OSBI Drug Laboratory Training Manual

Revision #17, Effective Date 09-23-2024

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Introduction

The Controlled Substances Laboratory of the Criminalistics Services Division (CSD) of the Oklahoma State Bureau of Investigation (OSBI) is part of an accredited full-service laboratory system responsible for the analysis of samples suspected to contain a controlled dangerous substance. This training manual is intended to provide an analyst with the skills and information needed to perform analysis of submitted samples. Each section of this manual lists a specific goal and the tasks that a trainee should complete in order to achieve this goal. The training will be assessed using written and oral examinations as well as a competency examination.

At the conclusion of training the trainee should have the following:

1. Knowledge of the principles and practices of forensic marijuana and drug analysis as they relate to the analysis of case material.
2. Knowledge of the theory and application of instrumentation and specialized techniques used to examine marijuana, controlled substances, and non-controlled substances.
3. The skills and ability to perform accurate forensic analysis independently and proficiently, to accurately document the findings of all analysis in accordance with the appropriate policies and procedures, and to accurately generate a report on those findings.

If an analyst has previously passed a mock trial in the OSBI Controlled Substances Unit and has previous experience testifying in court, the analyst may be given an oral examination in lieu of a second mock trial. Two or more Senior Criminalists and the Technical Manager or designee will be present during the mock trial and the “Mock Trial Evaluation Form” will be used for grading. Requirements for passing include a minimum score of a 2 for each section and approval from the Technical Manager. Any score lower than a 2 must have a written explanation for the score.

This training manual can be modified by the Technical Manager for re-training purposes, including an analyst that is returning to Drug Chemistry from another discipline or an analyst that needs retraining in a specific area for remedial reasons.

Once released for casework, it is up to the analyst to seek further training for the maintenance of skills and expertise. The Technical Manager will periodically send out articles for the analyst to read; those articles are to be documented on the Additional Reading/Training form.

The finalized training notebook will be kept by the analyst at the OSBI laboratory. Once training is completed, the training notebook will be scanned and uploaded into the analyst’s individual folder on the QA server. Upon termination or transfer to another unit, the training notebook will be scanned, if not already in digital format, and uploaded into the analyst’s individual folder on the QA server.

Orientation to the OSBI

Goals

- To ensure the trainee is familiar in forensic science and the different types of forensic services
- To familiarize the trainee with criminal and civil laws that pertain to forensic chemistry
- To familiarize the trainee with the OSBI Drug Quality System
- To introduce the trainee to the OSBI laboratory management systems
- To introduce the trainee to courtroom testimony dynamics and behavior in the courtroom

General Knowledge of Forensic Science – This section is intended to provide the analyst with a broad overview of forensic science and the types of analysis performed by the OSBI CSD.

Date	Literature
	Smith, F.P. **Overview of Forensic Drug Analysis.** *Handbook of Forensic Drug Analysis.* 2005, pages 1-12

Applicable Criminal and Civil Law and Procedures – This section is intended to familiarize the analyst with criminal and civil law procedures that are applicable to controlled substance analysis.

Date	Literature
	Oklahoma State Statute Title 63, Chapter 2 – Uniform Controlled Dangerous Substances Act, www.oklegislature.gov
	Federal Code of Regulations Title 21 Part 1308
	Haggerty II, M.D. **Confrontation and the Preliminary Hearing.** *Q & A: The Newsletter of the Criminal Law Section.* Vol. 4, Issue 3, May-June 2006, pages 23-31
	Woodson, M. **Relevance and Reliability: What All Expert Testimony Needs.** *Oklahoma Bar Journal,* 79 OBJ 534, March 2008
	Calhoun, M. C. **Scientific Evidence in Court: Daubert or Frye, 15 Years Later.** *Legal Backgrounder,* Vol. 23, No. 37, August 22, 2008
	Tasks
	Discuss differences in distribution vs. trafficking vs. possession charges
	Discuss why drugs are scheduled and criteria for different schedules
	Discuss how drug laws are enacted, by vote of the people & legislative process, including the process of how drugs are controlled.

Quality System Overview – This section is intended to familiarize the analyst with the OSBI Drug Quality system.

Date	Literature/Tasks
	OSBI *Controlled Substances Quality Assurance Manual*
	Review OSBI CSD QM 7.4 and QP 6.1

Miscellaneous – The section is intended to introduce the analyst to the laboratory management systems.

