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REVISION HISTORY

Effective Date	Brief Description of Change(s)
12/30/2019	Original Issue Previous revision history for individual chapters included in archived documents



01 OVERVIEW

SD-TM-01-01 SEIZED DRUGS TRAINING PROGRAM OVERVIEW

1 Introduction

This program is designed to train Forensic Scientists employed by the Texas Department of Public Safety Crime Laboratory as Seized Drugs analysts. Trainees will learn to properly analyze unknown samples for the absence or presence of controlled substances, dangerous drugs, and other substances using scientifically valid techniques and procedures.

The trainee must meet the specific qualifications outlined in the Seized Drugs Training Manual before being authorized for independent work. Trainees with prior experience in seized drugs analysis may be allowed to proceed with a modified training program per guidelines outlined in the Crime Laboratory Service Manual.

2 Purpose

The Seized Drugs Training Manual is designed to provide the trainee with the background, laboratory skills, education, competency, and hands-on experience to perform independent work in the discipline of seized drugs. The Texas DPS training program is comprised of a series of modules that are divided into units and typically takes approximately six to eight months to complete.

3 Program Format

A. **General Laboratory Training: Fundamentals Unit**

Note: This unit must be completed before starting the Seized Drugs Analysis Unit.

B. **General Laboratory Training: Forensic Legal Unit**

Note: This unit must be completed before supervised work and should be completed before starting the Seized Drugs Analysis Unit.

C. **General Laboratory Training: Advanced Topics: Measurement Uncertainty Unit**

Note: This unit must be completed before supervised work.

D. **Seized Drugs Analysis Unit** will introduce the trainee to screening tests, analysis schemes, extraction procedures, and instrumental analysis of controlled substances, dangerous drugs, and other substances. This unit will also introduce the trainee to report writing, case review, and expert testimony. Optionally, the training can include the analysis of clandestine laboratories.

Note: This unit must be completed before supervised work.

E. **Quantitative Analysis Unit (optional)** will introduce the trainee to the quantitative sampling and analysis procedures.

Note: This unit is only required for trainees who will conduct quantitative analysis and must be completed before supervised work.

4 Safety

A. Safety precautions outlined in the Safety Manual will be followed at all times during the training program.

B. Any additional safety considerations will be highlighted within the modules.



5 Trainer Responsibilities

- A. Meetings between the trainee, the trainer, and/or supervisor should be held weekly in order to evaluate the trainee's progress, plan future study and practical assignments, set goals and reasonable deadlines to reach those goals, and discuss any deficiencies that may require additional training.
- B. After a thorough review and discussion, an evaluation will be completed by the trainer and signed by the trainer and trainee for each exercise and assessment that is completed.

6 Trainee Responsibilities

- A. The trainee is required to maintain a training notebook.
- B. The reading assignments in the training program are extensive and cover a broad spectrum of information that requires the trainee to complete the reading material for each module on a self-study basis.
- C. The trainee is responsible for informing their trainer and/or supervisor when problems arise at any time during the training period.

7 Training Notebook

During the training program, the trainee is responsible for keeping detailed records in a training notebook. The items to be maintained in the training notebook, organized within the appropriate modules, include:

- A. Training Checklist (LAB-SD-TM-01) ;
- B. Training Record (LAB-303) or other documentation recording the trainee's daily activities;
- C. Documentation of casework observations;
- D. Independent exercise evaluation sheets for all independent exercises signed by the trainer and trainee;
- E. Completed independent exercises including corrections, if needed;
- F. Written assessment evaluation sheets for all written assessments signed by the trainer and trainee;
- G. Written assessments including corrections, if needed;
- H. Evaluation sheets for unknown samples and competency samples;
- I. All results from unknown samples and competency samples (instrumental data may be excluded if electronic data is referenced and available in LIMS);
- J. Mock trial performance documented on a Testimony Technical Review Form (LAB-313) and Testimony Survey Form (LAB-314);
- K. Documentation of courtroom testimonies observed;
- L. Special project assignments with summary reports (if applicable);
- M. List of in-house training videos viewed and lectures attended (if applicable); and
- N. Work Authorization Form (LAB-309) which is submitted with the final notebook as outlined in the Crime Laboratory Service Manual.



8 Review and Authorization

8.1 Unit Assessment

The unit is considered complete when:

- A. The trainee successfully completes all modules.
- B. The trainee successfully identifies all competency samples.
- C. The trainee successfully completes a comprehensive final written assessment.
- D. The trainee successfully completes a mock trial.
- E. The training notebook, other training records documenting completion of training requirements, and trainee's credentials are reviewed by the appropriate process outlined in the Crime Laboratory Service Manual.

8.2 Work Authorization

- A. The trainee may begin performing supervised work when the following requirements are met:
 1. They have obtained a license as a Texas Forensic Analyst in the discipline of Seized Drugs from the Texas Forensic Science Commission
 2. They have obtained approval from the Laboratory Director on a completed Work Authorization Form (LAB-309).
- B. Supervised work will conclude when the following requirements are met:
 1. The trainee performs analysis on at least 75 cases submitted for seized drugs analysis, to include a variety of sample types.
 2. The mentor must add a "Mentor - Supervised Work" case activity for each supervised case observed per the Laboratory Information Management System Manual.
 3. The trainee maintains a Supervised Case Work Log (LAB-307 or LIMS equivalent) with the training records.
- C. The trainer recommends that the examiner be approved for independent work. The Quality Manager approves the examiner to conduct independent work by signing the trainee's Work Authorization Form (LAB-309).



02 SEIZED DRUGS UNIT

SD-TM-02-01 INTRODUCTION TO SEIZED DRUGS

Duration Approximately 14 days

Purpose To familiarize the trainee with how compounds are classified and controlled

Prerequisite General Laboratory Training

1 Objectives

1.1 Theoretical

Understanding how compounds are classified and controlled sets the foundation for this training program. The ability to understand and use proper terminology is necessary. Compounds are typically classified by structure or pharmacological effects. Additionally, there are numerous ways a compound may be legally classified. The penalty associated with these legal classifications is another critical factor to be considered when performing seized drugs analysis.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Understand and provide the common legal definitions listed in the Texas Health and Safety Code as well as common general terms used in the laboratory.
- B. Explain the different ways in which a substance may be classified.
- C. Understand the penalties associated with the weight and offense of various substances.

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. Definitions, including:
 1. Controlled substance
 2. Controlled substance analogue
 3. Marihuana
 4. Adulterant or dilutant
 5. Abuse unit
- B. Drug Classifications, including:
 1. Stimulants
 2. Depressants
 3. Opioids
 4. Hallucinogens
 5. Cannabinoids
 6. Designer Drugs
 7. Steroids
 8. Other non-controlled substances (dangerous drugs and OTC)



9. Clandestine laboratory chemicals (optional)
- C. Legal Classifications, including:
 1. Penalty Groups
 - a. *Possession*
 - b. *Manufacture/Delivery*
 - c. *Weights and Abuse Units*
 - d. *Structural Groups*
 2. Texas Schedules
 3. Federal Schedules
 4. Other Penalties
 - a. *Drug-Free Zones*
 - b. *Correctional Facility*

2.2 Required Readings

For literature references, use of the most current edition is recommended.

- A. Texas Health and Safety Code, Title 6, Subtitle C:
 1. Chapter 481 – Texas Controlled Substances Act
 2. Chapter 483 – Dangerous Drugs
 3. Chapter 485 – Abusable Volatile Chemicals
 4. Chapter 487 – Texas Compassionate-Use Act
 5. Chapter 443 – Manufacture, Distribution, and Sale of Consumable Hemp Products
- B. Texas Administrative Code, Title 37, Part 1, Chapter 13 – Controlled Substances.
- C. Texas Penal Code, Title 8, Chapter 38, Section 38.11 – Prohibited Substances and Items in Correctional or Civil Commitment Facility.
- D. Texas Department of State Health Services, Texas Schedules of Controlled Substances.
- E. Title 21 United States Code (USC) Controlled Substances Act, Section 812 – Schedules of Controlled Substances.
- F. Texas Department of Public Safety Crime Laboratory Service Manual (CLS):
 1. Terms and Definitions
 2. Seized Drugs Analysis
- G. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP:
 1. Reporting Guidelines
 2. Controlled Substance Overview
 3. Critical Weights
 4. Examination and Destruction of Excess Quantity Controlled Substance Property or Plant Material



- H. Saferstein, R. "Drugs". In *Criminalistics: An Introduction to Forensic Science*, 8th ed; Prentice-Hall: 2004; pp 233-254.
- I. Christian, D. R., Jr. "Analysis of Controlled Substances". In *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 3rd ed; James, S. H., Nordby, J. J., Eds.; CRC: Boca Raton, 2009; pp 457-485.
- J. Addiction Science Network:
 - 1. Drug Classification
 - 2. Illicit Drug Index
- K. United States Drug Enforcement Administration:
 - 1. Drug Facts
 - 2. Drug Scheduling
 - 3. The Controlled Substances Act
- L. PowerPoint presentation: *Introduction to Seized Drugs*
- M. PowerPoint presentation: *Legislation Based on Structural Class*

3 Practice

3.1 Safety

None

3.2 Standards, Controls, Reagent Preparation

None

3.3 Equipment

None

3.4 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. Definitions Exercise
- B. Schedule vs. Penalty Group Exercise
- C. Penalties Exercise
- D. Structurally Controlled Exercise
- E. Synthetic Cannabinoids Exercise

4 Assessment

4.1 Competency and Qualifying Examination

A written assessment will be completed by the trainee and corrections will be made, if necessary.

