M., Triggs, C. M., Almirall, J. R., Buckleton, J. S., Walsh, K. A. J., The Interpretation of Elemental Composition Measurements from Forensic Glass Evidence: I, Science & Justices 1997, 37(4):241-244.

12. Curran, J. M., Triggs, C. M., Almirall, J. R., Buckleton, J. S., Walsh, K. A. J., The Interpretation of Elemental Composition Measurements from Forensic Glass Evidence: II, Science & Justices 1997, 37(4):245-249.

13. Reeve, B., Mathiesen, J. and Fong, W., Elemental Analysis by Energy Dispersive X-Ray: A Significant Factor in the Forensic Analysis of Glass, Journal of Forensic Sciences, 21: 291-306.

14. Stoecklein, W., Determination of Source and Characterization of Glass of International Origin, presentation to the International Symposium on the Forensic Examination of Trace Evidence, San Antonio, TX, June 1996.

15. Koons, R., Fiedler, C. and Fawalt, R., Classification and Discrimination of Sheet and Container Glasses by Inductively Coupled Plasma-Atomic Emission Spectrometry and Pattern Recognition, Journal of the Forensic Sciences, 1988, 33, 49-67.

16. Koons, R., Peters, C. and Rebbert, P., Comparison of Refractive Index, Energy Dispersive X-Ray Fluorescence and Inductively Couples Plasma Atomic Emission Spectrometry for Forensic Characterization of Sheet Glass Fragments, Journal of Analytical Atomic Spectrometry, 1991, 6, 451-456.

17. Buscaglia, J., Elemental Analysis of Small Glass Fragments in Forensic Science, Analytica Chimica Acta, 288 (1994) 17-24.

LESSON 9

Estimated Time: 1 Day

Purpose: The trainee will demonstrate his/her comprehensive knowledge of handling a glass fracture examination and the demonstration of the direction of force.

Lectures:
Terminology Related to Glass Fractures
Criteria to Determine the Direction of Force
Criteria to Determine Sequence of Breakage When Multiple Forces Were Applied
Problems Associated with the Determination of Direction of Force in Tempered Glass

Exercises:
1. Examine a broken sheet of glass. Explain to the training coordinator the direction of force and the basis for your conclusion.
2. Observe broken tempered glass. Provide visual proof to the training coordinator concerning the problems associated with a direction of force determination.
3. Pass glass fracture portion of the written criterion test.

Recommended Reading:

1. Wunsche, C., Radlein, E., Frischat, G. H., Glass Fracture Surfaces Seen with an Atomic Force Microscope, Fresenius J. Anal Chem 1997, 358:349-351.

2. Garrison, D., “A Template for Reconstructing the Center-of-Impact in Broken Windows,” MAFS Newsletter, Oc. 1990, p. 38.

3. McJunkins, S. P. and Thornton, J. L., “Glass Fracture. A Review,” Forensic Science, Vol. 2, 1973, pp. 1-27.

4. Rhodes, E., Thornton, J., “The Interpretation of Impact Fractures in Glassy Polymers,” JFS, 1975, Vol. 20, #2, pp. 274-282.

5. Saferstein, R., Ed., Forensic Science Handbook, "Glass Fracture Examination," 1982, pp. 146-153.

LESSON 10

Estimated Time: 2 Days

Purpose: The trainee must demonstrate that he/she knows the proper documentation, QA measures, statistical applications, and report wording related to glass examinations and comparisons.

Lectures:
Markings and Proper Completion of the Worksheet
QA Measures
Statistical Applications in Reporting Glass Results
Report Wording

Exercises:
1. The trainee will describe to the training coordinator how he/she would document work performed and how to properly use the computer program and data base related to glass.
2. The trainee will describe the QA measures required for each type of test performed and general QA measures for glass examination and comparison.
3. The trainee will provide the correct report wording for various scenarios presented by the training coordinator.
4. Complete Part I of the Glass Study Guide.
5. Pass the portion of the criterion test that deals with the subject matter covered in Lesson 10.

Recommended Reading:
1. Trace Chemistry Procedures Manual TC-IV, pp. 4-6.
2. Trace Chemistry Procedures Manual TC-App III, pp 2-3, 8-10.

LESSON 11

Estimated Time: 2 Days

Purpose: The trainee will demonstrate that he/she knows and can apply the recognition, collection, preservation and submission of glass evidence.

Lectures:
Removal of Glass from Clothing and Footwear
Package and Shipment of Small glass Fragments
Removal and Handling of Glass Submitted for a Direction of Force Determination
How, What, and Where to Collect the Glass Standards
The Importance of preserving Edges for a Physical Match

Exercises:

1. The trainee will demonstrate the proper collection and preservation techniques for samples and scenarios provided by the training coordinator.
2. Pass the portion of the criterion test that deals with subject matter covered in Lesson 11.

Recommended Reading:

1. Trace Chemistry Procedures Manual, TC-IVA-1, pp. 1-4.
2. Trace Chemistry Procedures Manual, TC-App III, pp. 6-7.
3. Hicks, T., Vanina, R., Margot, P., Transfer and Persistence of Glass Fragments on Garments, Science & Justice 1996, 36(2): 101-107.
4. Underhill, M., The Acquisition of Breaking and Broken Glass, Science & Justice 1997, 37(2): 121-127.
5. Lambert, J. A., Satterthwaite, M. J., Harrison, P. H., A Survey of Glass Fragments Recovered from Clothing of Persons Suspected or Involvement in Crime, Science & Justice 1995, 35(4): 273-281.
6. Lau, L., Beveridge, A. D., Callowhill, B. C., Conners, N, Foster, K., Groves, R. J., et al, The Frequency of Occurrence of Paint and Glass on the Clothing of High School Students, Can Soc Forensic Sci J 1997, 30(4):233-240.
7. Triggs, C. M., Curran, J. M., Buckleton, J. S., Walsh, K. A. J., The Grouping Problem in Forensic Glass Analysis: A Divisive Approach, Forensic Sci Int 1997, 85(10):1-14.
8. Evett, I. W., Lambert, J. A>, Buckleton, J. S., Further Observations on Glass Evidence Interpretation., Science & Justice 1995, 35(4):283-289.
9. McQuillan, J., Edgar, K., A Survey of the Distribution of Glass on Clothing, Journal of the Forensic Science Society, 1992, 32(4):333-348.
10. Curran, J. M., Triggs, C. M., Buckleton, J., Sampling in Forensic Comparison Problems, Science & Justice, 1998, 38(2): 101-107.

LESSON 12

Estimated Time: 35 Days

Purpose: The trainee must provide the correct answers for the examination and comparison of mock glass evidence. This represents the general unknowns for this unit of study. The trainee will pass the written criterion test for this unit of study.

Lecture: None

Exercises:
1. Thirty mock samples will be given to the trainee. This may be distributed as 15 mock cases. This is a criterion practical test and the trainee must get a score of 100%.
2. The trainee will pass the written criterion test for the unit of study with a score of no less than 80%.

Recommended Reading:
1. Trace Chemistry Procedures Manual "Glass" TC-IV, TC-App I, and TC-App II.

LESSON 13

Estimated Time: 2 Days

Purpose: The trainee must demonstrate the ability to testify in court about the findings and conclusions derived from his/her examination and/or comparison.

Lecture: Tips on Testimony About Glass

Exercises:
1. Trainee will develop a curriculum vitae.
2. Trainee will generate a list of qualifying questions.
3. The trainee will receive a passing score based on a pass/fail system for his/her testimony on a mock case.

Recommended Reading:
1. Trace Chemistry Resource Manual on Court Testimony.

LESSON 14

Estimated Time: 40 Days

Purpose: The trainee must demonstrate that he/she will provide correct analysis on actual case samples.

Lecture: Review of Ethical Responsibilities in Casework
Service to Law Enforcement Agencies
Case and Individual Activity Reports
Evidence Security

Exercises:
1. Trainee will receive and analyze a minimum of 20 cases under the direct supervision of an experienced examiner. Reports will be signed by both individuals.

Recommended Reading:

1. Forensic Sciences Command Quality Manual.
2. Forensic Sciences Command Directives Manual.

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: GLASS REFRACTIVE INDEX MEASUREMENT (GRIM) INSTRUMENTATION

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Section Advisory Committee

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for Refractive Index (TC-IVB-1).

PREREQUISITE REFERENCE

Successful completion of the sections of the Trace Chemistry Glass Training Module pertaining to the theoretical and casework applications of glass refractive index measurements and comparisons using the Double Variation Method (Training Module TC-IA-8).

UNIT ESTIMATED TIME

15 Days

GOAL

Upon completion of this module, the trainee will possess the necessary knowledge, skills, and abilities to be proficient in determining glass refractive index values using automated Glass Refractive Index Measurements (GRIM) instruments by the GRIM Standard Method and the GRIM Compatibility Method.

OBJECTIVES

1. The trainee will demonstrate comprehension of the theoretical foundations of automated Glass Refractive Index Measurement (GRIM) instrumentation, the GRIM Standard Method, the GRIM Compatibility Method, and the differences between these methods and the Double Variation Method, by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate practical skill in the operation of automated Glass Refractive Index Measurement (GRIM) instrumentation using the GRIM Standard Method and the GRIM Compatibility Method by successfully performing a variety of practical exercises. These exercises will include the following:

    A. Perform and document a successful calibration for the GRIM Standard Method.

    B. Perform and document quality assurance checks and assess operation of the system for GRIM Standard Method.

    C. Measure refractive index values for a minimum of three of the Locke B series certified glass standards using the GRIM Standard Method, and assess the measured values against the certified values for the standards.