Date	Literature/Tasks
	Review OSBI CSD QMA 2, Evidence Management Requirements, and observe evidence submitting procedures
	Review OSBI CSD QMA 3, Evidence Packaging and Sealing Guidelines, and observe evidence sealing and handling procedures
	The analyst will be shown where to locate the BEAST LIMS system and a brief overview will be given
	The analyst will observe checking out, inventorying and analyzing of a minimum of 5 cases
	The analyst will be shown where to locate Chemical Inventory and a brief overview will be given

Testimony & Presentation of Evidence in Court – This section is intended to provide the analyst with knowledge of acceptable courtroom attire and behavior when called upon to testify.

Date	Literature
	Review OSBI Policy 108
	Shelton Hon., D.E., Barak, G., Kim, Y.S. **A Study of Juror Expectation and Demands Concerning Scientific Evidence: Does the "CSI Effect" Exist.** *Selected Works (www.works.bepress.com).* February 2007, pages 331-368

Date	Tasks
	Discuss courtroom testimony and presentation of evidence with trainer
	Discuss bringing and opening evidence in court
	Discuss requirements for external testing requested by defense, including any accreditation requirements
	Review documentation when leaving evidence in court, BEAST
	Review a witness critique form and qualified reviewer form
	Review testimony report and who to send it to
	Observe a Criminalist from the Controlled Substances laboratory giving testimony

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Weights and Measures Utilized in Drug and Marijuana Reports and Balance Scale Calibration and Uncertainty (DR-3 and DR-4)

Goals

- To establish uniform guidelines in the determination and reporting of weights and volumes of substances submitted for analysis.
- To establish guidelines for procedures to document balance verification, calibration and uncertainty.
- To provide an understanding of the theory of uncertainty of measurement.
- To understand how uncertainty of measurement is calculated and factors that can affect uncertainty.
- To be able to explain uncertainty of measurement in a way a layperson can understand.

Literature Reading

Date	Literature
	PowerPoint Presentation for Uncertainty of Measurement
	Bell, S. **A Beginner's Guide to Uncertainty of Measurement**. *Measurement Good Practice Guide No. 11 (Issue 2).* National Physical Laboratory (PDF: Uncertainty of Measurement)
	Protocol DR-3 (Weights and Measures Utilized in Drug and Marijuana Reports)
	Protocol DR-4 (Balance/Scale Calibration and Uncertainty)
	Protocol DR-4 Attachment 1 (Budget for Calculating Uncertainty of Measurement)
	Protocol DR-4 Attachment 2 (Controlled Substances Scale Scenarios)
	Weighing the Right Way. *Guide Book Proper Weighing with Laboratory Balances.* Mettler Toledo, 05/2012 (PDF: Uncertainty of Measurement)
	M3003 The Expression of Uncertainty and Confidence in Measurement. United Kingdom Accreditation Service, Edition 2, January 2007

Articulate

Date	Tasks
	The definitions for: net weight, gross weight, approximate volume and residue
	When gross weights can be utilized
	The recommended report wording concerning significant digits for the reported weight ranges
	When a balance is to be checked for proper calibration and when a balance is to be calibrated
	The acceptable operating range of a balance

	The proper procedure if a balance is not operating within specified operating range, or if a balance is out of service
	The recommended procedure for checking balances while working cases involving trafficking charges
	The reason for not reporting weights under a predetermined weight for the different scales
	Uncertainty of Measurement
	The definition of Uncertainty of Measurement
	How uncertainty of measurement is calculated and the factors considered, including budget items vs items not included in budget
	How often it is calculated and why it is recalculated
	Proper report wording of uncertainty and when it is reported
	Trafficking levels
	Trafficking weights for controlled substances (i.e., marijuana, meth, cocaine, cocaine base, etc.)

Tasks

Date	Tasks
	Verify a bench top balance and record on appropriate OSBI DR4 form
	Verify a large capacity scale and record on appropriate OSBI DR4 form
	Verify an analytical balance, and record on appropriate OSBI DR4 form
	Perform 31-day Measurement Assurance Program for bench top balance
	Perform 31-day Measurement Assurance Program for large capacity scale
	Perform 31-day Measurement Assurance Program for analytical balance
	Demonstrate how to determine the approximate volume of a container using the formula $V=\pi r^2 h$

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Thermometers

Goals

- To establish a guide for the proper reading of thermometers used in the laboratory