4.2 Evaluation of Training

The trainee and trainer will sign off the appropriate module on the Seized Drugs Training Checklist (LAB-SD-TM-01).



SD-TM-02-02 INTRODUCTION TO SEIZED DRUGS CASEWORK

Duration Approximately 21 days

Purpose To familiarize the trainee with the initial steps that are utilized when performing seized drugs analysis on a case, including barcoding, labeling, weighing, sampling, and measurement uncertainty

Prerequisite General Laboratory Training, SD-TM-02-01

1 Objectives

1.1 Theoretical

After a case has been assigned to an analyst, the evidence must be retrieved, transferred, and inspected. Evidence is itemized and tracked in the Laboratory Information Management System (LIMS), physically labeled with required information, and then the analyst can begin to determine which items of evidence may require analysis. Numerous factors must be considered when determining the analytical scheme of a case, such as the suspected penalty group of the substance, weight of the substance, and the number of suspects involved. Measurement uncertainty must be considered when reporting a weight, and understanding how it is calculated allows the analyst to select the most appropriate weighing technique for each item.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Understand how cases are assigned, how a worklist is created, and the requirements for transferring evidence.
- B. Identify and apply proper seals and case identifiers on exterior and interior evidence packaging.
- C. Inventory/itemize evidence and understand the requirements regarding submission form discrepancies.
- D. Use LIMS to look up and document case information.
- E. Understand and be able to demonstrate proper evidence handling procedures designed to prevent cross-contamination between evidence within a case and from other cases.
- F. Understand and be able to demonstrate the proper use of balances and how to perform quality control checks for all balance types.
- G. Determine the appropriate sampling procedure for single and multiple packages.
- H. Determine tare weights and net weights for single and multiple packages, including consideration of how uncertainty guidelines can affect the weighing procedure.
- I. Apply knowledge of reporting guidelines, penalty groups, and critical weights when determining how evidence will be sampled.
- J. Understand and be able to explain measurement uncertainty as it pertains to weighing and sampling procedures.



2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. LIMS
 - 1. Case information
 - 2. Crystal reports
 - 3. Worklists
 - 4. Electronic worksheets
- B. Evidence handling
 - 1. Transferring
 - 2. Itemizing
 - 3. Labeling
 - 4. Sealing
- C. Analytical scheme
 - 1. Visual inspection
 - 2. Weight determination
 - 3. Sampling of evidence
 - 4. Documentation
- D. Measurement uncertainty

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at the trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP:
 - 1. Reporting Guidelines
 - 2. Measurement Uncertainty Estimate – Weights
 - 3. Case Documentation and Exam Counting
 - 4. Approved Standard Abbreviations List
 - 5. Controlled Substance Overview
 - 6. Standards and References
 - 7. Approved List of Reference Libraries and Abbreviations
 - 8. Approved Abbreviation List for Pharmaceutical References
 - 9. Reagents
 - 10. Quarterly Controlled Substance Evidence Reexamination
 - 11. Examination of Controlled Substances, Dangerous Drugs and Related Compounds
 - 12. Instructions for Controlled Substance and Marijuana Worksheets



13. Critical Weights
 14. Examination and Destruction of Excess Quantity Controlled Substance Property or Plant Material
- B. Laboratory Information Management System Instructions (JusticeTrax):
1. Crystal Reports
 2. Storage of Evidentiary Images in DIMS
 3. Autotext
 4. Worklists/Batch Process
 5. Submission of Bulk Evidence
 6. Controlled Substance Bulk Evidence Itemization
- C. Texas Department of Public Safety Crime Laboratory Service Manual (CLS):
1. Measurement Uncertainty
 2. Evidence Processing
 3. Laboratory Equipment
- D. *Appendix HA-01: Evidence Sampling Plan*. DEA Laboratory Operations Handbook.
- E. Ginn, W. L., Jr. *Statistical Validity of Random Sampling*. Texas Department of Public Safety: Austin, TX, 1992.
- F. Clark, A. B.; Clark, C. C. Sampling of Multi-Unit Drug Exhibits. *J. Forensic Sci.* 1990, 35 (3), pp 713-719.
- G. European Network of Forensic Science Institutes - Drug Working Group. *Guidelines on Representative Drug Sampling*; Version 1-1; 2003.
- H. SWDRUG. *Methods of Analysis/Sampling Seized Drugs for Qualitative Analysis*; Version 7.1; SWGDRUG, June 2016; pp 7-13.
- I. General Laboratory Training Manual: Advanced Topics: Measurement Uncertainty
- J. PowerPoint presentation: *Introduction to Casework*

2.3 Suggested Readings

- A. Laboratory Information Management System Instructions (JusticeTrax):
1. Misdemeanor Controlled Substance Cases
 2. Case Info Tab
 3. Requests Tab
 4. Receiving a New Case

3 Practice

3.1 Safety

- A. Safety precautions outlined in the Safety Manual will be followed at all times during the training program.
- B. Care should be exercised during the use of cutting tools, especially when opening evidence.



3.2 Standards, Controls, and Reagent Preparation

None

3.3 Equipment

Including, but not limited to:

- Balance
- Cutting tools

3.4 Observed Performance

- A. The trainee will observe experienced analysts as they open, weigh, and determine sampling procedures for seized drugs cases, including the resealing and storage of evidence at completion. A record of the observations must be maintained by the trainee on the appropriate form provided by trainer.
- B. After an appropriate observation period, as determined by the trainer, the trainee will discuss their understanding of how cases are handled (transferring, sampling, labeling, sealing, documentation).

3.5 Supervised Performance

The trainee will performance check each balance type in the trainee's home laboratory.

3.6 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. Analysis Overview Exercise
- B. Uncertainty Exercise
- C. Practical Exercise Part I

4 Assessment

4.1 Competency and Qualifying Examination

A written assessment will be completed by the trainee and corrections will be made, if necessary.

4.2 Evaluation of Training

The trainee and trainer will sign off the appropriate module of the Seized Drugs Training Checklist (LAB-SD-TM-01).



SD-TM-02-03 PHYSICAL IDENTIFICATION OF CANNABIS SATIVA L.

Duration Approximately 14 days

Purpose To familiarize the trainee with the history, taxonomy, and visual examination of Cannabis sativa L.

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-02

1 Objectives

1.1 Theoretical

The analysis of marihuana and hemp requires that a trainee be able to distinguish Cannabis sativa L. from other plant material with macroscopic and microscopic examinations and have a rudimentary understanding of the taxonomy of Cannabis sativa L.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Describe the complete taxonomy of Cannabis sativa L.
- B. Understand the differences between marihuana and hemp.
- C. Describe the different parts of a Cannabis sativa L. plant.
- D. Examine plant material with the aid of a microscope.
- E. Identify Cannabis sativa L. by macroscopic and microscopic examination.
- F. Determine when a significant amount of an impurity is present and how to report it.
- G. Differentiate between stems and stalks.
- H. Distinguish Cannabis sativa L. seeds from other plant seeds.

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. History and legality
- B. Taxonomy and botany
- C. Physical characteristics
 1. Macroscopic examination
 2. Microscopic examination
 3. Stalk and stems
 4. Seeds
- D. Cannabinoids in Cannabis sativa L.
- E. Cannabis sativa L. products
- F. Reporting guidelines



2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at the trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP: Examination of Marihuana.
- B. Nakamura, G. R. Forensic Aspects of Cystolith Hairs of Cannabis and Other Plants. *J. of AOAC*. 1969, 52 (1), pp 5-16.
- C. Siegel, J. A. Forensic Identification of Controlled Substances. In *Forensic Science Handbook, Volume II*; Saferstein, R., Ed; Prentice Hall: New Jersey, 1988, pp 87-92.
- D. Stearn, W. T. The Cannabis Plant: Botanical Characteristics. In *The Botany and Chemistry of Cannabis*; Joyce, C. R. B., Curry, S. H., Eds.; J. & A. Churchill: London, 1970; pp 1-10.
- E. Nakamura, G. R.; Thornton, J. I. The Forensic Identification of Marihuana: Some Questions and Answers. *J. Police Sci. Admin.*, 1973, 1 (1), pp 102-111.
- F. Schultes, R. E.; Hofmann, A. Plants of Hallucinogenic Use. In *The Botany and Chemistry of Hallucinogens*; Charles C Thomas: Springfield, 1973; pp 53-65.
- G. Summary of Species Argument. *Microgram Journal*, 1974, VII (2), pp 16-19.
- H. Small, E. The Forensic Taxonomic Debate on Cannabis: Semantic Hokum, *J. Forensic Sci*, 1975, 21 (2), pp 239-251.
- I. Harvey, D. J. Cannabinoids. In *Mass Spectrometry: Modern Analytical Chemistry*; Desiderio, D. M., Ed; Springer: Boston, 1992; pp 207-219.
- J. Frank, M. History and Taxonomy of Cannabis. *Marijuana Grower's Guide Deluxe*. Red Eye: Los Angeles, CA, 1990; pp 3- 20.
- K. Marijuana. *Drug Identification Bible*; Amera-Chem: Grand Junction, CO, 2012; pp 442-465. (Current edition may be used, if available – page numbers may vary depending on the version)
- L. Srivastava, A.; Yadav V. K. Microscopical and Chemical Study of Cannabis sativa. *J. Forensic Res.*, 2013, 5 (1), pp 1- 6.
- M. ASTM E2329-14. *Standard Practice for Identification of Seized Drugs*; ASTM International: West Conshohocken, PA, 2014; pp 1- 3.
- N. PowerPoint presentation: *Cannabis sativa L. Analysis*

2.3 Suggested Readings

- A. United Nations Office on Drugs and Crime. *Recommended Methods for the Identification and Analysis of Cannabis and Cannabis Products*. United Nations: New York, 2009; pp 1-50.
- B. Farnsworth, N. R. Pharmacognosy and Chemistry of 'Cannabis Sativa'. *J Am Pharm Assoc*, 1969, NS9 (8), pp 410-415.
- C. "Sinsemilla", The World's Best Pot. Source unknown, pp 21-26.
- D. Nordal, A. Microscopic Detection of Cannabis in the Pure State and in Semi-Combusted Residues. In *The Botany and Chemistry of Cannabis*; Joyce, C. R. B., Curry, S. H., Eds.; J. & A. Churchill: London, 1970; pp 61-68.