    D. Measure and compare refractive index values for a minimum of two sets of standards and unknowns using the GRIM Standard Method to determine which sets are similar in refractive index values.

    E. Repeat Exercises 2B, 2C, and 2D using the GRIM Compatibility Method. When repeating Exercise 2C, also compare the measured values to those obtained using the Double Variation Method.

F. Demonstrate the effects of potential sources of error and how to correct them.

3. The trainee will demonstrate his/her ability to correctly perform GRIM Standard Method analysis and interpret the results with a 100% practical criterion test score on a set of standards and unknowns.

4. The trainee will demonstrate his/her ability to correctly perform GRIM Compatibility Method analysis and interpret the results with a 100% practical criterion test score on a set of standards and unknowns.

LESSON 1

Estimated Time: 1 Day

Purpose: To familiarize the trainee with the theoretical foundations of automated Glass Refractive Index Measurements (GRIM) instrumentation and the GRIM Standard Method.

Lectures: Introduction to GRIM Instrumentation

Theoretical Foundations of the GRIM Standard Method

Procedural Overview: GRIM Standard Method

Exercises:

1. Read the assigned materials.

2. Complete related sections of the GRIM Study Guide.

Required Reading:

1. Either (A) or (B):
   (A) "GRIM2 Installation & Instruction Manual," by Foster + Freeman Ltd., UK, 1998, and "GRIM2 Application Notes," by Foster + Freeman Ltd., UK, 2000.
   (B) "GRIM3 User's Manual 08," by Foster + Freeman Ltd., UK, 2006.

2. ASTM Standard E1967, 2011a, "Standard Test Method for the Automated Determination of Refractive Index of Glass Samples Using the Oil Immersion Method and a Phase Contrast Microscope," ASTM International, West Conshohocken, PA, 2011, DOI: 10.1520/E1967-11A.

3. ISP SAC Memo 02-TRACE-02, "Glass Refractive Index Measurement Validation and Procedure (GRIM2)," Don Kristiansen, 2002.

4. "Refractive Index," ISP Trace Chemistry Procedures Manual, Section TC-IVB-1.

5. "Reference Glasses and Silicone Oils for Refractive Index Measurement," by Locke Scientific Services, Ltd., UK, no date specified.

6. SWGMAT Guideline, "Glass Refractive Index Determination," July 2004.

LESSON 2

Estimated Time: 2 Days

Purpose: To familiarize the trainee with the theoretical foundations of the GRIM Compatibility Method.

Lectures: Theoretical Foundations of the GRIM Compatibility Method

Procedural Overview: GRIM Compatibility Method

Exercises:

1. Read the assigned materials.
2. Complete related sections of the GRIM Study Guide.
3. Pass the GRIM Training Module written criterion test.

Required Reading:

1. ISP SAC Memo 12-TRACE-02, "Achieving Compatibility Between GRIM Instruments and the ISP Glass Database," Kimberly Kunkler, 2012.

LESSON 3

Estimated Time: 8 ½ Days

Purpose: To develop the trainee's practical skill in the operation of GRIM instrumentation using the GRIM Standard Method.

Lectures: Overview of GRIM Instrumentation: Parts, Start-Up & Shut-Down Procedures, General Maintenance

Performing Calibration for GRIM Standard Method

Quality Assurance Checks for GRIM Standard Method

Measuring Refractive Index Values Using GRIM Standard Method

Exercises:

1. Perform and document a successful calibration for the GRIM Standard Method.
2. Perform and document quality assurance checks and assess operation of the system for GRIM Standard Method.
3. Measure refractive index values for a minimum of three of the Locke B series certified glass standards using the GRIM Standard Method, and assess the measured values against the certified values for the standards.

4. Measure and compare refractive index values for a minimum of two sets of standards and unknowns using the GRIM Standard Method to determine which sets are similar in refractive index values.

5. Demonstrate the effects of potential sources of error and how to correct them.

6. Pass the GRIM Standard Method practical criterion test.

Required Reading:

1. "Refractive Index." ISP Trace Chemistry Procedures Manual, Section TC-IVB-I.

LESSON 4

Estimated Time: 3 ½ Days

Purpose: To develop the trainee's practical skill in the operation of GRIM instrumentation using the GRIM Compatibility Method.

Lectures: Quality Assurance Checks for GRIM Compatibility Method

Measuring Refractive Index Values Using GRIM Compatibility Method

Exercises:

1. Perform and document quality assurance checks and assess operation of the system for GRIM Compatibility Method.

2. Measure refractive index values for a minimum of three of the Locke B series certified glass standards using the GRIM Compatibility Method, and assess the measured values against the certified values and the Double Variation Method measured values for the standards.

3. Measure and compare refractive index values for a minimum of two sets of standards and unknowns using the GRIM Compatibility Method to determine which sets are similar in refractive index values.

4. Demonstrate the effects of potential sources of error and how to correct them.

5. Pass the GRIM Compatibility Method practical criterion test.

Required Reading:

1. "Refractive Index." ISP Trace Chemistry Procedures Manual, Section TC-IVB-I.

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: PAINT ANALYSIS

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for Paint Analysis (TC-V).

UNIT ESTIMATED TIME

128 Days

GOAL

Upon completion of this unit, the trainee will possess the necessary knowledge, skills, and abilities to be proficient in the identification and comparison of paint.

OBJECTIVES

1. The trainee will demonstrate a comprehensive knowledge of paint terminology, technology, chemistry and classification by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a comprehensive knowledge of the analytical schemes used for paint analysis. This will be accomplished with a score of no less than 80% on a written criterion test.

3. The trainee will demonstrate his/her comprehensive knowledge, skills and abilities to perform macroscopic and microscopic examinations of paints. This will be accomplished with a score of no less than 80% on a written criterion test and a passing score on a practical quiz based on a pass/fail system.

4. The trainee will demonstrate knowledge and skills related to chemical reactivity procedures used in paint analysis. Accomplishment will be based on a score of no less than 80% on a written criterion test and a passing score on a practical quiz based on a pass/fail system.

5. The trainee will demonstrate knowledge and skills related to the application of pyrolysis gas chromatography (PGC) in the analysis of paint. Accomplishment will be based on a score of no less than 80% on a written criterion test and a passing score on a practical quiz based on a pass/fail system.

6. The trainee will demonstrate knowledge, skills and abilities related to the application of Fourier Transform Infrared Spectroscopy (FTIR) in the analysis of paint. Accomplishment will be based on a score of no less than 80% on a written criterion test and a passing score on a practical quiz based upon a pass/fail system.

7. The trainee will demonstrate knowledge, skills, and abilities related to the application of the scanning electron microscope/energy dispersive x-ray system in the analysis of paint. Accomplishment will be based on a score of no less than 80% on a written criterion test and a passing score on a practical quiz based upon a pass/fail system.

8. The trainee will demonstrate his/her comprehensive knowledge of documentation, QA measures, safety precautions, classification, and report wording related to paint analysis by passing a written criterion test with a score of no less than 80%.

9. The trainee will demonstrate his/her comprehensive knowledge and ability to recognize, collect, preserve, and submit paint evidence. This will be accomplished with practical quizzes on a pass/fail system and a score of no less than 80% on a written criterion test.

10. The trainee will demonstrate that he/she can apply the knowledge, skills and abilities required to perform the examination and analysis of paint with 100% accuracy on mock paint cases.

11. The trainee will demonstrate his/her ability to communicate the truth in a manner that is understandable and believable by passing on a pass/fail system a mock court testimony.

12. The trainee will demonstrate that he/she uses proper procedures, evaluations, and conclusions in actual casework based upon verification with cosignatory of reports by an experienced forensic scientist.

LESSON 1

Estimated Time: 5 Days

Purpose: Provide the trainee with background information related to paint. This will include: terminology, technology, chemistry, classifications and historical developments.

Lectures:
Terminology
History of Paint
Types/Classification/Uses
Paint Chemistry
Application Techniques
Defects

Exercises:
1. Complete Part A of the Paint Study Guide.
2. Complete Part A assignments in Paint Introduction.
3. Pass the paint introduction portion of the written criterion test.

Recommended Reading:

1. "How a House Works – Making Latex Paint Better," The Family Handyman, 1993, June, pp. 20-24.

2. Peng, W. & Riedl, B., "Thermosetting Resins," Jour. of Chem. Education, 1995, V. 72, #7, pp. 587-592.

3. CD-Rom "SciQuest", Vol. 1, 1995, Federation of Societies for Coatings Technology.

4. CD-Rom, "Paint and Coating Raw Materials Electronic Handbook," 1996, Gower Publishing Co.

5. Schneberger, G., Understanding Paint and Painting Processes, 3rd Ed., Hitchcock Publ. Co.

6. Morgans, W., Outlines of Paint Technology, 3rd Ed., 1990, Halsted Press.

7. Lambourne, R., paint & Surface Coatings Theory and Practice, 1987, Ellis Harwood Limited.

8. Brandau, A., Introduction to Coatings Technology, 1990, Federation of Societies for Coatings Technology.

9. McBane, B., Automotive Coatings, 1987, Federation of Societies for Coatings Technology.

10. Pierce, P., Coating Film Defects, 1994, Federation of Societies for Coatings Technology.

11. Levinson, S., Application of Paints and Coatings, 1988, Federation of Societies for Coatings Technology.

12. Jilek, J., Powder Coatings, 1991, Federation of Societies for Coatings Technology.

13. Trace Chemistry Procedures Manual TC-V, pp. 3-6.

14. ASTM Standard, 2012, "Terminology Relating to Paint, Coatings, Materials, and Applications," ASTM International, West Conshohocken, PA, 2012, DOI:"10.1520/D0016-12.