How to Read a Thermometer

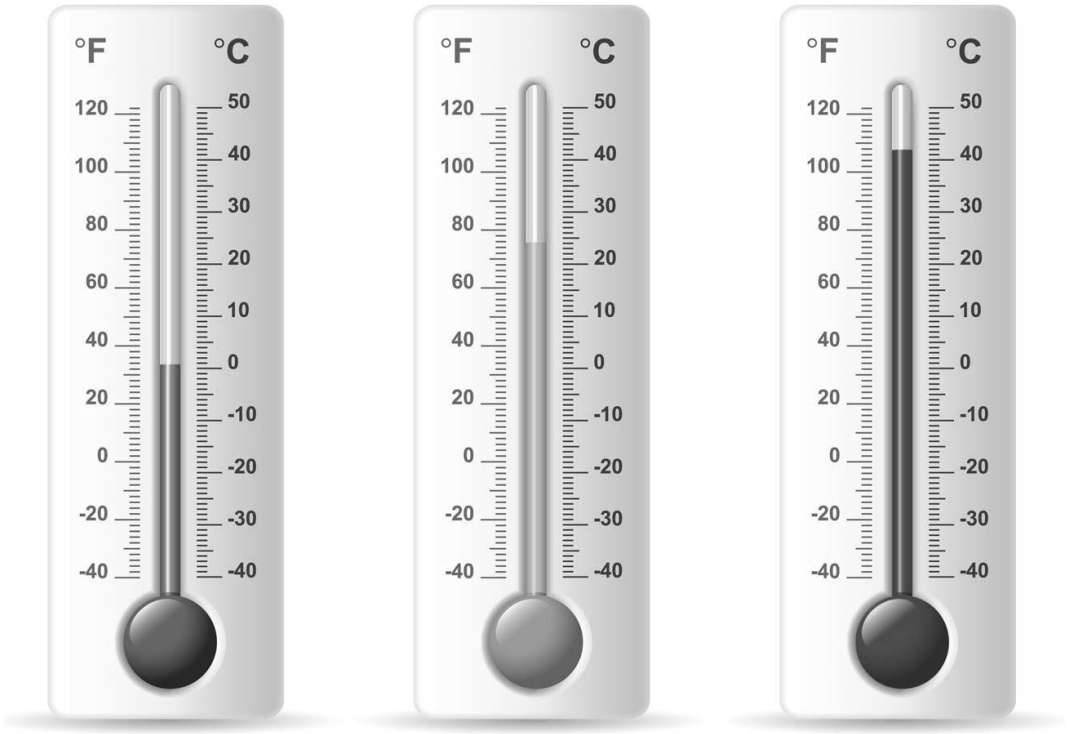
Thermometers should be handled carefully because they are tubes of glass filled with either mercury or colored spirits.

Laboratory thermometers should NOT be shaken like the home variety thermometer. To lower the temperature, just cool them in a refrigerator or water/ice bath. Usually, they are either partial or whole immersion thermometers; this means that the bulb may be either partially submerged in a liquid or must be totally submerged in a liquid to accurately register the temperature. Thermometers used in the refrigerators are not to be submerged or placed into any liquid.

Place the thermometer in the material/refrigerator in which the temperature is to be measured. If you are measuring the temperature of a material while it is being heated, make certain that you do not let the thermometer rest on the bottom of the container and that the bulb is submerged in the material itself.

To read the temperature indicated on a thermometer, your eye should be at the level of the liquid in the thermometer. Read the thermometer to the appropriate number of digits. For example, a thermometer on which the heavy or extended lines are marked 10, 20, 30… should be read to the nearest degree.

First examine the scales below, each degree is divided into smaller divisions. The number of divisions may vary between thermometers, so it is important to look at the scale.



Record the temperature of the three thermometers, to the nearest degree Celsius.

#1 _____ #2 _____ #3 _____

Literature Reading

Date	Literature
	Review OSBI CSD QP 6.4, Evidence Refrigerator and Freezer Maintenance

Articulate

Date	Tasks
	What is to be done in the event the refrigerator/freezer is out of temperature range?
	When should monitoring the temperature be performed and how is this documented?

Tasks

Date	Tasks
	Backup System or Generator
	Trainer will demonstrate the proper steps to take in the event of a power failure, i.e. use of alternative storage location, backup system or generator.