- E. Central Bureau of Investigation (CBI). Criteria Used for the Identification of Marihuana, *CBI Bulletin*; 1973, pp 2-5.
- F. "Kenaf, Don't Get Burned!" *Microgram Journal*, 1990, XXIII (12), pp 274-275.
- G. Fussell, J. L.; Thornton, J. I.; Whitehurst, F. W. The Visual Characterization and Identification of Cannabis sativa (Marijuana) Seeds. *J. Forensic Identif.*, 2009, 59 (5), pp 569- 593.

3 Practice

3.1 Safety

- A. Safety precautions outlined in the Safety Manual will be followed at all times during the training program.
- B. The use of a dust mask may be necessary when analyzing samples with dust, dirt, or mold.

3.2 Standards, Controls, Reagent Preparation

None

3.3 Equipment

Including, but not limited to:

- Microscope
- Balances

3.4 Observed Performance

- A. The trainee will observe the trainer demonstrate the proper use of the microscope, identify Cannabis sativa L., and show examples of positive and negative microscopic and macroscopic examinations.
- B. The trainee will discuss their understanding of Cannabis sativa L. identification and documentation.

3.5 Supervised Performance

The trainee will demonstrate their understanding by properly identifying each type of hair microscopically and at least one macroscopic characteristic from a known Cannabis sativa L. sample.

3.6 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. Taxonomy and Definitions Exercise
- B. Known Plant Sample Exercise
 - 1. Visually examine a minimum of thirty-five (35) known plant samples and mixtures.
 - 2. Observations will be recorded in LIMS or on the appropriate form provided by the trainer.
- C. Unknown Plant Sample Exercise
 - 1. Visually examine a minimum of fifteen (15) unknown plant samples and mixtures.
 - 2. Observations will be recorded in LIMS.



4 Assessment

4.1 Competency and Qualifying Examination

A written assessment will be completed by the trainee and corrections will be made, if necessary.

4.2 Evaluation of Training

The trainee and trainer will sign off on the appropriate module of the Seized Drugs Training Checklist (LAB-SD-TM-01).



SD-TM-02-04 SCREENING TESTS

Duration Approximately 21 days

Purpose To familiarize the trainee with the various screening tests available for seized drugs analysis and assist the trainee in determining which screening tests are appropriate based on the type of sample.

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-03

1 Objectives

1.1 Theoretical

Screening tests are typically rapid, easy to perform, and can provide insight when analyzing unknown substances. Screening tests assist the analyst to develop a hypothesis related to which compounds may be present in a sample prior to instrumental analysis, but are not considered confirmatory tests. These tests provide an indication of what a sample may contain, which allows the analyst to choose the most appropriate sample extraction and preparation for instrumental analysis.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Name the various types of screening tests (chemical, pharmaceutical, TLC, etc.) and determine which are appropriate based upon the evidentiary sample.
- B. Name the chemical screening reagents and the possible substances that each may indicate.
- C. Name the TLC systems and the substances that are intended to be tested with each. (Only the TLC solvent system 1 and the Fast Blue RR indicating reagent is mandatory, but the trainee should be aware of the other systems and how they are used.)
- D. Prepare, performance check (if applicable) and document the results of each of the various screening tests to evaluate the possible substances that might be present in an evidentiary sample.

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. Chemical Screening (color tests)
 1. Theory
 2. Preparation and performance check
 3. Analysis and interpretation
 4. Documentation of results
- B. Pharmaceutical Identification
 1. Approved references
 2. Documentation of results



- C. Thin-Layer Chromatography
 - 1. Theory
 - 2. Preparation and performance check
 - 3. Analysis and interpretation
 - 4. Documentation of results
- D. Other Screening Tests
 - 1. pH test
 - 2. UV light source
- E. Discussion of limitations and advantages

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at the trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP:
 - 1. Reagents
 - 2. Chemical Screening Spot Tests – Overview
 - 3. Marquis Test
 - 4. Scott Test/Cobalt Thiocyanate Tests
 - 5. Modified Sodium Nitroprusside (SNP) Test
 - 6. Ferric Chloride Test
 - 7. Cobalt Nitrate Test
 - 8. p-Dimethylaminobenzaldehyde (pDMABA) Test
 - 9. Weber Test
 - 10. Duquenois-Levine Test
 - 11. Formaldehyde-Sulfuric Acid Test
 - 12. Liebermann Test
 - 13. Chlorophenol red: Modified Schweppe's Test
 - 14. Thin-Layer Chromatography
- B. Widdop, B. "Colour Tests". In *Clarke's Analysis of Drugs and Poisons*, 4th ed.; Moffat, A. C., Osselton, M. D., Widdop, B., Watts, J., Eds.; Pharmaceutical: London, 2011; pp. 471-495.
- C. Saferstein, R. "Drugs". In *Criminalistics: An Introduction to Forensic Science*, 8th ed; Prentice-Hall: 2004; pp 254- 261.
- D. Siegel, J. A. "Forensic Identification of Controlled Substances". In *Forensic Science Handbook, Volume II*; Saferstein, R., Ed.; Prentice Hall: New Jersey, 1988, pp 122-125.
- E. Christian, D. R., Jr. "Analysis of Controlled Substances". In *Forensic Science: An Introduction to Scientific and Investigative Techniques*; James, S.H., Nordby, J. J., Eds.; CRC: Boca Raton, 2003; pp 380-383.
- F. Scott, L. J. Specific Field Test for Cocaine. *Microgram Journal*. 1973, 6 (11), pp 179-181.



- G. Garrett, A. S.; Clemens, S. R.; Gaskill, J. H. The Weber Test: A Color Test for the Presence of Psilocin in Mushrooms. *SWAFS Journal*. 1993, 15 (1), pp 44-45.
- H. Hughes, R. B.; Warner, V. J. A Study of False Positives in the Chemical Identification of Marihuana. *J. Forensic Sci.* 1978, 23 (2), pp 304- 310.
- I. Lau-Cam, C. A. Coffee as an Interference in the Duquenois Test: A Differential Test. *Clin. Toxicol.* 1978, 12 (5), pp 535- 541.
- J. Poole, C. F. "Thin-layer Chromatography". In *Clarke's Analysis of Drugs and Poisons*, 4th ed.; Moffat, A. C., Osselton, M. D., Widdop, B., Watts, J., Eds.; Pharmaceutical: London, 2011; pp 600- 635.
- K. Beasley, L.; Valadez, M., Jr. Alternate Thin-Layer System for Marihuana. *Nanogram*, 1986, pp 1-3.
- L. ASTM E2329-14. *Standard Practice for Identification of Seized Drugs*; ASTM International: West Conshohocken, PA, 2014; pp 1- 3.
- M. PowerPoint presentation: *Screening Tests*

2.3 Suggested Readings

- A. *Carolina's Solution Preparation Manual Instructions*; 84-1201; Carolina Biological Supply Company: Burlington, NC; pp 1- 14.
- B. Johns, S. H.; Wist, A. A.; Najam, A. R. Spot Tests: A Color Chart Reference for Forensic Chemists. *J. Forensic Sci.* 1979, 24 (3), 631- 649.
- C. NIJ Standard – 0604.01. *Color Test Reagents/Kits for Preliminary Identification of Drugs of Abuse*; U.S. DOJ, 2000.
- D. Siegel, J. A. "Forensic Identification of Controlled Substances". In *Forensic Science Handbook, Volume II*; Saferstein, R., Ed.; Prentice Hall: New Jersey, 1988, pp 125-129.

3 Practice

3.1 Safety

- A. Safety precautions outlined in the Safety Manual will be followed at all times during the training program.
- B. TLC systems and indicator sprays will be stored and used inside chemical fume hoods.
- C. Chemicals used may be carcinogenic or caustic.

3.2 Standards, Controls, Reagent Preparation

Including, but not limited to:

- Reagents appropriate to the specific chemical spot tests, as outlined by SD SOP
- Reagents appropriate to the specific TLC solvent systems and indicating reagents, as outlined by SD SOP
- Performance check standards
- Sodium Carbonate
- Sulfuric Acid
- Hydrochloric Acid
- Chloroform
- Petroleum Ether



3.3 Equipment

Including, but not limited to:

- Balances
- Stir/hot plate
- Test tubes
- Spot well plates
- TLC plates
- TLC chamber
- Capillary tubes
- UV light source

3.4 Observed Performance

The trainee will observe experienced analysts perform screening tests on seized drugs evidence and keep a record of the observations on the appropriate form provided by trainer.