LESSON 2

Estimated Time: 2 Days

Purpose: Provide the trainee with the analytical schemes used in paint analysis.

Lectures:
Analytical Approach to Paint Analysis
General Analytical Flow Charts
Required and Optional Tests

Exercises:
1. Complete Part B of the Paint Study Guide
2. Complete Part B assignments in Paint.
3. Pass the analytical scheme portion of the criterion test.

Recommended Reading:
1. Trace Chemistry Procedures Manual, TC-V, pp. 9-10.

2. ASTM E1610, 2014, "Standard Guide for Forensic Paint Analysis and Comparison," ASTM International, West Conshohocken, PA, 2014, DOI: 10.1520/E1610-14.

3. Thornton, J. I., "Forensic Paint Examination," Forensic Science Handbook, Vol. 1, Saferstein, R., Ed., Prentice-Hall, NJ, 1982, pp. 529-571.

4. Mary, R. W., Porter, J., "An Evaluation of Common Methods of Paint Analysis," Journal of Forensic Science Society, 1975, 15, 2, 137-146.

LESSON 3

Estimated Time: 10 Days

Purpose: The trainee will demonstrate his/her knowledge, skills, and abilities to perform macroscopic and microscopic examinations of paints.

Lectures:
Macroscopic Checks to Include: Physical Match, Color under Different Illuminations
Microscopic Checks to Include: Color, Thickness, Layer Continuity, Surface Defects, Paint Texture, Number of Layers and Sequence, Contaminants, and Inclusions
Thickness Measurement of Paint Layer and Expected Thickness Range
The Use of Edge Matching or Striae for Physical Match
The Use of the Stereomicroscope and Compound Microscope
Information That Must Be Documented
Review Terms in the Description of Paint Surface Characteristics
Criteria for Paint Identification

Exercises:
1. Trainee will complete Part C of the Paint Study Guide
2. Complete set of practice samples provided by the training coordinator. Document your observations and provide information to support findings that a sample is paint.
3. Complete practical quiz provided by the training coordinator. This is a pass/fail quiz. A passing grade with less than 100% correct will require additional unknown samples with 100% correct.
4. Pass the paint portion of the written criterion test.

Recommended Reading:

1. Laing, D. K., Locke, J., Richard, R. A., and Wilkinson, J. M., "The Examination of Paint Films and Fibers as Thin Sections," The Microscope, Vol. 35, No. 3, 1987, pp. 233-248.

2. Trace Chemistry Procedures Manual, "Minimum Standards & Controls", TC-V, p. 6-8.

3. Trace Chemistry Procedures Manual, "Microscopic Examination," TC-VA-1, pp. 1-3.

4. Ryland S. G., et al, "The Evidential Value of Automobile Paint. Part II: Frequency of Occurrence of Topcoat Colors," Journal of Forensic Sciences, 1981, 26, 1, 64-74.

5. ASTM E1610, 2014, "Standard Guide for Forensic Paint Analysis and Comparison," ASTM International, West Conshohocken, PA, 2014, DOI: 10.1520/E1610-14.

6. Ryland, S. G., Kopec, R. J., "The Evidential Value of Automobile Paint Chips," Journal of Forensic Sciences, 1979, 24, 1, 140-147.

7. Gothard, J. A., "Evaluation of Automobile Paint Flakes as Evidence," Journal of Forensic Sciences, 1976, 21, 3, 636-641.

8. Hamer, P. S., "Pigment Analysis of the Forensic Examination of Paints III. A Guide to Motor Vehicle Paint Examination by Transmitted Light Microscopy," *Journal of Forensic Science Society*, 1982, 22, 22, 187-192.

9. Cartwright, L. J., Cartwright, N. S., Norman, E. W. W., Cameron, R., MacDougall, D. A., Clark, W. H., "The Classification of Automotive Paint Primers Using the Munsell Color Coordinate System – A Collaborative Study," *Canadian Society of Forensic Science Journal*, 1984, 17, 14-18.

10. Thornton, J. I., "Visual Colour Comparisons in Forensic Science," *Forensic Science Review*, 1997, 9:37-57.

LESSON 4

Estimated Time: 5 Days

Purpose: The trainee will demonstrate knowledge and skills related to the proper use of chemical reactivity procedures in paint analysis.

Lectures:
Types and Purpose of the Chemical Reagents Used
Documentation of Results, Immediate Reactions and Set Time Intervals
Characteristics to Be Check Include: Softening, Swelling, Curling or Wrinkling, Layer Desolution, Pigment Filler Effervescence, Flocculation, and Color Changes or Dye Solubility
QA Measures for Use of Chemical Reactivity Tests
Safety Precautions

Exercises:
1. Complete Part D of the Paint Study Guide.
2. Prepare chemical reagents. Complete set of practice samples provided by the training coordinator. Document your observations.
3. Complete practical quiz provided by the training coordinator. This is a pass/fail quiz. A passing grade with less than 100% correct will require additional unknown samples with 100% correct.

4. Pass chemical reactivity portion of the written criterion test.

Recommended Reading:

1. Trace Chemistry Procedures Manual "Minimum Standards & Controls" TC-V, pp. 6-8.

2. Trace Chemistry Procedures Manual "Chemical Reactivity", TC-VB-1, pp. 1-5.

LESSON 5

Estimated Time: 10 Days

Purpose: The trainee will demonstrate that he/she can explain the operation of the pyrolysis gas chromatograph (PGC) in terms understandable to a jury and can operate the instrument to provide the data required for paint analysis.

Lectures: Instrument Conditions for PGC. Factors That Will Effect the Pyrogram: Pyrolytic Temperature and Time, Temperature of Interface, Pyrolytic Temperature Ramp Rate
How to Perform Comparative Analysis of Pyrograms
Sample Prep
QA Measures for the Use of PGC in Paint Analysis

Exercises:

1. Must have successfully completed the unit on gas chromatography or demonstrated proficiency in gas chromatography with passing scores on written and practical tests.
2. Complete Part E of the Paint Study Guide.
3. Successfully complete an oral quiz on the explanation of the GC operation and interpretation of the data. This is a pass/fail quiz.
4. A set of known samples will be provided by the training coordinator. The trainee will set up a method and run the samples. The trainee must obtain data to support his/her opinion concerning a match between the paints.
5. A set of unknown samples will be provided by the training coordinator. The trainee must provide documentation to support answers and must obtain a passing grade on a pass/fail system.
6. Pass the PGC portion of the criterion test.

Recommended Reading:

1. Trace Chemistry Procedures Manual, "Pyrolysis Gas Chromatography Analysis" TC-VB-2, pp. 1-6.

2. Trace Chemistry Procedures Manual, "Minimum Standards & Controls," TC-V, pp. 6-8.

3. Trace Chemistry Training Manual, "Gas Chromatography," TC-IA-1.

4. Stewart, W. D., Jr., "Pyrolysis-Gas Chromatographic Analysis of Automotive Paints," Journal of Forensic Science, Vol. 19, No. 1, 1974, pp. 121-129.

5. Irwin, W. J., "Analytical Pyrolysis-An Overview," Journal of Analytical and Applied Pyrolysis, Vol. 1, No. 1, 1979, pp. 3-25.

6. Windig, W., Kistemaker, P. G., and Haverkamp, J., "The Effects of Sample Preparation, Pyrolysis and Pyrolyzate Transfer Conditions on Pyrolysis Mass Spectra," Journal of Analytical and Applied Pyrolysis, Vol. 1, No. 1, 1979, pp. 39-52.

7. McMinn, D. G., Carlson, T. L., and Munson, T. O., :Pyrolysis Capillary Gas Chromatography/Mass Spectrometry for Analysis of Automotive Paints," Journal of Forensic Sciences, Vol. 30, No. 4, 1985, pp. 1064-1073.

8. Blackledge, R. D., "Application of Pyrolysis Gas Chromatography in Forensic Science," Forensic Science Review, Vol. 4, No. 1, 1992,pp. 2-15.

9. See Reference #5 in Lesson 3.

LESSON 6

Estimated Time: 10 Days

Purpose: The trainee will demonstrate that he/she can explain the operation of the Fourier Transform Infrared Spectrometer (FTIR) in terms understandable to a jury and can operate the instrument to provide the data required for paint analysis.

Lectures:
Operation, Theory and Instrument Parameters Related to the FTIR Microscope
QA Measures for the Use of FTIR in Paint Analysis
Sample Prep and Thin Sections
Guidelines Used for Interpretation and Classification Related to Paint Analysis
Guidelines Used for Comparative Analysis
Sensitivity Limit >5% for Paint Vehicle Component

Exercises:
1. Must have successfully completed the unit on FTIR or demonstrated proficiency in FTIR with passing scores on written and practical tests.
2. Complete Part F of the Paint Study Guide.
3. Successfully complete an oral quiz on the explanation of the FTIR operation and interpretation of the data. This is a pass/fail quiz.
4. Perform analysis on practice samples. Provide complete documentation to support your findings and explain your conclusion to the training coordinator.