Evaluation of Training

Date	Tasks	
	Demonstrate how to properly read thermometer and document below (5 occurrences)	
	Temperature:	Verified by:
	Temperature:	Verified by:
	Temperature:	Verified by:
	Temperature:	Verified by:
	Temperature:	Verified by:

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Cannabis Analysis

This guide is intended to provide a trainee with the necessary skills to perform laboratory analysis of samples suspected to be marijuana, hashish, hashish oil, THC, or THCA-A using a series of examinations. These examinations are stereomicroscopic examination, thin layer chromatography, FTIR, gas chromatography with flame ionization detector and gas chromatography with mass spectral examination.

Goals

- To become familiar with the legal status of marijuana in Oklahoma.
- To become skilled at the identification of marijuana samples using a series of examinations.

Literature Reading

Date	Literature
	Protocol DR-01 (Cannabis Analysis)
	Protocol DR-01 Attachment 1
	Protocol DR-01 Attachment 2
	Review Oklahoma Statutes – Title 63, Section 2-101. Specifically, the controlled parts of the marijuana plant. General familiarization with the remainder of the section.
	Oklahoma Statutes - Title 22, Section 751. Admission of Laboratory findings. Release of CDS for independent analysis
	Nakamura, G.R. **Forensic Aspects of Cystolithic Hairs of Cannabis and Other Plants.** *Journal of the Association of Official Analytical Chemists*. Vol. 52, No. 1, 1969, pages 5-16
	Mechoulam, R. **Marihuana Chemistry.** *Science.* Vol. 168, No. 3936, June 5, 1970, pages 1159-1165 (Stop at Biogenesis Section on 3rd page)
	Marihuana, Its Identification. US Treasury Department, Bureau of Narcotics, 1948
	Methods of Analysis. Internal Revenue Service Publication No. 341, Rev. 6-67, page 105

	Lesson Plan #7, Marihuana and THC. *Basic Training Program for Forensic Drug Chemists*. May 1972, pages 146-157
	Analysis of Drugs. *DEA Analytical Manual.* U.S. Department of Justice, pages 165-168
	Coutts, R.T. & Jones, G.R. **A Comparative Analysis of Cannabis Material.** *Journal of Forensic Science.* Vol. 24, No. 2, 1979, pages 291-302.
	Small, E. **American Law and the Species Problem in Cannabis.** *Microgram*. Vol. VII, No. 11, November 1974, pages 131-132.
	Nakamura, G.R. and Thornton, J.I. **The Forensic Identification of Marihuana: Some Questions and Answers.** *Journal of Police Science and Administration.* Vol. I, No. I, 1973, pages 102-112
	Zimmerman, Miles C. **Marijuana Analysis: Winters V. State.** *OSBI Legal Update.* Index Tab: Drugs, Control No. 07-77-02, March 24, 1977
	Marihuana. *Basic Training Program for Forensic Drug Chemists*. 2nd Edition, DEA, pages 6-25 to 6-44
	Johnson, Donald W. **Hashish Oil.** *DEA Laboratory Notes.* No. 58, May 1973
	Cannabis. *The Drug Chromatographer.* Alltech-Applied Science, Vol. 3, Number 1, 1986, pages 1-3
	Recommended Methods for the Identification and Analysis of Cannabis and Cannabis Products. United Nations Office on Drugs and Crime, 2009
	Warner, M.L., Alford, I., Lawrence, D.M., Kohl, A.C., Williams, S.J., Yeatman, D.T. **Comparative Analysis of Freshly Harvested Cannabis Plant Weight and Dried Cannabis Plant Weight**. *Forensic Chemistry.* Vol. 3, 2017, pages 52-57
	Hughes, R. B. M. S. and Kessler, R. R., M.S. **Increased Safety and Specificity in the Thin-Layer Chromatographic Identification of Marihuana**. Journal of Forensic Sciences. Vol. 24, March 19, 1979, pages 842-846
	Guy, B. **The Identification of Cannabis by Thin Layer Chromatography**. Microgram. Vol. XVII, No. 5, May 1984, pages 78-80

Microscopic Examination

Date	Tasks
	Articulate the microscopic characteristics of marijuana
	Demonstrate use of a stereomicroscope including magnification range
	Articulate the requirement for a positive examination

Analysis

Date	Tasks
	Articulate the proper method for analysis of seeds
	Articulate some of the possible indicators that a second controlled dangerous substance may be present in a marijuana submittal

Medical marijuana and hemp

Date	Tasks
	Articulate differences between hemp and marijuana
	Articulate any differences in analysis of medical marijuana and illegal marijuana