3.5 Supervised Performance

The trainee will prepare and performance check the reagents, TLC solvent systems, and indicating reagents commonly used in the trainee's home laboratory.

3.6 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. Reagent Preparation Exercise
- B. Pharmaceutical Identification Exercise
- C. Practical Exercise Part II
- D. Known Samples
 1. Perform appropriate screening tests on a minimum of fifty (50) known samples, including plants (may be the same samples as SD-TM-02-03), negatives, dangerous drugs, controlled substances, mixtures, and non-controlled substances.
 2. Observations will be recorded in LIMS or on the appropriate form provided by trainer.
- E. Unknown Samples (optional)
 1. Perform appropriate chemical spot tests on a minimum of ten (10) unknown samples.
 2. Observations will be recorded in LIMS or on the appropriate form provided by trainer.

4 Assessment

4.1 Competency and Qualifying Examination

A written assessment will be completed by the trainee and corrections will be made, if necessary.

4.2 Evaluation of Training

The trainee and trainer will sign off on the appropriate module of the Seized Drugs Training Checklist (LAB-SD-TM-01).



SD-TM-02-05 SAMPLE PREPARATION AND EXTRACTION PROCEDURES

Duration Approximately 28 days, concurrently with SD-TM-02-06

Purpose To familiarize the trainee with sample preparation and extraction techniques utilized in the analysis of unknown substances

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-04

1 Objectives

1.1 Theoretical

Preparation and extraction techniques are extremely important when identifying unknown substances. Almost every sample will need some type of extraction prior to instrumental analysis. Lewis acids/bases, solubilities, and sample concentrations are all factors that must be considered when preparing a sample for analysis. If a sample is not prepared appropriately it could potentially lead to a missed identification. Additionally, the compound of interest may need to be isolated from a mixture and it is vital to understand the proper cleanup and/or separatory techniques that may be necessary.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Discuss sample extraction theory and methodology, including Lewis acids and bases.
- B. Discuss proper extraction techniques for various substances.
- C. Perform a variety of extractions, separatory techniques, and/or cleanup procedures for instrumental analysis.
- D. Discuss derivatization techniques and when they are useful for instrumental analysis.
- E. Discuss other separation and/or cleanup procedures including microdiffusion, column chromatography, preparative TLC and the cobalt thiocyanate cleanup procedure.
- F. Perform other separation and/or cleanup procedures including microdiffusion, column chromatography, preparative TLC and the cobalt thiocyanate cleanup procedure. (optional)

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. Lewis acid/base compounds
- B. Direct solvent extraction
 1. Dry wash
 2. Dry extraction
- C. Liquid/liquid extraction
- D. Physical separation
- E. Preparative TLC



- F. Derivatization techniques
 - 1. Theory
 - 2. Types
 - 3. Advantages
 - 4. Disadvantages
- G. Column Chromatography (optional)

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at the trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP:
 - 1. Approved Standard Abbreviations List
 - 2. Examination of Controlled Substances, Dangerous Drugs and Related Compounds
- B. Hand, C. W.; Blewitt, H. L. *Acid-Base Chemistry*; Macmillian: New York, NY, 1986; pp 1-18, 58-69.
- C. Siegel, J. A. Forensic Identification of Controlled Substances. In *Forensic Science Handbook, Volume II*; Saferstein, R., Ed.; Prentice Hall: New Jersey, 1988, pp 73-78.
- D. Christian, D. R., Jr. Analysis of Controlled Substances. In *Forensic Science: An Introduction to Scientific and Investigative Techniques*; James, S.H., Nordby, J. J., Eds.; CRC: Boca Raton, 2003; pp 383-386.
- E. Noggle, T. F., Jr.; Clark, C. R. Identification of Some Benzodiazepines of Forensic Interest. *J. Assoc. Off. Anal. Chem.* 1979, 62 (4), pp 799- 807.
- F. Neto, J. C.; Andrade, A. F.; Rogerio, A. L.; Lordeiro, R. A.; Muchado, Y.; Elie, M.; Junior, E. F.; Arantes, L. C. Preventing Misidentification of 25I-NBOH as 2C-I on Routine GC-MS Analyses. *Forensic Toxicol.* 2017, 35 (2), pp 415-420.
- G. Lewis Acids and Bases. Information from the book: Jensen, W. B. *The Lewis Acid-Base Concepts*. Wiley: 1980.
- H. Regis Technologies. *GC Derivatization*; 2000, pp 1-15.
- I. Regis Technologies. *GC Derivatization Procedures*; 2000, pp 1- 8.
- J. PowerPoint presentation: *Sample Preparation and Extraction Procedures*

3 Practice

3.1 Safety

Safety precautions outlined in the Safety Manual will be followed at all times during the training program. Chemicals used may be carcinogenic or caustic.

3.2 Standards, Controls, Reagent Preparation

Including, but not limited to:

- Sodium Carbonate
- Sulfuric Acid
- Chloroform



- Ethanol
- Hexanes
- Hydrochloric Acid
- Methanol
- Sodium Bicarbonate
- Sodium Sulfate
- Alumina

3.3 Equipment

Including, but not limited to:

- Balance
- Cutting tools
- Spatula
- Test tubes
- Pipettes

3.4 Observed Performance

Trainee will observe experienced analysts prepare samples for instrumental analysis, including extractions and other separatory and/or clean-up procedures. Keep a record of the observations on the appropriate form provided by the trainer.

3.5 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. Extraction Concepts Exercise
- B. Drug Extraction Process Exercise
- C. Advanced Extraction Procedures Exercise
- D. Known Samples

Prepare a minimum of fifty (50) known samples, including plants, negatives, dangerous drugs, controlled substances, mixtures, and non-controlled substances for instrumental analysis using the proper extraction and/or cleanup procedures for each sample (may be the same used in SD-TM-02-04).

- E. Known Mixture Cleanup

Prepare five (5) known mixtures for instrumental analysis by performing the proper extraction and/or clean-up procedure to isolate the drug(s) of interest.

4 Assessment

4.1 Competency and Qualifying Examination

A written assessment will be completed by the trainee and corrections will be made, if necessary.

4.2 Evaluation of Training

The trainee and trainer will complete the appropriate module of the Seized Drugs Training Checklist (LAB-SD-TM-01).



SD-TM-02-06 INSTRUMENTAL ANALYSIS

Duration Approximately 28 days, concurrently with SD-TM-02-05

Purpose To familiarize the trainee with the theoretical and practical aspects of common instrumentation utilized in the analysis of seized drug evidence

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-04

1 Objectives

1.1 Theoretical

A variety of instrumentation is available for the analysis of seized drug evidence. It is important to understand the purpose of each instrument and which is appropriate for the analysis being performed. Different instruments can provide a wide variety of information, including structural information, chemical and physical characteristics, and/or general or class information. Certain instrumentation can be used for general screening, while others can be used as a confirmatory examination. Selecting the proper instrument or combination of instruments is vital for the identification of seized drug evidence.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Understand the difference between qualitative and quantitative analysis.
- B. Explain the theory of Ultraviolet/Visible Spectrophotometry (UV/VIS) and the operation of the instrument.
- C. Explain the theory of Fourier Transform Infrared Spectroscopy (FTIR) and the operation of the instrument.
- D. Explain the theory of Gas Chromatography (GC) and the operation of the instrument.
- E. Explain the theory of Mass Spectrometry (MS) and the operation of the detector.
- F. Explain the theory of Flame Ionization Detection (FID) and the operation of the detector. (optional)
- G. Explain the theory of High Performance Liquid Chromatography (HPLC) and the operation of the instrument. (optional)
- H. Understand how to use the software associated with the instruments utilized in the trainee's home laboratory.
- I. Understand how to conduct and interpret performance checks for each instrument.
- J. Understand how to document and interpret the results from the instrumental analysis.
- K. Understand the approved references and documentation requirements.
- L. Know the advantages and limitations of each instrument and recognize the effects of sample impurities.
- M. Gain a general understanding of performance verifications and validations.