5. Analyze a set of unknowns provided by the training coordinator. This is a practical quiz which requires a passing score on a pass/fail scoring system.
6. Pass FTIR portion of the criterion test.

Recommended Reading:

1. Trace Chemistry Procedures Manual, "Minimum Standards & Controls," TC-V, pp.6-8.

2. Trace Chemistry Procedures Manual, "Fourier Transform Infrared Spectrometer (FTIR) Analysis," TC-VB-3, pp. 1-8.

3. Trace Chemistry Training Manual, "Fourier Transform Infrared Spectrometer (FTIR)," TC-IA-3.

4. Laing, D. K., Locke, J., Richard, R. A., and Wilkinson, J. M., "The Examination of Paint Films and Fibers as Thin Sections," The Microscope, Vol. 35, No. 3, 1987, pp. 233-248.

5. Tweed, F. T., et al., "The Forensic Microanalysis of Paints, Plastics and Other Materials by an Infrared Diamond Cell Technique," Forensic Science, Vol. 4, 1974, pp. 211-218.

6. Tilman, V. L., "Automotive Paint Binder Infrared Classification Flowchart," 1991.

7. Audette, R. J., Percy, R. F. E., " A Rapid, Systematic, and Comprehensive Classification System for the Identification and Comparison of Motor Vehicle Paint Samples, I: The Nature and Scope of the Classification System," J. Forensic Sci, 1979, 24:790-807.

8. Cartwright, L. J., Cartwright, N. S., Rodgers, P. G., :A Mocrotome Technique for Sectioning Multilayer Paint Samples for Microanalysis," Can. Soc. Forensic Sci. J., 1977, 10:7-12.

9. Cassita, A. C., Sandercock, P. M. L., "Comparison and Identification of Automotive Topcoats; Microchemical Spot Tests, Microspectro-photometry, Pyrolysis-Gas Chromatography, and Diamond Anvil Cell FITR," Can. Soc. Forensic Sci. J., 1994, 27:209-223.

10. See Reference #5 in Lesson 3.

LESSON 7

Estimated Time: 5 Days

Purpose: The trainee will demonstrate his/her ability to explain and properly operate the scanning electron microscope (SEM)/energy dispersive x-ray system (EDX), perform the required troubleshooting and quality assurance measures, and interpret EDX data related to paint analysis.

Lectures: Instrument Parameters for Paint Analysis
QA Measures for the Use of SEM/EDX in Paint Analysis
Sample Prep and Mounting Samples
Guidelines for Interpretation
Stress A 10x10 µm Scan Area of SEM Will Generate X-Rays from a Depth of 10 µm and a Surface Area of 20 µm x20 µm.
Sensitivity Limit for Paint. Elements must be > 0.8%.

Exercises:
1. Must have successfully completed the unit on SEM/EDX or demonstrated proficiency in SEM/EDX with passing scores on written and practical tests.
2. Complete Part G of the Paint Study Guide.
3. Successfully complete an oral quiz on the explanation of the SEM/EDX operation and interpretation of the data. This is a pass/fail quiz.
4. Perform analysis on practice samples. Provide complete documentation to support your findings and explain your conclusion to the training coordinator.
5. Analyze a set of unknowns provided by the training coordinator. This is a practical quiz which requires a passing score on a pass/fail scoring system.
6. Pass the SEM/EDX portion of the criterion test.

Recommended Reading:
1. Trace Chemistry Procedures Manual, "Minimum Standards & Controls," TC-V, pp. 6-8.
2. Trace Chemistry Procedures Manual, "Scanning Electron Microscope/Energy Dispersive X-Ray," TC-VB-4, pp. 1-6.
3. Trace Chemistry Training Manual, "Scanning Electron Microscopy/Energy Dispersive X-Ray," TC-IA-5.

LESSON 8

Estimated Time: 2 Days

Purpose: The trainee must demonstrate that he/she knows the proper documentation, QA measures, safety precautions, classification, and report wording related to paint analysis.

Lectures: Markings and Proper Completion of the Worksheet
QA Measures
Safely Working with Paint Chemicals
Report Wording

Exercises:
1. The trainee will describe to the training coordinator how he/she would document work performed and what safety measures would be practiced.
2. The trainee will describe the QA measures required for each type of test performed and general QA measures for paint analysis.

3. The trainee will provide the correct report wording for various scenarios presented by the training coordinator.
4. Complete Part H of the Paint Study Guide.
5. Pass portion of the criterion test that deals with subject matter covered in Lesson 8.

Recommended Reading:

1. Trace Chemistry Procedures Manual, "Introduction," TC-V.
2. Trace Chemistry Procedures Manual, "Report Wording."
3. Trace Chemistry Procedures Manual, "Minimum Standards & Controls," TC-V, pp 6-8.
4. Trace Chemistry Procedures Manual, TC-VB-3, pp. 5-6.

LESSON 9

Estimated Time: 2 Days

Purpose: The trainee will demonstrate that he/she knows and can apply the proper action related to the recognition, collection, preservation and submission of paint evidence.

Lectures:
Proper Collection Technique Includes Collection of Paint Chips from Areas Immediately Adjacent to Damaged Area or Points of Transfer. The Sample Collected Should Include All Layers Methods to Remove Paint Chips
Preservation Means to Properly Secure Chips in Evidence Container and Avoid Attaching Sample on Tape
Proper Documentation Before Removal of Transferred Chips
Review Importance of Physical Match
Screening Clothing for Paint Chips

Exercises:

1. Materials will be provided by the training coordinator. The trainee will demonstrate to the training coordinator the proper approach for checking and removal of any paint chips. This includes paint standards.
2. The trainee will demonstrate the proper method to package the paint evidence and proper documentation.
3. Pass the portion of the criterion test that deals with the subject matter covered in Lesson 9.

Recommended Reading:

1. Trace Chemistry Procedures Manual, "Collection and Preservation of Evidence," TC-App III, pp 8-9.
2. McDermott, S. D., Willis, S. M., "A Survey of the Evidential Value of Paint Transfer Evidence," J. Forensic Sci., 1997, 42(6): 1012-1018.

LESSON 10

Estimated Time: 35 Days

Purpose: The trainee must provide the correct answers for the analysis of mock paint evidence. This represents the general unknowns for this unit of study. The trainee will pass the written criterion test.

Lectures: None

Exercises:

1. Thirty mock samples will be given to the trainee. This may be distributed as 15 mock cases. This is a criterion practical test and the trainee must get a score of 100%.
2. The trainee will pass the written criterion test for the unit with a score of no less than 80%.

Recommended Reading:

1. Trace Chemistry Procedures Manual, "Paint Analysis," TC-V.

LESSON 11

Estimated Time: 40 Days

Purpose: The trainee must demonstrate the ability to testify in court about the findings and conclusions derived from his/her analysis.

Lecture: Tips on Testimony in Paint

Exercises:

1. Trainee will develop a curriculum vitae.
2. Trainee will generate a list of qualifying questions.
3. The trainee will receive a passing score based on a pass/fail system for his/her testimony on a mock case.

Recommended Reading:

1. Trace Chemistry Resource Manual on Court Testimony.

LESSON 12

Estimated Time: 40 Days

Purpose: The trainee must demonstrate that he/she will provide correct analysis on actual case samples.

Lectures: Review of Ethical Responsibilities in Casework
Service to Law Enforcement Agencies
Case and Individual Activity Reports

Exercises:

1. Trainee will receive and analyze a minimum of 20 cases under the direct supervision of an experienced examiner. Reports will be signed by both individuals.

Recommended Reading:

1. Forensic Sciences Command Quality Manual.
2. Forensic Sciences Command Directives Manual.

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: PAINT DATA QUERY (PDQ)

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

Procedures in the Trace Chemistry Procedures Manual for Make, Model, Year Determination (TC-VC-2).

PREREQUISITE REFERENCE

Trace Chemistry Procedure Manual for Paint TC-V.

UNIT ESTIMATED TIME

15 Days

GOAL

Upon completion of this module, the trainee will possess the necessary knowledge, skills, and abilities to be proficient in determining the possible make, model, and year range of unknown automotive paint chips.

OBJECTIVES

1. The trainee will demonstrate knowledge, skills, and abilities in sampling and analyzing the individual layers of an automotive paint chip using either the bench or microscope accessory on the FTIR as observed and evaluated by the training coordinator on a pass/fail basis.

2. The trainee will demonstrate a comprehensive knowledge in determining if a paint chip is Original Equipment Manufacturer (OEM) or a refinish as observed and evaluated by the training coordinator on a pass/fail basis.

3. The trainee will demonstrate a comprehensive knowledge on how to determine the chemical components of a paint chip based on the FTIR spectra and be able to code the components using RCMP's coding system as observed and evaluated by the training coordinator on a pass/fail basis.

4. The trainee will demonstrate knowledge in using the Munsell Color Coordinate System as observed and evaluated by the training coordinator on a pass/fail basis.

5. The trainee will demonstrate a comprehensive knowledge on how to search the PDQ automotive paint database as observed and evaluated by the training coordinator on a pass/fail basis.

6. The trainee will demonstrate a comprehensive knowledge on how to effectively use the spectral search library software to narrow down a hit list of possible manufacturers, plants, and years as observed and evaluated by the training coordinator on a pass/fail basis.