Reagent Preparation

Date	Tasks
	Prepare TLC Reagent

Tasks

Date	Tasks
	Articulate the proper procedure for TLC with a sample suspected to contain delta 9 tetrahydrocannabinol
	Demonstrate the preparation and analysis of a sample using TLC
	Articulate interpretation criteria of TLC plate results, such as height of a sample/standard, and color of spots
	Articulate when a TLC plate needs to be rejected
	Articulate how to analyze a green leafy sample
	Articulate how to analyze a wax or oil-like substance
	Articulate how to analyze a food/drink product
	Demonstrate how to extract a cannabis sample using BSTFA
	When should a sample use the 1% protocol
	Demonstrate how to use the calibrated pipettes
	Demonstrate how to prepare a sample for the 1% protocol

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Drug Analysis

This guide is intended to provide a trainee with the necessary skills to perform laboratory analysis of samples suspected to contain a controlled substance. This analysis will involve the use of various instruments and laboratory techniques to reach conclusions on the identification of a substance.

Goals

- To provide a general understanding of controlled substances and their analysis.
- To become skilled at the preparation of samples for analysis.
- To be able to independently operate the equipment in the controlled substances unit necessary for sample analysis.
- To become proficient in the analysis of samples suspected to contain a controlled substance.

Literature Reading

Date	Literature
	Review Oklahoma Statutes – Title 63, Section 2-101, 2-201 thru 2-212, 2-321, 2-407.1, 2-414, 2-415
	Bell, S. **What is a Drug.** *Forensic Chemistry.* pages 213-231, 234-239
	Drugs of Abuse. US Department of Justice, Drug Enforcement Agency, 2011
	Gahlinger, P.M. *Illegal Drugs, A Complete Guide to Their History, Chemistry, Use and Abuse.* pages 232-236 (PDF: Cathinone)
	Synthetic Cathinones ("Bath Salts"). National Institute on Drug Abuse, www.drugabuse.gov, 01/10/2013
	Drug Identification Bible. 2022/2023, MDMA, pages 646-652
	Gahlinger, P.M. *Illegal Drugs, A Complete Guide to Their History, Chemistry, Use and Abuse.* pages 264-275 (PDF: Hallucinogens (DMT, Bufotenine and Psilocybin))
	Gahlinger, P.M. *Illegal Drugs, A Complete Guide to Their History, Chemistry, Use and Abuse.* pages 224-228 (PDF: Barbiturates)
	Drug Identification Bible. 2022/2023, Anabolic Steroids, pages 581-584
	Drug Identification Bible. 2022/2023, Heroin, pages 609-623
	Recommended Methods for Testing Opium, Morphine and Heroin. United Nations Office on Drugs and Crime, 1998 (Modified PDF version)
	Drug Identification Bible. 2022/2023, Fentanyl, pages 600-605
	Drug Identification Bible. 2022/2023, PCP, pages 653-656

	Drug Identification Bible. 2022/2023, Ketamine, pages 624-626
	Drug Identification Bible. 2022/2023, Amphetamine/Methamphetamine, pages 567-580
	Kelly, B.C. **Legally Tripping: A Qualitative Profile of *Salvia Divinorum* Use Among Young Adults.** *Journal of Psychoactive Drugs.* Vol. 43 (1), 2011, pages: 46-54
	Harris, D. et al. **GC-MS Differentiation of Three Synthetic Cannabinoid Positional Isomers: JWH-250, JWH-302 and JWH-201.** *Journal of the Clandestine Laboratory Investigating Chemists Association.* Vol. 21, No. 4, October 2011, pages 23-32
	Protocol DR-103 (Classification of Synthetic Cannabinoids)

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Pharmaceutical Identification by Literary Reference (DR-5)

Goals

- To establish guidelines when using visual examinations and comparison to a literary reference as the presumptive examinations for tablet and capsule exhibits.

Literature Reading

Date	Literature
	Protocol DR-5 (Pharmaceutical Identification by Literary Reference)
	Commonly Abused Prescription Drugs. American Addiction Centers, https://drugabuse.com/prescription-drugs/, 05/06/2022
	Commonly Abused Drugs. American Addiction Centers, https://drugabuse.com/drugs/most-abused-drugs/ , 05/30/2022

Articulate

Date	Tasks
	When a literary reference is sufficient and when a conclusive analysis is needed
	The procedure when a suspected tablet or capsule was clandestinely manufactured
	The different resources that can be used for a literary reference

Tasks

	Look up at least 5 tablet/capsules using the references in DR-05		
Date	Tablet Description	Reference	Result (Identification and Concentration)

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Training Procedures for Extractions & Handling

Goals

- To familiarize the analyst with extraction and handling procedures commonly used to prepare samples for analysis using gas chromatography (GC) and gas chromatography-mass spectrometry (GC/MS).