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. Introduction to qualitative analysis using instrumentation



- B. Theory, operation, performance checks, documentation and interpretation of results, and approved references for the following:
 - 1. Ultraviolet/Visible Spectroscopy (UV/VIS)
 - 2. Fourier Transform Infrared Spectroscopy (FTIR)
 - 3. Gas Chromatography (GC)
 - 4. Mass Spectrometry (MS)
 - 5. Flame Ionization Detection (FID) (optional)
 - 6. High Performance Liquid Chromatography (HPLC) (optional)
- C. Advantages and limitations
- D. Performance verifications and validations

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at the trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP:
 - 1. Approved Standard Abbreviations List
 - 2. Standards and References
 - 3. Approved List of Reference Libraries and Abbreviations
 - 4. Ultraviolet/Visible Spectrophotometry
 - 5. Fourier Transform Infrared Spectrophotometry
 - 6. Gas Chromatography/ Mass Spectrometry (GC/MS)
 - 7. Balances and Scales
- B. Texas Department of Public Safety Crime Laboratory Service Manual (CLS):
 - 1. Laboratory Equipment
 - 2. Validations and Performance Verifications
- C. Saferstein, R. *Criminalistics: An Introduction to Forensic Science*, 8th ed; Prentice-Hall: 2004; pp 123- 146.
- D. Stafford, D. T. Forensic Capillary Gas Chromatography. In *Forensic Science Handbook, Volume II*; Saferstein, R., Ed.; Prentice Hall: New Jersey, 1988, pp 38- 65.
- E. Gross, J. H. *Mass Spectrometry: A Textbook*; Springer: New York, 2004, pp. 2-21, 193, 196- 205, 213- 222, 475- 487, 505.
- F. Siegel, J. A. Forensic Identification of Controlled Substances. In *Forensic Science Handbook, Volume II*; Saferstein, R., Ed.; Prentice Hall: New Jersey, 1988, pp 78- 86.
- G. Christian, D. R., Jr. Analysis of Controlled Substances. In *Forensic Science: An Introduction to Scientific and Investigative Techniques*; James, S.H., Nordby, J. J., Eds.; CRC: Boca Raton, 2003; pp 386-393.
- H. Robinson, J. W.; Frame, E. M. S.; Frame, G. M, II. *Undergraduate Instrumental Analysis*, 6th ed; Marcel Dekker: New York, 2005, pp 213- 225, 230- 236, 242- 251, 317- 332, 337- 348, 749- 771, 773- 774, 780- 785, 789- 791.



- I. Smith, R. M. *Understanding Mass Spectra: A Basic Approach*, 2nd ed; John Wiley & Sons: New Jersey, 2004, pp 26- 30.
- J. Davidson, T. J.; Lum, B. J.; Nano, G.; Jackson, G. P. Comparison of Measured and Recommended Acceptance Criteria for the Analysis of Seized Drugs Using Gas Chromatography- Mass Spectrometry (GC-MS). *J. Forensic Sci.* **2018**, *35*, pp 15-26.
- K. Local laboratory instrument instructions and/or portions of the instrument manual, as determined by the trainer.
- L. PowerPoint presentation: *Instrumental Analysis*

2.3 Suggested Readings

- A. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP:
 1. Gas Chromatography/Flame Ionization Detection (GC/FID)
 2. High Performance Liquid Chromatography (HPLC) (**Required for labs with an HPLC**)
 3. Ultra Performance Liquid Chromatography/Mass Spectrometry (UPLC/MS) (**Required for labs with an LC/MS**)
- B. Robinson, J. W.; Frame, E. M. S.; Frame, G. M, II. *Undergraduate Instrumental Analysis*, 6th ed; Marcel Dekker: New York, 2005, pp 797- 810, 812- 816, 824- 829. (**Required for labs with an HPLC or LC/MS**)
- C. Kim, E. *Care, Maintenance, and Troubleshooting of HPLC Columns: Columns and Consumables*. Agilent Technologies Presentation.
- D. Cordonnier, J.; Schaep, J. Ultraviolet, Visible and Fluorescence Spectrophotometry. In *Clarke's Analysis of Drugs and Poisons*, 4th ed.; Moffat, A. C., Osselton, M. D., Widdop, B., Watts, J., Eds.; Pharmaceutical: London, 2011; pp 507- 520.
- E. Jee, R. D. Infrared Spectroscopy. In *Clarke's Analysis of Drugs and Poisons*, 4th ed.; Moffat, A. C., Osselton, M. D., Widdop, B., Watts, J., Eds.; Pharmaceutical: London, 2011; pp 521- 537.
- F. Watson, D. Mass Spectrometry. In *Clarke's Analysis of Drugs and Poisons*, 4th ed.; Moffat, A. C., Osselton, M. D., Widdop, B., Watts, J., Eds.; Pharmaceutical: London, 2011; pp 577- 593.
- G. Dawling, S. Gas Chromatography. In *Clarke's Analysis of Drugs and Poisons*, 4th ed.; Moffat, A. C., Osselton, M. D., Widdop, B., Watts, J., Eds.; Pharmaceutical: London, 2011; pp 636- 717.
- H. Kupiec, T.; Kemp, P. High Performance Liquid Chromatography. In *Clarke's Analysis of Drugs and Poisons*, 4th ed.; Moffat, A. C., Osselton, M. D., Widdop, B., Watts, J., Eds.; Pharmaceutical: London, 2011; pp 718- 757.
- I. NFSTC Training Manual, Texas DPS Training Manual.
 1. UV-Visible Spectrophotometry
 2. Infrared Spectrophotometry
 3. Gas Chromatography
 4. Mass Spectrometry



- J. Agilent Technologies. *MS Tuning*.
- K. Agilent Technologies. *Maintaining Your GC/MS System*; 5988-3960EN; Agilent Technologies, 2001; pp 1-47.

3 Practice

3.1 Safety

Safety precautions outlined in the Safety Manual will be followed at all times during the training program. Chemicals used may be carcinogenic or caustic.

3.2 Standards, Controls, Reagent Preparation

Including, but not limited to:

- Sodium Carbonate
- Sulfuric Acid
- Chloroform
- Ethanol
- Hexanes
- Hydrochloric Acid
- Methanol
- Sodium Bicarbonate
- Sodium Sulfate

3.3 Equipment

Including, but not limited to:

- Vortex mixer
- Hot plate
- GC/MS
- FTIR
- UV/VIS
- Centrifuge
- Balance
- GC/FID (optional)
- HPLC (optional)
- LC/MS (optional)

3.4 Observed Performance

- A. Trainee will observe experienced analysts perform analysis on instruments commonly used in the trainee's home laboratory and keep a record of the observations on the appropriate form provided by the trainer.
- B. Trainer and trainee will discuss the appropriate instrument and/or method for the identification of a sample.

3.5 Supervised Performance

The trainee will conduct a performance check on the instruments commonly used in the trainee's home laboratory.



3.6 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. Instrument Exercise (This should be completed in the trainee's home laboratory if training at another laboratory.)
- B. Instrument Maintenance Exercise (This should be completed in the trainee's home laboratory if training at another laboratory.)
- C. Mass Spectrometry Tune Evaluation Exercise
- D. Practical Exercise Part III
- E. Known Samples Analysis
 - 1. Analyze the known samples prepared from SD-TM-02-05 by UV/VIS, FTIR, and GC/MS, as appropriate.
 - 2. Observations will be recorded in LIMS or on the appropriate form provided by trainer.
 - 3. The trainer will review the analytical results and any issues will be resolved by the trainee.
- F. Known Mixture Cleanup Analysis
 - 1. Analyze the known mixture cleanup samples prepared from SD-TM-02-05 by UV/VIS, FTIR, and GC/MS.
 - 2. Observations will be recorded in LIMS or on the appropriate form provided by trainer.
 - 3. The trainer will review the analytical results and any problems will be resolved by the trainee.
- G. Trainee will analyze known samples using HPLC. (**required in labs with an HPLC**)
- H. Trainee will analyze known samples using Liquid Chromatography/ Mass Spectrometry (LC/MS). (**required in labs with an LC/MS**)

4 Assessment

4.1 Competency and Qualifying Examination

A written assessment will be completed by the trainee and corrections will be made, if necessary.

4.2 Evaluation of Training

The trainee and trainer will complete the appropriate module of the Seized Drugs Training Checklist (LAB-SD-TM-01).



SD-TM-02-07 REPORT WRITING AND CASE REVIEW

Duration Approximately 14 days

Purpose To familiarize the trainee with and provide guidelines for report writing, technical review, and administrative review of completed cases

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-06

1 Objectives

1.1 Theoretical

The laboratory report is used to communicate analytical results and other important information to the customer. The report must be accurate in all details, including administrative and technical information. After analysis has concluded, the results and any result notes are entered into LIMS. A thorough review of the case record is the completed and corrections are made as needed.

A technical review of the case record is required to be completed by another qualified seized drugs analyst before results can be discussed with or disseminated to the customer. The technical review is an independent assessment of the scientific validity of the test results, opinions, and interpretations. An administrative review is also required and once complete, the report is finalized and released to the customer. Technical and administrative review are both extremely important and they help to ensure the quality of the analysis and results.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Understand the proper documentation required in the case record.
- B. Understand and be able to demonstrate the process of entering analysis results into LIMS.
- C. Determine which, if any, result notes are appropriate for use in a report.
- D. Understand the required elements of a report.
- E. Understand the different types of reports.
- F. Understand how to perform and properly document a technical review.
- G. Understand how to perform and properly document an administrative review.
- H. Understand how to document corrections from review.
- I. Understand the requirements for releasing information and results to the customer prior to the distribution of the report.