7. The trainee will demonstrate knowledge on how to use the refinish color collection books to narrow down the possible make, model, and year list as observed and evaluated by the training coordinator on a pass/fail basis.

8. The trainee will demonstrate a knowledge in determining the possible vehicle models by using Automotive News magazine and other printed resources as observed and evaluated by the training coordinator on a pass/fail basis.

9. The trainee will discuss options for report wording as observed and evaluated by the training coordinator on a pass/fail basis.

LESSON 1

Estimated Time: 1 Day

Purpose: Introduction to PDQ, background behind the PDQ database, and characteristics of automotive paint (how it is applied and the type of layers seen in a typical automotive paint system).

Lectures:

What is PDQ
A database maintained by the Royal Canadian Mounted Police (RCMP) that contains over 18,000 samples (over 70,000 individual paint layers) representing the paint systems used on most domestic and foreign vehicles marketed in North America. Each year over 500 samples are added to the international automotive paint database.

Significance of PDQ
The paint systems on an automobile typically have three or four layers. Automotive manufacturers and their suppliers tend to use unique combinations of pigments and binders in each of these layers. It is this unique combination that allows forensic scientist to determine the possible make, model, and year range for the vehicle that a paint chip may have originated from.

History of PDQ
Studies conducted over 30 years ago by the RCMP forensic laboratory system showed that vehicles could be differentiated by comparing the color, layer sequence, and chemical composition of each individual layers in a paint system.

The Different Layers Of An Automotive Paint System, Their Purposes And How They Are Applied To The Vehicle

Required Reading:

1. PDQ Workshop notebook: Section 1, 2 and 3.

2. Buckle, J.L., MacDougall, D.A., and Grant, R.R., "PDQ – paint data queries: The history and technology behind the development of the Royal Canadian Mounted Police Forensic Laboratory Services automotive paint database," Can. So. For. Sci. J., Vol. 30, No. 4, 1997, pp. 199-212.

3. Bishea, G., Buckle, J., and Ryland, S., "International forensic automotive paint database." Proceedings of SPIE Conference, Investigation and Forensic Science Technologies, International Society for Optical Engineering, Vol. 3576, February, 1999, pp. 73-76.

LESSON 2

Estimated Time: 1 Day

Purpose: The trainee will be able to take an automotive paint chip and slice the layers individually, mount the layers onto a sampling device, and analyze each layer separately on the FTIR.

Lectures: The Importance Of Getting Clean Slices Of Each Layer

Slicing A Sample Using Different Types Of Scalpels, Techniques, And Microtome

The Different Possible Sampling Devices That Can Be Used On The FTIR (Scope, Compression Cells, Etc.)

Exercises:

1. The trainee will demonstrate to the training coordinator a proper technique in getting clean slices of each layer of paint in an automotive paint system and be able to mount them onto an acceptable sampling device for FTIR analysis (KBr crystal, diamond compression cell, etc.).

2. The trainee will analyze each layer by FTIR and obtain acceptable and usable spectra.

Required Reading:

1. ISP R&D Laboratory "Preparations of Thin Sections of Paint for Fourier Transform Infrared (FTIR) Microscopic Analysis", ISP Trace Memo, 02-TRACE-7.

2. Ryland, S.G., "Infrared Microspectroscopy of Forensic Paint Evidence," Chapter 6, Practical Guide to Infrared Microspectroscopy, Humecki, H.J., ed., Marcel Dekker, Inc., 1995, pp. 177-185.

LESSON 3

Estimated Time: 1½ Days

Purpose: The trainee will look at FTIR spectra of a paint sample and be able to determine the chemical components of the paint sample and label the samples using PDQ's coding system.

Lectures: Determination Of Chemical Components In A Paint Layer By FTIR Analysis (Binder Types, Fillers), What To Look For

The Codes Used In PDQ

The Differences Seen In Each Layer And How It Can Sometimes Be Determined What Layer A Paint Is From, By Its Components

Exercises:

1. The trainee will take the FTIR spectra produced from the previous lesson, figure out the chemical components, and code them using RCMP's coding system.

2. The trainee will take an additional 5 sets of FTIR spectra from different paint systems and code each layer.

Required Reading:

1. PDQ Workshop notebook: Section 5.

2. Ryland, S.G., "Infrared Microspectroscopy of Forensic Paint Evidence," Chapter 6, Practical Guide to Infrared Microspectroscopy, Humecki, H.J., ed., Marcel Dekker, Inc., 1995, pp. 185-209.

3. Rodgers, P.G., et al, "The Classification of Automobile Paint by Diamond Cell Window Infrared Spectrophotometry – Part I: Binders and Pigments", Canadian Society of Forensic Science Journal, 9 (1), pp. 1-14, 1976.

4. Rodgers, P.G., et al, "The Classification of Automotive Paint by Diamond Window Infrared Spectrophotometry – Part II: Automotive Topcoats and Undercoats," Canadian Society of Forensic Science Journal, 9 (2), pp. 49-68, 1976.

LESSON 4

Estimated Time: ½ Day

Purpose: The trainee will look at a paint chip and be able to determine if the paint chip is OEM paint or refinish paint based upon the stereoscopic properties of the paint and/or the FTIR spectra of the layers.

Lectures: Determining If The System Is OEM Or Repaint By Physical Appearance

Determining If The System Is OEM Or Repaint By Chemistry

Exercises:

1. The trainee will look at various paint chips and try to determine if they are OEM or a repaint based upon stereoscopic examination.

2. The trainee will take the spectra from Lesson 3 and try to determine if the spectra are from an OEM paint system or a repaint.

Required Reading: None

LESSON 5

Estimated Time: 1 Day

Purpose: The trainee will learn about the PDQ software, the different possible searches that can be performed on the PDQ database, how to get a hit list, and how to narrow down a hit list. The trainee will also become familiar with Munsell Color System, how it works, and how it applies to PDQ.

Lectures: Layer System Query (LSQ) And How To Enter Data

Editing LSQ Searches (What Components To Look To Exclude If The Hit List Is Too Large)

Fill In The Blank Query (FITB)

The Different Ways To Display The Hit List Results And What Documentation Is Required For Casework

What Is The Munsell Color System And How Is It Used In PDQ

Exercise: The trainee will take the codes of the suspected OEM spectra from Lesson 3 and enter them into the PDQ database to generate a hit list for each paint system.

Required Reading:

1. PDQ Workshop Notebook: Sections 4 and 6.

2. The Munsell Book of Color Collection.

LESSON 6

Estimated Time: 2 Days

Purpose: The trainee will be able to take a hit list from PDQ and do a spectral library search to narrow the hit list down into possible makes, plants, and years. The trainee will know the different types of searches available and be able to determine what constitutes a significant difference when comparing spectra.

Lectures: The Use Of The Know It All Software (Or Other Spectral Library Search Software)

Loading Unknown Spectra Into The Spectral Library Search Software

How PDQ Labels The Standards In The Spectral Search Software

Extracting A Specific Layer Or Layer System From The PDQ Libraries

Spectral Searching Vs. Name Searching Vs. Combination Searching

What To Enter When Doing A Name Search

How To Narrow Down The Year Range

How To Generate A Report And What Documentation Is Required For Casework

Exercise: The trainee will take 1-2 hit lists (and associated spectra) generated in Lesson 5 and the hit list and spectra of the paint generated in Lesson 2 and do a search to determine the possible makes, plants, and years of those paint systems.

Required Reading:

1. PDQ Workshop notebook: Section 7.

LESSON 7

Estimated Time: ½ Day

Purpose: The trainee will be able to narrow the year range down by using the Refinish Color Collection books. The trainee will also be able to determine the possible vehicle models of a paint system by using the Automotive News magazine and other resources.

Lectures: How To Use The Refinish Color Collection Books To Narrow Down Year Range

How To Determine The Possible Vehicle Models By Using The Automotive News Magazine

Exercises:

1. The trainee will take the year ranges of the paint systems from Lesson 6 and see if the year ranges can be narrowed down by using the Refinish Color Collection.

2. The trainee will determine the possible vehicle models by using the Automotive News magazine and other information in Section 3 of the Content Manual supplied by RCMP.

Required Reading:

1. PDQ Workshop notebook: Section 8.

LESSON 8

Estimated Time: ½ Day

Purpose: Introduction to report wording and court testimony.

Lectures:

Possible Results From PDQ Analysis

A. A possible list of makes, models, and years, was produced
B. The paint does not appear to be OEM
C. The hit list is too large for meaningful results
D. No hits were observed

Report Wording

The Necessary Information And Documentation Needed In A Casefile

Testimony And Pre-Trial Qualifying Questions

A. Limitations of PDQ – not every single paint layer in PDQ
B. Significance of PDQ – over 18,000 paint layer systems in database (over 70,000 layers overall) and growing every year

Exercise: The trainee will write a mock report of the results from the exercise in Lesson 7.

Required Reading: None

LESSON 9

Estimated Time: 4 Days

Purpose: The trainee will be able to determine the possible make, model, and years of practical paint layer sets.

Lectures: None

Exercises:

1. The trainee will receive 1-2 paint chips from the training coordinator, analyze the layers by FTIR and utilize PDQ to identify possible make, model, and year range information.

2. The trainee will write a sample report for one of the paint sample sets.

Required Reading: None

LESSON 10

Estimated Time: 3 Days

Purpose: The trainee must provide the correct answers for the analysis of mock PDQ evidence. This represents the general unknowns for this unit of study.

Lectures: None

Exercise: One mock paint sample will be given to the trainee. The trainee will section the layers of the paint, do a complete PDQ analysis, write a mock report and include all necessary paperwork in a casefile. This is a criterion practical test and the trainee must get a score of 100%.

Required Reading: None

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: COLLECTION AND PRESERVATION OF PRIMER GUNSHOT RESIDUE

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

None

UNIT ESTIMATED TIME

½ Day

GOAL

To achieve the necessary knowledge, skills and abilities to properly accept, collect, and preserve primer gunshot residue evidence.

OBJECTIVES

1. The trainee will become familiar with gunshot residue: its definition, its deposition, its composition, its transfer properties, and its examination. Successful completion of this assignment will be determined by the training coordinator on a pass/fail basis.

2. The trainee will learn to determine what types of evidence to accept and the appropriate information needed by Trace examiners. Successful completion of this assignment will be determined by the training coordinator on a pass/fail basis.

3. The trainee will learn how to collect, preserve, and document primer gunshot residue evidence. Successful completion of this assignment will be determined by the training coordinator on a pass/fail basis.

4. The trainee will demonstrate his/her ability to explain sample documentation and the proper collection of samples. This will be evaluated through an oral quiz on a pass/fail basis.

LESSON 1

Estimated Time: ½ Day

Purpose: To teach the trainee about gunshot residue and how to collect and preserve primer gunshot residue.

Lecture: Gunshot Residue Definition, Collection, and Documentation

Exercises:

1. Definition of gunshot residue, primer gunshot residue, interpretation of case acceptance policy, and discussion on how to determine what type of analysis required.
2. Discussion of various evidence types and collection areas.
3. Demonstration on the collection, preservation, and documentation process.

ILLINOIS STATE POLICE

TRACE CHEMISTRY TRAINING MANUAL

MODULE: AUTOMATED PRIMER GUNSHOT RESIDUE ANALYSIS USING SEM/EDX AND BIBLIOGRAPHY

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

PROCEDURAL REFERENCE

This training is for the automated scanning electron microscope/energy dispersive x-ray (SEM/EDX) analysis of primer gunshot residue (PGSR). It can employ the training module for SEM/EDX (TC-IA-5).

UNIT ESTIMATED TIME

4 Months

GOAL

To achieve the necessary knowledge, skills and abilities associated with the SEM/EDX for performing automated PGSR analysis and identifying primer gunshot residue.

OBJECTIVES

1. The trainee will demonstrate a comprehension of the knowledge of primer gunshot residue by passing a written criterion test with a score of no less than 80%.

2. The trainee will demonstrate a practical knowledge of the interpretation of primer gunshot residue particles by passing a written criterion test with a score of no less than 80%.

3. The trainee will demonstrate his/her ability to explain and properly operate the SEM/EDX, perform the required troubleshooting, routine maintenance, and Quality Assurance measures, and interpret the data. This will be evaluated with oral and practical quizzes on a pass/fail basis.

4. The trainee will develop a reference collection of primer gunshot residue particles that will serve as a basis for identifying such particles.

5. The trainee will demonstrate his/her knowledge and ability to recognize, collect, preserve, and prepare PGSR evidence. This will be accomplished by oral and practical quizzes on a pass/fail basis.

6. The trainee will demonstrate that he/she can apply the knowledge, skills, and abilities required to perform the examination and analysis of PGSR with a 100% on mock PGSR cases.

7. The trainee will demonstrate that he/she uses proper procedures, evaluations, and conclusions in actual casework based upon verification with cosignatory of reports by an experienced forensic scientist.

8. The trainee will demonstrate his/her ability to communicate the truth in a manner that is understandable and believability by passing on a pass/fail system a mock court testimony.

LESSON 1

Estimated Time: 2 Weeks

Purpose: To familiarize the trainee with the operational control of the automated SEM and utilization of the EDX system.

Lecture:
Components of SEM/EDX
Function and Operation of the Components
Functional Capabilities of the Software for Manual and Automated Operations
Primer Gunshot Residue Software Package
Maintenance of the SEM

Exercises:
1. Read assigned material.
2. Demonstrate the ability to operate the instrument and produce an image with spectra and the associated printout.
3. Demonstrate the ability to perform routine maintenance.
4. Develop a reference collection of pure reference powders and mixture of pure powders.
5. Demonstrate the ability to identify sample elemental components.
6. Demonstrate the ability to perform automated analysis.

Recommended Reading:
1. SEM User and Operations Manual.
2. Bibliography of journal articles on primer gunshot residue analysis.

LESSON 2

Estimated Time: 4 Weeks

Purpose: To provide trainee with the definition of a primer gunshot residue particle and the ability to identify them using SEM/EDX.

Lectures:
Aerospace Report
Primer Manufacture and Composition
Discussion of Journal Articles
Particle Types

Exercises:
1. Read assigned materials.
2. Complete the associated study guides.
3. Develop a reference collection of PGSR particle types.

Recommended Reading:
1. Bibliography of journal articles on primer gunshot residue analysis.

LESSON 3

Estimated Time: 10 Weeks

Purpose: To familiarize the trainee with the automated operation of the SEM/EDX system for PGSR analysis.

Lectures:
Automated System Operation
Sample Preparation
Data Interpretation
ISP Protocol and Validation Study
Study Guide Discussions

Exercises:
1. Automated analysis of previously analyzed discharge samples.
2. Complete study guides.
3. Pass written criterion test with score of 80% or better.
4. Pass particle identification criterion test with score of 80% or better.
5. Complete mock cases/mock trial.

Recommended Readings:
1. ISP PGSR Procedure.
2. ISP PGSR Validation Study.

Gunshot Residue Bibliography

1. "Firearms Discharge Residues," H. Harrison, R. Gilroy, Journal of Forensic Sciences, Vol. 4, No. 2, Apr 59, p. 184.
2. "A Study of the Paraffin Test," Mary E. Cowan, & Patricia L. Purdon, Journal of Forensic Sciences, Vol. 12, No. 1 Jan 67, pp. 19-36.
3. "Rapid Detection of Firearm Discharge Residue by Atomic Absorption and Neutron Activation Analysis," S. S. Krishnan, K. A. Gillespie, E. J. Anderson, Journal of Forensic Sciences, Vol. 16, No. 2, Apr 71, pp. 144-151.
4. "Optimization of Firearm Residue Detection by Neutron Activation Analysis," E. Rudzitis, M. Kopina, M. Wahlgren, Journal of Forensic Sciences, Vol. 18, No. 2, Apr 73, pp. 93-100.
5. "Rapid Neutron Activation Analysis for Gunshot Residue Determination," R. C. McFarland and M. E. McLain, Journal of Forensic Sciences, Vol. 18, No. 3, July 73, pp. 226-231.
6. "New Method for Collection and Analysis of Gunshot Residue as Forensic Evidence," K. K. S. Pillay, W. A. Jester, H. A. Fox III, Journal of Forensic Sciences, Vol. 19, No. 4, Oct 74, pp. 768-783.
7. "Examination of Gunshot Residue," I. C. Stone and C. S. Petty, Journal of Forensic Sciences, Vol. 19, No. 4, Oct 74, pp. 784-788.
8. "Detection of Gunshot Residue on the Hands by Neutron Activation an Atomic Absorption Analysis," S. S. Krishnan, Journal of Forensic Sciences, Vol. 19, No. 4, Oct 74, pp. 789-797.
9. "Firearm Residue Detection by Instrumental Neutron Activation Analysis," E. Rudzitis and M. Wahlgren, Journal of Forensic Sciences, Vol. 20, No. 1, Jan 75, pp. 119-124.
10. "Activity After Shooting and Its Effect on the Retention of Primer Residue," J. W. Kilty, Journal of Forensic Sciences, Vol. 20, No. 2, Apr 75, pp. 219-230.
11. "A Photoluminescence Technique for the Detection of Gunshot Residue," P. F. Jones and R. S. Nesbitt, Journal of Forensic Sciences, Vol. 20, No. 2, Apr 75, pp. 231-242.
12. "Firearms Discharge Residue Sample Collection Techniques," J. A. Goleb and C. R. Midkiff, Jr., Journal of Forensic Sciences, Vol. 20, No. 4, Oct 75, pp. 701-707.
13. "Detection of Gunshot Residue by Use of Scanning Electron Microscope," R. S. Nesbitt, J. E. Wessel, P. F. Jones, Journal of Forensic Sciences, Vol. 21, No. 3, July 76, pp. 595-610.
14. "Studies of the Spatial Distribution of Firearms Discharge Residues," A. Seamster, T. Mead, J. Gislason, K. Jackson, F. Ruddy, B. D. Pate, Journal of Forensic Sciences, Vol. 21, No. 4, Oct 76, pp. 868-882.
15. "Detection of Gunshot Residue on Hands by Scanning Electron Microscopy," J. Andrasko and A. c. Maehly, Journal of Forensic Sciences, Vol. 22, No. 2, Apr 77, pp. 279-287.
16. "Evaluation of a Photoluminescence Technique for the Detection Residue," R. S. Nesbitt, J. E., Wessel, G. M. Wolten, P. F. Jones, Journal of Forensic Sciences, Vol. 22, No. 2, Apr 77, pp. 288-303.
17. "Detection of Gunshot Residue on the Hands by Trace Element Analysis," S. S. Krishnan, Journal of Forensic Sciences, Vol. 22, No. 2, Apr 77, pp. 304-324.
18. "Detection of Gunshot Residue Particles from the Hands of a Shooter," V. A. Matricardi and J. W. Kilty, Journal of Forensic Sciences, Vol. 22, No. 4, Oct 77, pp. 725-738.