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. Case documentation
 1. Case record preparation
 2. Documentation practices
 3. Case related correspondence



- B. Reporting guidelines
 - 1. Health and Safety Code guidelines
 - 2. Reporting results for controlled substances
 - 3. Reporting weights
 - 4. Process to get a result added to LIMS
- C. Laboratory report
 - 1. Elements of the report
 - 2. Format of the report
 - 3. Types of reports
 - 4. Report distribution
 - 5. Quarterly reexaminations
- D. Case Review
 - 1. Technical Review
 - 2. Administrative Review
 - 3. Documenting review and corrections

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at the trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory Service Manual (CLS):
 - 1. Review of Laboratory Records
 - 2. Laboratory Records
 - 3. Laboratory Reports, Letters, and Certificates
 - 4. Control of Laboratory Records
- B. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP:
 - 1. Reporting Guidelines
 - 2. Case Documentation and Exam Counting
 - 3. Approved Standard Abbreviations List
 - 4. Controlled Substance Overview
 - 5. Approved List of Reference Libraries and Abbreviations
 - 6. Approved Abbreviation List for Pharmaceutical References
 - 7. Quarterly Controlled Substance Evidence Reexamination
 - 8. Guidelines for Technical Review
 - 9. Examination of Controlled Substances, Dangerous Drugs, and Related Compounds
 - 10. Instructions for Controlled Substances and Marihuana Worksheets



11. Critical Weights
 12. Examination and Destruction of Excess Quantity Controlled Substances
 13. Examination of Marihuana
- C. Laboratory Information Management System Instructions (JusticeTrax):
1. Amended Controlled Substance Reports
 2. Requests Tab
 3. Misdemeanor Controlled Substance Cases
 4. Controlled Substance Result List
- D. Health and Safety Code, Title 6, Subtitle C, Chapter 481, Subchapter D – Offenses and Penalties.
- E. Texas Penal Code, Title 8, Chapter 38, Section 38.11 – Prohibited Substances and Items in Correctional or Civil Commitment Facility.
- F. Texas Administrative Code, Title 37, Part 1, Chapter 13, Subchapter G – Forfeiture and Destruction.

2.3 Suggested Readings

Texas Criminal and Traffic Law Manual, Health and Safety Code:

1. Chapter 481, Section 481.002 – Definitions
2. Chapter 483 – Dangerous Drugs

3 Practice

3.1 Safety

None

3.2 Standards, Controls, Reagent Preparation

None

3.3 Equipment

None

3.4 Observed Performance

- A. Trainee will observe a trained analyst performing technical reviews on completed case records. This will be documented on the appropriate form provided by the trainer. The number of technical reviews observed will be determined by the trainer.
- B. Trainee will observe a trained analyst performing administrative reviews on completed case records. This will be documented on the appropriate form provided by the trainer. The number of administrative reviews observed will be determined by the trainer.

3.5 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. Practical Exercise Part IV
- B. Case Review Questions and Definitions Exercise



- C. Case Review Scenarios Exercise
- D. Mock Case Review Exercise
- E. Trainee will be given case records to perform an independent review. The number of cases will be determined by the trainer and documented on the appropriate form as determined by the trainer:
 - 1. Trainee will perform a technical review on case records that have already been technically reviewed by a qualified reviewer.
 - 2. Trainee will perform a technical review on non-reviewed case records before they are given to a qualified reviewer.
 - 3. Trainee will perform an administrative review on completed case records that have already been administratively reviewed by a qualified reviewer.
 - 4. Trainee will perform an administrative review on non-administratively reviewed, completed case records before they are given to a qualified reviewer.

4 Assessment

4.1 Competency and Qualifying Examination

A written assessment will be completed by the trainee and corrections will be made, if necessary.

4.2 Evaluation of Training

The trainee and trainer will complete the appropriate module of the Seized Drugs Training Checklist (LAB-SD-TM-01).



SD-TM-02-08 PRACTICAL ASSESSMENT

Duration Approximately 28 days

Purpose To assess the trainee's ability to independently analyze, evaluate, and report results for unknown substances, and to demonstrate their knowledge of seized drugs analysis as well as laboratory policies and procedures

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-07

1 Objectives

1.1 Theoretical

The practical assessment is the culmination of the entire analytical scheme. At this point, all of the tools for a successful analysis have been explained, and these can be applied to any unique situation that arises. Seized drugs is always evolving and new substances are continuously being identified. Not every case can be approached similarly so it is imperative that the analyst be able to apply critical thinking and use the tools learned in the training program when handling both typical and atypical casework.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Independently demonstrate their familiarity with the seized drugs analytical scheme through the analysis of unknown samples.
- B. Demonstrate their ability to evaluate, document, and report analytical results in accordance with proper analysis techniques and laboratory policies.
- C. The ability to summarize their understanding of seized drugs analysis and laboratory policies and procedures.

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. Analytical scheme
- B. Sample examination and analysis
- C. Data evaluation and interpretation
- D. Documentation of analytical results
- E. Report preparation

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at the trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP:
 1. Reporting Guidelines
 2. Measurement Uncertainty Estimate – Weights
 3. Case Documentation and Exam Counting
 4. Approved Standard Abbreviations List



5. Standards and References
 6. Approved List of Reference Libraries and Abbreviations
 7. Approved Abbreviation List for Pharmaceutical References
 8. Examination of Controlled Substances, Dangerous Drugs and Related Compounds
 9. Instructions for Controlled Substance and Marihuana Worksheets
 10. Critical Weights
 11. Examination of Marihuana
- B. Laboratory Information Management System Instructions (JusticeTrax):
1. LIMS Login
 2. Requests Tab
 3. Controlled Substance Result List
- C. Texas Department of Public Safety Crime Laboratory Service Manual (CLS): Evidence Processing

3 Practice

3.1 Safety

- A. Safety precautions outlined in the Safety Manual will be followed at all times during the training program.
- B. Chemicals used may be carcinogenic or caustic.

3.2 Standards, Controls, Reagent Preparation

None

3.3 Equipment

Including, but not limited to:

- Vortex mixer
- Hot plate
- GC/MS
- FTIR
- UV/VIS
- Centrifuge
- Balance
- LIMS

3.4 Independent Exercises

Unknown Samples

- A. Analyze a minimum of twenty (20) unknown samples and mixtures. The samples should be a variety of substances, including plants, negatives, dangerous drugs, controlled substances, mixtures, and non-controlled substances.
- B. Observations will be recorded in LIMS.



- C. Trainer will review the analytical results and any issues will be resolved by the trainee before progressing to competency samples.
- D. Major deficiencies will be determined by the trainer and additional samples may be provided, if necessary.

4 Assessment

4.1 Competency and Qualifying Examination

- A. Competency Samples
 - 1. Analyze a minimum of twenty (20) unknown samples and mixtures. The samples should be a variety of substances, including plants, negatives, dangerous drugs, controlled substances, mixtures, and non-controlled substances.
 - 2. Observations will be recorded in LIMS.
 - 3. Acceptable performance is outlined in the Crime Laboratory Service Manual.
 - 4. Trainee will complete all corrections as determined by the trainer.
- B. A comprehensive written assessment will be completed by the trainee and corrections will be made, if necessary.

4.2 Evaluation of Training

The trainee and trainer will complete the appropriate module of the Seized Drugs Training Checklist (LAB-SD-TM-01).



SD-TM-02-09 COURT TESTIMONY

Duration Approximately 7 days, can be completed concurrently with SD-TM-02-08

Purpose To familiarize the trainee with concepts of court testimony as an expert witness, including rules of testimony and court etiquette

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-08

1 Objectives

1.1 Theoretical

Expert witnesses are individuals who have knowledge, skills, educations and/or experience in a specialized field and can be called to offer opinions on evidence in court. There are specific rules and etiquette that the witness must consider when preparing for trial and while testifying. Many factors, such as how the witness presents themselves, can influence the jury's perception. Adequate preparation will allow the witness to present their analysis and results effectively.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Explain basic courtroom procedures, legal definitions, and important court rulings.
- B. Discuss courtroom etiquette, customs, and rules of evidence for an expert witness.
- C. Explain the characteristics of an effective witness and how dress, body language, tone of voice, and other factors may influence jury perceptions.
- D. Prepare adequately for courtroom testimony when subpoenaed, which includes gathering the appropriate documentation.
- E. Answer questions regarding accreditation, quality assurance procedures, training, and qualifications.
- F. Explain, in lay terms, laboratory procedures including the scientific techniques and instrumental analysis performed.
- G. Function as an effective expert witness in a court of law.
- H. Understand the general requirements regarding testimony monitoring.

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. Review of general court information
 1. Definitions and terminology
 2. Texas Rules of Evidence
 3. Significant court rulings
 4. Disclosure requirements
 5. Courtroom presentation, including
 - a. *Pretrial meeting*
 - b. *Proper dress and appearance*
 - c. *Etiquette*



B. Testimony

1. Documents to bring to court
2. Characteristics of an effective witness
3. Jury perceptions
4. Predicate questions
5. Procedural explanations in lay terms
6. Cross-examination
7. Testimony monitoring

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at the trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory Service Manual (CLS):
 1. Expert Witness Testimony Guidance
 2. Attire and Appearance
 3. Forensic Disclosure and Compliance Policy
 4. Court Testimony and Monitoring
- B. General Laboratory Training Manual:
 1. Overview of the Legal Processes and Testimony
 2. Rules of Evidence and General Legal Opinions
- C. Texas Rules of Evidence:
 1. Article VI – Witnesses
 2. Article VII – Opinions and Expert Testimony
 3. Article VIII – Hearsay
- D. Sapir, G. I. Qualifying the Expert Witness: A Practical Voir Dire. *Forensic Magazine*, **2007**, February/March, pp 1- 5.
- E. How to Be an Effective Witness. Unknown Source.
- F. Dunn, R. R. Persuasive Expert Witness. *Fire and Arson Investigator*, pp 25-29.
- G. Philipps, K. A. The “Nuts and Bolts” of Testifying as a Forensic Scientist. *J. of Forensic Sci.* 1977, 22 (2), pp 457-463.
- H. Kogan, J. D. On Being a Good Expert Witness in a Criminal Case. *J. of Forensic Sci.* 1978, 23 (1), pp 190- 200.
- I. Thornton, J. I. Courts of Law v Courts of Science: A Forensic Scientist's Reaction to Daubert. In *Shepard's Expert and Scientific Evidence Quarterly*, Volume 1; Black, B., Klein, M. S., Brunette, S. A., Eds.; Shepard's/ McGraw-Hill: Colorado Springs, 1994; Number 3; pp 475-485.
- J. Babitsky, S. 25 Tips for Expert Witnesses. SEAK: The Expert Witness Training Company.
- K. Ashlock, S. Expert Witness: Effective Courtroom Testimony. *Forensic Magazine*, 2010, February, pp 1-5.