19. "The Application of Oxygen Plasma Ashing to Gunshot Residue Analysis," W. D. Kinard and C. R. Midkiff, Jr., Journal of Forensic Sciences, Vol. 23, No. 2, Apr 78, pp. 368-374.

20. "Feasibility of Gunshot Residue Detection Via Its Organic Constituents. Part I: Analysis of Smokeless Powders by Combined Gas Chromatography Chemical-Ionization Mass Spectrometry," M. H. Mach, A. Pallos, P. F. Jones, Journal of Forensic Sciences, Vol. 23, No. 3, July 78, pp. 433-445.

21. "Feasibility of Gunshot Residue Detection Via Its Organic Constituents. Part II: A Gas Chromatography-Mass Spectrometry Method," M. H. Mach, a. Pallos, P. F. Jones, Journal of Forensic Sciences, Vol. 23, No. 3, July 78, pp. 446-455.

22. "Particle Analysis for the Detection of Gunshot Residue. I: Scanning Electron Microscopy/Energy Dispersive X-Ray Characterization of Hand Deposits from Firing," G. M. Wolten, R. S. Nesbitt, A. R. Calloway, G. L. Lopes, P. F. Jones, Journal of Forensic Sciences, Vol. 24, No. 2, Apr 79, pp. 409-422.

23. "Particle Analysis for the Detection of Gunshot Residue. II: Occupational and Environmental Particles," G. M. Wolten, R. S. Nesbitt, A. R. Calloway, G. L. Lopes, Journal of Forensic Sciences, Vol. 24, No. 2, Apr 79, pp. 423-430.

24. "Particle Analysis for the Detection of Gunshot Residue. III: The Case Record," G. M. Wolten, R. S. Nesbitt, A. R. Calloway, Journal of Forensic Sciences, Vol. 24, No. 4, Oct 79, pp. 864-869.

25. "The Analysis for the Detection of Gunshot Residues for Antimony and Barium by Flameless Atomic Absorption of Spectrophotometry," M. L. Newbury, Canadian Society of Forensic Sciences, Vol. 13, No. 2, Jun 80, pp. 19-26.

26. "On the Mechanism of Gunshot Residue Particle Formation," G. M. Wolten and R. S. Nesbitt, Journal of Forensic Sciences, Vol. 25, No. 3, July 80, pp. 533-545.

27. "Analysis of the Results of Gunshot Residue Detection in Case Work," E. Rudzitis, Journal of Forensic Sciences, Vol. 25, No. 4, Oct 80, pp. 839-846.

28. "Rapid Determination of Antimony, Barium, and Lead in Gunshot Residue Via Automated Atomic Absorption Spectrophotometry," J. T. Newton, Journal of Forensic Sciences, Vol. 26, No. 2, Apr 81, pp. 302-312.

29. "Formation of Gunshot Residues," Samarendra Basu, Journal of Forensic Sciences, Vol. 27, No. 1, Jan 82, pp. 72-91.

30. "Application of Proton-Induced X-Ray Emission Technique to Gunshot Residue Analyses," Prasanta Sen, Nokuleswar Pangrahi, M. S. Rao, K. M. Varier, Sudhir Sen, G. K. Mehta, Journal of Forensic Sciences, Vol. 27, No. 2, Apr 82, pp. 330-339.

31. "Characterization of Gunshot Residues by X-Ray Diffraction," Menachem Tassa, Yacov Leist, Menachem Steinberg, Journal of Forensic Sciences, Vol. 27, No. 3, July 82, pp. 677-683.

32. "A Field Kit for Sampling Gunshot Residue Particles," Menachem Tassa, Nachum Adan, Nathan Zeldes, Yacov Leist, Journal of Forensic Sciences, Vol. 27, No. 3, July 82, pp. 671-676.

33. "Suicide Reconstruction by Glue Lift of Gunshot Residue," Samarendra Basu, Stark Ferriss, Robert Horn, Journal of Forensic Sciences, Vol. 29, No. 3, July 84, pp. 843-864.

34. "Characterization of Shotgun Pellets by Trace Element Concentration Patterns by Neutron Activation Analysis Using the SLOWPOKE Reactor," S. S. Krishnan, R. E. Jervis, Canadian Society of Forensic Sciences, Vol. 17, No. 4, Dec 84, pp. 167-181.

35. "An Interesting Gunshot Residue Pattern," R. Briner, Journal of Forensic Sciences, Vol. 30, No. 3, July 85, pp. 945-947.

36. "Detection of Bullet Residue in Bone Using Photon-Induced X-Ray Emission (PIXE) Analysis," H. J. Fishbeck, S. R. Ryan, C. C. Snow, Journal of Forensic Sciences, Vol. 31, No. 1, Jan 86, pp. 79-85.

37. "Close Proximity Gunshot Residues," J. I. Thornton, Journal of Forensic Sciences, Vol. 31, No. 2, Apr 86, pp. 756-757.

38. "Automated Gunshot Residue Particle Search and Characterization," Warren Tillman, Journal of Forensic Sciences, Vol. 32, No. 1, Jan 87, pp. 62-71.

39. "Investigation of Gunshot Residues by Means of Auger Electron Spectroscopy," Guenter Hellmiss, Wolfgang Lichtenberg, Manfried Neiss, Journal of Forensic Sciences, Vol. 32, No. 3, May 87, pp. 747-760.

40. "Analysis of Gunshot Primer Residue Collection Swabs Using Flameless Atomic Absorption Spectrophotometry: A Reexamination of Extraction and Instrument Procedures," R. Koons, D. Havekost, C. Peters, Journal of Forensic Sciences, Vol. 32, No. 4, July 87, pp. 846-865.

41. "Automation of Gunshot Residue Detection and Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray analysis (SEM/EDX)," R. White and A. Owens, Journal of Forensic Sciences, Vol. 32, No. 6, Nov 87, pp. 1595-1604.

42. "Determination of Barium in Gunshot Residue Collection Swabs Using Inductively Coupled Plasma-Atomic Emission Spectrometry, R. Koons, D. Havekost, C. Peters, Journal of Forensic Sciences, Vol. 33, No. 1, Jan 88, pp. 35-41.

43. "The Detection of Gunshot Residue (GSR) Particles on the Bottom of Discharge Bullets," P. Berman, P. Enzel, E. Springer, Journal of Forensic Sciences, Vol. 33, No. 4, July 88, pp. 969-968.

44. "Analysis of Gunshot Primer Residue Collection Swabs using Flameless Atomic Absorption Spectrophotometry and Inductively Coupled Plasma-Atomic Emission Spectrometry: Effects of a Modified Extraction Procedure and Storage of Standards," R. Koons, D. Havekost, C. Peters, Journal of Forensic Sciences, Vol. 34, No. 1, Jan 89, pp. 218-221.

45. "Concentration Techniques for the Detection of Gunshot Residues by Scanning Electron Microscopy/Energy Dispersive X-Ray Analysis (SEM/EDX)," A. Zelchner, H. Foner, M. Dvorachek, P. Bergman, N. Levin, Journal of Forensic Sciences, Vol. 34, No. 2, Mar 89, pp. 312-320.

46. "The Form of Gunshot Residue Is Modified by Target Impact," B. Burnett, Journal of Forensic Sciences, Vol. 34, No. 4, July 89, pp. 808-822.

47. "Analysis of Gunshot Residue Test Results in 112 Suicides," G. Reed, P. McGuire, A. Boehm, Journal of Forensic Sciences, Vol. 35, No. 1, Jan 90, pp 62-68.

48. "A Reevaluation of the Aerospace Corporation Final Report on Particle Analysis – When to Stop Searching for Gunshot Residue (GSR)?," A. Owens, Journal of Forensic Sciences, Vol. 35, No. 3, May 90, pp. 698-705.

49. “The Use of Plasma Ashing on Samples for Detection of Gunshot Residues with Scanning Electron Microscopy and Energy Dispersive X-Ray Analysis (SEM/EDXA),” L. Varetto, Journal of Forensic Sciences, Vol. 35, No. 4, May 90, pp. 964-970.

50. “Barium and Antimony Distributions on the Hands of Nonshooters,” D. Havekost, C. Peters, R. Koons, Journal of Forensic Sciences, Vol. 35, No. 5, Sep 90, pp. 1096-1114.

51. “Survey of Gunshot Residue Analysis in Forensic Science Laboratories,” D. DeGaetano, J. Siegel, Journal of Forensic Sciences, Vol. 35, No. 5, Sep 90, pp. 1087-1095.

52. “Evaluation of Instrumental Parameters for Automated Scanning Electron Microscopy/ Gunshot Residue Particle Analysis,” M. S. Germani, Journal of Forensic Sciences, Vol. 36, No. 2, Mar 91, pp. 331-342.

53. “A Sensitive Electrochemical Method for the Analysis of Nitrite Ion and Metals In Gunshot Residue,” E. Bohannan, D. Van Galen, Journal of Forensic Sciences, Vol. 36, No. 3, May 91, pp. 886-893.

54. “Gunshot Residue Particles Formed by Using Different Types of Ammunition in the Same Firearm,” A. Zeichner, N. Levin, E. Springer, Journal of Forensic Sciences, Vol. 36, No. 4, July 91 pp. 1020-1026.

55. “Gunshot Residue Particles Formed by Using Ammunition That Have Mercury Fulminate Based Primers,” Journal of Forensic Sciences, Vol. 37, No. 6, Nov 92, pp. 1567-1573.

56. “A Comparison of Three Techniques Developed for Sampling and Analysis of Gunshot Residue by Scanning Electron Microscopy/Energy Dispersive Analysis (SEM/EDX),” D. DeGaetano, J. Siegel, K. Klomparens, Journal of Forensic Sciences, Vol. 37, No. 1, Jan 92, pp. 281-300.

57. “The Incidence of Transient Particulate Gunshot Primer Residue in Oregon and Washington Bow Hunters, M. J. Mann, E. O. Espinoza, Journal of Forensic Sciences, Vol. 38, No. 1, Jan 93, pp. 23-27.

58. “The Identification of Gunshot Particles from Lead-Free Sintox Ammunition,” L. Gunaratham, K. Himberg, Journal of Forensic Sciences, Vol. 39, No. 2, Mar 94, pp. 532-536.

59. “Spectophotometric Determination of Time Since Discharge of Firearms,” G. P. Voskertchian and G. V. Pairlova, Crime Laboratory Digest, Vol. 22, No. 1, Jan 95, p. 5.

60. "Analysis of Primer Residue from CCI Blazer® Lead Free Ammunition by Scanning Electron Micrscopy/Energy Dispersive X-Ray,” Harris, Annalivia, Journal of Forensic Sciences, Vol. 40, No. 1, Jan 95, pp. 27-30.

61. “Density Characterization of Armor Piercing Ammunition,” Heye, C. L., Rios, F. G., Thornton, J. I., Journal of Forensic Sciences, Vol. 40, No. 3, May 95, pp.

62. “Casework Experience of GSR Detection in Israel, on Samples from Hands, Hair and Clothing Using an Autosearch SEM/EDX System,” Zeichner, A. and Levin, N., Journal of Forensic Sciences, Vol. 40, No. 6, Nov 95, pp. 1082-1085.

63. “Officers, Their Weapons and Their Hands: An Empirical Study of GSR on the Hands of Non-Shooting Police Officers,” Gialamas, D. M., Rhodis, E. F., Sugarman, L. A., Journal of Forensic Sciences, Vol. 40, No. 6, Nov 95, pp. 1086-1089.

64. “A Survey of Gunshot Residue Analysis Methods,” Singer, R. L., Davis, D., Houck, M. M., Journal of Forensic Sciences, Vol. 41, No. 2, Mar 96, pp. 195-198.

65. "The Analysis of Nyclad Ammunition Discharge Residues Using Transmission Electron Microscopy and Polarized Light Microscopy," Charles A. Zona, Microscope, Vol. 44:1, (1996), pp. 11-14.

66. "The Persistence of Gunshot Residue on Shooters' Hands, T. Jalanti, P. Henchoz, A. Gallusser, and M. S. Bonfanti, Science and Justice, Vol. 39:1 (1999), pp. 48-52.

67. "Gunshot Residue – Similar Particles Produced by Fireworks," P. V. Mosher, M. J. McVicar, E. D. Randall, and E. H. Sild, Canadian Society Forensic Science Journal, Vol. 31, No. 2 (1998), pp. 157-168.

68. "Identification of Gunshot Residue: A Critical Review," Francesco Saverio Romolo and Pierre Margo, Forensic Science International, Vol. 199, (2001), pp. 195-211.

69. "Handguns and Ammunitions Indicators Extracted from the GSR Analysis," Josef Lebiedzik and David Johnson, Journal of Forensic Sciences, Vol. 47:3, (2002), pp. 483-495.

70. "Brake Linings: A Source of Non-GSR Particles Containing Lead, Barium, and Antimony," Carola Torre, M. D., Grazia Mattutino, Valentino Vasino, and Carola Rubino, Journal of Forensic Sciences, Vol. 47:3, (2002), pp. 494-504.

71. "Distribution of GSR in the Surroundings of Shooting Pistol," Lubor Fojtasek, Jitka Vacinova, Pavel Kolar, and Marek Kotrly, Forensic Science International, Vol. 132, (2003), pp. 99-105.

72. "X-Ray Mapping Technique: A Preliminary Study in Discriminating Gunshot Residue Particles from Aggregates of Environmental Occupational Origin," Bruno Cardinetti, Claudio Ciampini, Carlo d'Onofrio, Giovanni Orlando, Luciano Gravina, Francesco Ferrari, Donatello DiTullo, Luca Torresi, Forensic Science International, Vol. 143, (2004), pp. 1-19.

73. "An Evaluation of Instant Shooter Identification (ISid™) Gunshot Residue Kits," Angela M. Hansen and Faye Springer, AFTE Journal, Vol. 37, No. 3, (2005), pp. 172-178.

74. "Time Periods of GSR Particle Deposition After Discharge – Final Results," Lubor Fojtasek and Tomas Kmjec, Forensic Science International, Vol. `153, No. 2, (2005), pp. 132-135.

75. "Gunshot Residue in Chicago Police Vehicles and Facilities: An Empirical Study," R. Berk, S. Rochowicz, M. Wong, M. Kopina, Journal of Forensic Sciences, Vol. 52, No. 4, July 2007, pp. 838-841.

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TRACE CHEMISTRY TRAINING MANUAL

APPENDIX A-1: TRAINING CHECKLIST

Reviewed by:

Forensic Scientist Robert A. Dubbert, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

William E. Demuth II
Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

INITIAL FORENSIC SCIENCE TRAINING CHECKLIST
TRACE CHEMISTRY

Trainee: _____ Coordinator: _____

Training Start Date: _____ Training End Date: _____

Module	Completion Date	Trainee Initials	Coordinator Initials
General Forensic Science			
Ethics in Forensic Science			
Courtroom Training for Trace Chemistry			
Gas Chromatography			
Mass Spectrometry			
Fourier Transform Infrared Spectroscopy			
X-Ray Diffraction			
Scanning Electron Microscopy/Energy Dispersive X-Ray			
Fire Debris – Ignitable Liquids			
Explosives			
Glass			
Glass Refractive Index Measurement Instrumentation			
Paint Analysis			
Paint Data Query			
Collection and Preservation of Primer Gunshot Residue			
Automated Primer Gunshot Residue Analysis Using SEM/EDX and Bibliography			
Lamp Filament Analysis			
Supervised Casework			

If a module was not completed, mark it as "NC" ("Not completed").

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TRACE CHEMISTRY TRAINING MANUAL

APPENDIX A-2: AUTHORIZATIONS BASED ON SCOPE

Reviewed by:

Forensic Scientist Alan Osoba, Chairperson
Trace Chemistry Command Advisory Board

Approved by:

Sandra N. Brown
Acting Director of Training

ILLINOIS STATE POLICE
DIVISION OF FORENSIC SERVICES
FORENSIC SCIENCES COMMAND

AUTHORIZATIONS BASED ON SCOPE

Field of Testing: Forensic Testing Forensic Scientist: _____
Category: Trace Chemistry

Sub Catergory: Flammables

Analytical Technique	Authorized
1.4 Screening Techniques: Solubility	
2.1 Chromatography: Gas Chromatography	
3.1 Spectroscopy: Infrared	
3.2.1 Spectroscopy: Gas Chromatography/Mass Spectrometry	
4.3 Physical Examination: Performance Evaluation	
4.5 Physical Examination: Pattern Recognition	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: Paint / Paint Data Query (PDQ)

Analytical Technique	Authorized
1.2 Screening Tests: Color	
1.4 Screening Tests: Solubility	
2.1 Chromatography: Gas Chromatography	
3.1 Spectroscopy: Infrared	
3.2.1 Spectroscopy: Gas Chromatography/Mass Spectrometry	
3.7 Spectroscopy: Energy Dispersive X-ray (EDX)	
4.1 Physical Examination: Physical Measurements	
4.3 Physical Examination: Performance Evaluation	
4.4 Physical Examination: Database Comparison	
5.1 Microscopy: Optical	
5.2 Microscopy: Scanning Electron Microscope (SEM)	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: Glass Refractive Index Measurement (GRIM) Instrumentation

Analytical Technique	Authorized
1.2 Screening Tests: Color	
1.4 Screening Tests: Solubility	
4.1 Physical Examination: Physical Measurements	
4.2 Physical Examination: Striation/Impression/Mark Comparison	
4.4 Physical Examination: Population Database Comparison	
4.5 Physical Examination: Pattern Recognition	
5.1 Microscopy: Optical	
6.4 General Laboratory Procedures: General Laboratory Techniques	

Sub Category: Automated Gunshot Residue (PGSR) Analysis Using SEM/EDX

Analytical Technique	Authorized
3.7 Spectroscopy: EDX	
5.1 Microscopy: Optical	
5.2 Microscopy: SEM	
6.4 General Laboratory Procedures: General Laboratory Techniques	

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AUTHORIZATIONS BASED ON SCOPE

These are the areas under which I am authorized to conduct casework.

_____
Forensic Scientist / Date

_____
Training Coordinator / Date

_____
Director of Training / Date