- L. Texas District & County Attorneys Association. *2019-2021 Predicates*; TDCAA Publications Committee: Austin, TX, 2019; pp 29-31, 56.

2.3 Suggested Readings

- A. Bullis, R. K. Stressing Demeanor Credibility: Continued Impacts of Melendez-Diaz for Forensic Scientists. *Forensic Magazine*, 2012, February/March, pp 1-6.
- B. Olson, A. Bruce Expert Witness: Preparing for and Testifying at Depositions. *Forensic Magazine*, 2011, July, pp 1-5.

3 Practice

3.1 Safety

None

3.2 Standards, Controls, Reagent Preparation

None

3.3 Equipment

None

3.4 Observed Performance

- A. Observe court testimony of an experienced seized drugs analyst.
 - 1. Make notes about the questions that were asked and how the witness answered.
 - 2. Complete a Testimony Technical Review Form (LAB-313) and a Testimony Survey Form (LAB-314).
- B. Trainee will discuss with the trainer their answers to common predicate questions.

3.5 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. General Court Preparation Exercise
- B. Predicate Questions Exercise

4 Assessment

4.1 Competency and Qualifying Examination

- A. Mock trial at a minimum, evidence should include:
 - 1. Plant substance
 - 2. A substance commonly encountered in the trainee's home laboratory
 - 3. A compound controlled by structural class
- B. Acceptable performance and documentation is outlined in the Crime Laboratory Service Manual.

4.2 Evaluation of Training

The trainee and trainer will complete the appropriate module of the Seized Drugs Training Checklist (LAB-SD-TM-01).



SD-TM-02-10 ANALYSIS OF CLANDESTINE LABORATORIES

Duration Approximately 7 days (optional)

Purpose To familiarize the trainee with clandestine laboratories, including common manufacturing techniques, equipment, and basic safety

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-06

1 Objectives

1.1 Theoretical

This training module is recommend for the safety of the analyst, especially in areas with clandestine laboratory activity. It is important to be aware of the clandestine manufacturing process for a number of different chemical substances including, but not limited to, the production of methamphetamine, PCP, LSD, MDMA, fentanyl, and GHB. This knowledge will help in casework analysis by providing a basic understanding of the dangers present in these manufacturing processes.

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Define the general terms associated with clandestine laboratories.
- B. Understand what illicit drugs are manufactured and the relevant precursor chemicals, reagents, and commonly used chemicals.
- C. Understand the inherent dangers in some manufacturing techniques.
- D. Recognize a possible manufacturing case by the chemicals present.
- E. Understand identification techniques and reporting guidelines for common chemicals associated with the manufacture of controlled substances.
- F. Apply routine analysis procedures for the identification of unknown substances in a clandestine laboratory sample.
- G. Understand that they are **NOT** qualified to:
 1. Investigate an active clandestine laboratory crime scene.
 2. Safely quench an active reaction from a clandestine laboratory.
 3. Provide reports or testimony on potential yields from clandestine laboratories.

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with the trainer.

- A. Definitions, including:
 1. Precursor
 2. Reagent
 3. Reaction mixture
 4. By-product
 5. Manufacturing



- B. Clandestine manufacturing processes for the following:
 - 1. Methamphetamine
 - 2. Phencyclidine
 - 3. LSD
 - 4. MDMA
 - 5. Fentanyl
 - 6. GHB
 - 7. Conversion/processing labs
 - 8. Hash production
- C. Techniques for the analysis of common precursors and reagents.

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at the trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory Service Manual: Destruction of Hazardous Chemical Substances.
- B. Texas Health and Safety Code, Title 6, Subtitle C, Chapter 481:
 - 1. Section 481.002 - Definitions for:
 - a. *Manufacture*
 - b. *Raw Material*
 - c. *Chemical Precursor and*
 - d. *Chemical Laboratory Apparatus*
 - 2. Section 481.124 – Offense: Possession or Transport of Certain Chemicals with Intent to Manufacture Controlled Substance
 - 3. Section 481.141 – Manufacture or Delivery of Controlled Substance Causing Death or Serious Bodily Injury
- C. Clandestine Lab Basic Guide, Handouts from a presentation at the 12th Annual Training Seminar of the Clandestine Laboratory Investigating Chemists:
 - 1. Section 2 – Analysis
 - 2. Section 4 – Methamphetamine
 - 3. Section 6 – MDMA and Analogs
 - 4. Section 7 – PCP
 - 5. Section 11 – Chemical Information
 - 6. Section 12 – Inorganic Analysis
- D. Palmer, R. B. Illicit Drug Manufacture (with an Emphasis on Clandestine Methamphetamine Production): Synthetic Methods and Law Enforcement Concerns. In *Handbook of Forensic Drug Analysis*, 1st Ed.; Smith, F. P., Siegel, J. A., Eds.; Academic Press, 2005, pp 453-514.



- E. Frank, R. S. The Clandestine Drug Laboratory Situation in the United States. *J. Forensic Sci.* 1983, 28 (1), pp 18-31. (Note: Other than historical purposes, the routes of synthesis for the six different drugs is the significant information in this article.)
- F. Basic Clandestine Laboratory Safety Training, Handouts from Clandestine Laboratory Investigating Chemists Seminar:
 - 1. Labnote: Lab Type/Method Table
 - 2. Labnote: Clan Lab Commercial Chemical Guide
- G. Clandestine Laboratory Guide for Agents and Chemists Handouts:
 - 1. Alpha-Methyl Fentanyl
 - 2. Fentanyl
 - 3. LSD
 - 4. MDA
 - 5. Phencyclidine (PCP)
- H. Willers-Russo L. J. Three Fatalities Involving Phosphine Gas Produced as a Result of Methamphetamine Manufacturing. *J Forensic Sci.* 1999, 44 (3), pp 647-652.
- I. Homemade Ammonia Produced from Fertilizer, *CS Alert*, May 2003, Vol. 1, p 57.
- J. Oulton, S. R.; Skinner, H. F. Reaction Byproducts of Common Cold Tablet Ingredients via Hydriodic Acid/Red Phosphorus. *Journal Clandestine Laboratory Investigative Chemist Association.* 1999, 9 (4), pp 21 -35.
- K. Jacobs, J. L.; Martinez, F. S.; Skinner, H. F. Extraction of Reaction By-Products of Common Cold Tablet Ingredients Via Hydriodic Acid Reduction. *Journal of the Clandestine Laboratory Investigative Chemist Association.* 2003, 13 (1), pp 13-17.
- L. Teer, C. B.; Wittwer, J. D. Identification of Alpha-Benzyl-N-Methyl-Phenethylamine *Microgram*, 1981, XIV (8), pp 99-104.
- M. *Methamphetamine Myths: Fact or Fiction?* Narcotics Digest Weekly Product No. 2005-R0485-002; National Drug Intelligence Center, 2005, 4 (2), pp 1-3.

2.3 Suggested Readings

- A. Palmer, R. B. Illicit Drug Manufacture (with an Emphasis on Clandestine Methamphetamine Production): Synthetic Methods and Law Enforcement Concerns. In *Handbook of Forensic Drug Analysis*, 1st Ed.; Smith, F. P., Siegel, J. A., Eds.; Academic Press, 2005, pp. 514-532.
- B. Stolk, M.; Camilleri, A. The Synthesis of Thiophene-Based Analogues of Phenethylamine Controlled Drugs. *Journal of the Clandestine Laboratory Investigating Chemists Association.* 2018, 28 (2), pp 22-33.

3 Practice

3.1 Safety

- A. Safety precautions outlined in the Safety Manual will be followed at all times during the training program.
- B. Most chemicals used in the clandestine laboratories are hazardous, toxic, or flammable; inorganic acids are used in several areas.



- C. Sampling of suspected clandestine laboratories should be performed in a chemical fume hood.

3.2 Standards, Controls, Reagent Preparation

None

3.3 Equipment

None

3.4 Observed Performance

If applicable, the trainee will observe experienced analyst(s) as they analyze evidence collected from clandestine laboratories.

3.5 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. Clandestine Laboratory Definitions Exercise
- B. Precursor and Reagent Exercise

4 Assessment

4.1 Competency and Qualifying Examination

No written assessment for this module.

4.2 Evaluation of Training

The trainee and trainer will complete the appropriate module of the Seized Drugs Training Checklist (LAB-SD-TM-01).



03 QUANTITATIVE ANALYSIS UNIT

SD-TM-03-01 QUANTITATION SAMPLING PROCEDURE

Duration Approximately 7 days

Purpose To familiarize the trainee with how to sample and prepare seized drugs exhibits for quantitation

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-09

1 Objectives

1.1 Theoretical

Understand the proper sampling plan for quantitation based on the weights of the exhibits and/or the number of items.

1.2 Practical

Following the completion of this module the trainee will be able to:

- A. Use the sampling plan to select units for sampling.
- B. Document the sampling in analysis notes.
- C. Understand the procedures for packaging, sealing, and forwarding quantitation samplings to quantitation laboratories.

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with trainer.

- A. Types of quantitated samples
- B. Receiving laboratories and designated quantitation laboratories
- C. Weight limits for quantitation
- D. Qualitative analysis requirements
- E. Selection of samples
- F. Documentation
- G. LIMS itemization
- H. Packaging and forwarding

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP: Quantitative Sampling Procedure
- B. Laboratory Information Management System Instructions (JusticeTrax): Controlled Substance Quantitation Workflow



2.3 Suggested Readings

- A. ASTM International. *Standard Guide for Sampling Seized Drugs for Qualitative and Quantitative Analysis*. E2548-1. ASTM Int'l: West Conshohocken, 2011.
- B. Guidelines on Sampling of Illicit Drugs for Quantitative Analysis, European Network of Forensic Science Institutes-Drug Working Group, Ref. Code: DWG-GQS-002, Issue No: 001, April, 2014.

3 Practice

3.1 Safety

Safety precautions outlined in the Safety Manual will be followed at all times during the training program.

3.2 Standards, Controls, Reagent Preparation

None

3.3 Equipment

- Weighing vessel (weighing boats, weighing paper, etc.)
- Spatula
- Scalpel or Cutting Tool
- Butcher Paper
- Plastic Bags
- Top Loader Balance

3.4 Observed Performance

Observe Sampling for Quantitation

- A. The trainee should observe the proper sampling for quantitation of one-item exhibits and multi-item exhibits over 1 kilogram, if available.
- B. If no samples are available to observe, the trainer should provide mock samples to use as an example (i.e. sheets of paper, bags of flour).

3.5 Supervised Performance

Demonstrate Sampling for Quantitation

- A. The trainee should demonstrate knowledge of the proper sampling for quantitation of one-item exhibits and multi-item exhibits over 1 kilogram, if available.
- B. If no samples are available to demonstrate, the trainer should provide mock samples for use (i.e. sheets of paper, bags of flour).

3.6 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary:

Quantitation and Sampling Exercise

4 Assessment

4.1 Competency and Qualifying Examination

A written assessment will be included in the final exam.



4.2 Evaluation of Training

The trainee and trainer will complete the Seized Drugs Quantitation Training Checklist (LAB-SD-TM-02).



SD-TM-03-02 QUANTITATION BY GC AND/OR HPLC

Duration Approximately 7 days (optional)

Purpose To familiarize the trainee with the theoretical and practical aspects of determining the concentration of a controlled substance in a sample using gas chromatography (GC) and/or by using High Performance Liquid Chromatography (HPLC)

Prerequisite General Laboratory Training, SD-TM-02-01 through SD-TM-02-09, and SD-TM-03-01

1 Objectives

1.1 Theoretical

Quantitation is important for the Federal Prosecution of Methamphetamine HCl. It is critical to have an understanding of the difference between qualitative and quantitative analysis, and to have an understanding of how to perform a quantitative analysis by Gas Chromatography (GC) and/or High Performance Liquid Chromatography (HPLC).

1.2 Practical

Following the completion of this module, the trainee will be able to:

- A. Prepare samples appropriately for analysis using GC and/or HPLC
- B. Quantitate samples using GC and/or HPLC
- C. Recognize the effects of sample impurities on the various types of analyses
- D. Perform quality controls on the GC instrument and HPLC as it relates to quantitation

2 Training Outline

2.1 Lesson Plan

Topics will be addressed through readings and/or discussion with trainer.

- A. Introduction to Qualitative and Quantitative Analysis using instrumentation
- B. Trainer and trainee will discuss preparation of reagents and solutions.
- C. Trainer and trainee will discuss and practice proper pipetting techniques for quantitations.
- D. Trainer and trainee will discuss the correct method for performing a GC and HPLC quantitation analysis and discuss interpretations and limitations.
- E. Gas Chromatography – as it pertains to quantitation
 - 1. Theory
 - a. *Advantages*
 - b. *Disadvantages*
 - 2. Operation
 - 3. Interpretation of results
- F. High Performance Liquid Chromatography (HPLC) – as it pertains to quantitation
 - 1. Theory
 - a. *Advantages*
 - b. *Disadvantages*



2. Operation
3. Interpretation of results

2.2 Required Readings

Readings that have been completed in previous modules may be omitted or reviewed at trainer's discretion. For literature references, use of the most current edition is recommended.

- A. Texas Department of Public Safety Crime Laboratory, Seized Drugs SOP:
 1. Gas Chromatography/Flame Ionization Detector
 2. High Performance Liquid Chromatography (HPLC)
 3. Quantitation by Gas Chromatography with Internal Standard
 4. Quantitation by High Performance Liquid Chromatography
- B. Stafford, D. T. Forensic Capillary Gas Chromatography. In *Forensic Science Handbook, Volume II*; Saferstein, R., Ed.; Prentice Hall: New Jersey, 1988, pp 38-65.
- C. Siegel, J. A. Forensic Identification of Controlled Substances. In *Forensic Science Handbook, Volume II*; Saferstein, R., Ed; Prentice Hall: New Jersey, 1988, pp 82-86.
- D. Christian, D. R., Jr. Analysis of Controlled Substances. In *Forensic Science: An Introduction to Scientific and Investigative Techniques*; James, S.H., Nordby, J. J., Eds.; CRC: Boca Raton, 2003; pp 391-393.
- E. Aresnault, J. C.; McDonald, P. D. *Beginners Guide to Liquid Chromatography*. Waters: Milford, 2009.
- F. Grumbach, E. S.; Aresnault, J. C.; McCabe, D. R. *Beginners Guide to UPLC Ultra-Performance Liquid Chromatography*. Waters: Milford, 2012. (required only if have a UPLC in lab)
- G. Local laboratory instrument instructions and/or portions of the instrument manual, as determined by the trainer.

2.3 Suggested Readings

- A. Dawling, S. Gas Chromatography. In *Clarke's Analysis of Drugs and Poisons*, 4th ed.; Moffat, A. C., Osselton, M. D., Widdop, B., Watts, J., Eds.; Pharmaceutical: London, 2011; pp 636- 717.
- B. Kupiec, T.; Kemp, P. High Performance Liquid Chromatography. In *Clarke's Analysis of Drugs and Poisons*, 4th ed.; Moffat, A. C., Osselton, M. D., Widdop, B., Watts, J., Eds.; Pharmaceutical: London, 2011; pp 718- 757.
- C. Kim, E. *Care, Maintenance, and Troubleshooting of HPLC Columns: Columns and Consumables*. Agilent Technologies Presentation.
- D. Swartz, M. E. *Ultra Performance Liquid Chromatography (UPLC): An Introduction*. In *Ultra Performance LC Separation Science Redefined*. Waters: 2004, pp 8-14.

3 Practice

3.1 Safety

Safety precautions outlined in the Safety Manual will be followed at all times during the training program.



3.2 Standards, Controls, Reagent Preparation

- Chloroform (Chromatographic Grade or Ultra-high Purity)
- HPLC Grade Solution(s)
- Appropriate internal standard (e.g. n-Tetradecane (C-14) hydrocarbon)
- Controlled substance reference standards for drug quantitation
- 1 M Sodium Carbonate, 0.2N H₂SO₄ and other solutions, as needed
- Purchased standards (NIST Traceable) of known concentration as they become available

3.3 Equipment

- Gas chromatograph
- HPLC
- Appropriate carrier and fuel gases
- Injection syringe
- Analytical balance
- Volumetric pipet and/or pipettor, volumetric flask

3.4 Observed Performance

- A. Trainee should observe the proper use of the GC and HPLC and discuss findings, interpretations, advantages, limitations, documentation, and safety issues as it pertains to quantitation.
- B. Trainee will learn the quality control parameters for each instrument and perform quality control checks on each type of instrument.

3.5 Supervised Performance

- A. Trainee will perform extractions to allow the analysis on GC of a specific controlled substance contained within a mixture. (**Optional**)
- B. Trainee will perform extractions to allow the analysis on HPLC of a specific controlled substance.

3.6 Independent Exercises

Exercises covering the following topics will be completed by the trainee and reviewed by the trainer. Corrections to the exercises will be made, if necessary.

- A. Complete GC and HPLC Definitions and Operations Exercise
- B. Determine the purity of unknown samples using GC and/or HPLC as required by trainer.
- C. Complete written Uncertainty Determination of Quantitation Results Exercise, if not previously completed.

4 Assessment

4.1 Competency and Qualifying Examination

A written assessment will be included in the final exam.



4.2 Evaluation of Training

The trainee and trainer will complete the Seized Drugs Quantitation Training Checklist (LAB-SD-TM-02).

4.3 Work Authorization

When Quantitation is not completed at the same time as the initial SD training, it must be submitted on a Work Authorization form (LAB-309) as a “continued” authorization.



04 FORMS

TRAINING FORMS

	Document Name	FRN
1	Seized Drugs Training Checklist	LAB-SD-TM-01
2	Seized Drugs Quantitation Training Checklist	LAB-SD-TM-02