Literature Reading

Date	Literature
	Review SDS sheets on appropriate chemicals used, such Sodium Hydroxide, Hydrochloric Acid, Sodium Bicarbonate, Chloroform, Isopropanol, Hexanes, Methanol, etc.
	Protocol DR-110 (Extractions) and Appendix C: Extraction Data

Articulate

Date	Tasks
	Which solvent is a good, all-around solvent for most drugs
	Differences in solubility of different drugs
	When other extractions should be used
	The extraction produces a GC analysis cluttered with peaks The extraction produces a GC analysis where a secondary peak (i.e. acetaminophen) dwarfs the peak of interest The extraction produces a GC analysis where poor separation or broad peaks occur Presumptive color tests indicate amphetamine or methamphetamine Literary reference indicates a substance that needs to be extracted
	Why drugs need to be basic extracted
	Methamphetamine/Amphetamine; Ephedrine/Pseudoephedrine; Phenethylamines
	Which drugs need to be acid extracted
	When to use a back extraction
	Definition of amphoteric and know which drugs exhibit this property
	Which solvent systems should be used with morphine and hydromorphone
	What to do when tablets form an emulsion
	Which substances experience rapid breakdown in solution, and what to do when this occurs (i.e. oxymetholone)
	Describe what is to occur if told a sample needs to be placed on the instrument immediately

Solution Preparation

Date	Tasks
	Prepare 0.45N NaOH/DI water solution
	Prepare 10% HCl/DI water solution. H_2SO_4 can be substituted for HCl
	Prepare a saturated sodium bicarbonate solution. H_2SO_4 can be substituted for HCl

Extractions

Date	Tasks
	Determine the pH of a solution
	Demonstrate the procedure for performing a basic extraction
	Add 0.45N NaOH or another appropriate basic solution to the sample Add appropriate amount of chloroform or hexanes Mix thoroughly and centrifuge if necessary • Chloroform is preferred over hexanes since it can solubilize a greater number of drugs • When utilizing this extraction procedure chloroform will form the bottom layer and hexanes will form the top layer
	Demonstrate the procedure for performing an acidic extraction
	Add 5-10 drops of 10% HCl or H_2SO_4 to the sample Add appropriate amount of chloroform Mix thoroughly and centrifuge if necessary
	Demonstrate the procedure for a back extraction
	Add 1 milliliter of DI water to a sample Add 5-10 drops of 10% HCl solution to the sample Mix well and centrifuge if necessary Remove the aqueous layer and place in another culture tube Make the aqueous layer basic by adding 0.45N NaOH solution Verify the pH of the aqueous solution has converted from an acid to a base Once basic, add an appropriate solvent (chloroform or hexanes) Mix well and centrifuge if necessary

Sample Handling

Date	Literature
	NIJ Fingerprint Sourcebook, Sections 7.1.5 Evidence Handling and 7.1.6 Packaging
Date	Demonstrate
	Demonstrate how to label evidence and test tubes/vials
	Discuss proper packaging for fentanyl and liquids
	Safely remove clean syringe with needle (previously prepared by trainer) from sharps container, rinse with a solvent, recap and replace back into container
	Safely remove razor or knife from sharps container (previously prepared by trainer), sample (i.e., with swab) and replace back into container.
	Safely remove broken glass from envelope (previously prepared by trainer), sample residue from broken glass, and place into an appropriate sharps container
	Demonstrate handling, marking, & sampling of evidence to be forwarded to Latent Evidence Unit, with minimal risk of damaging potential latent prints

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Identification of Gamma-Hydroxybutyric Acid through Derivatization (DR-7)

Goals

- To establish guidelines for the identification of Gamma-Hydroxybutyric Acid (GHB) through derivatization with bis-(trimethylsilyl) trifluoroacetamide (BSTFA) and analysis using gas chromatography (GC) and gas chromatography mass spectrometry (GC/MS).

Literature Reading

Date	Literature
	Protocol DR-7 (Identification of Gamma-Hydroxybutyric Acid through Derivatization)
	SDS sheets for BSTFA and acetonitrile
	Drug Identification Bible. 2022/2023, GHB, pages 606-608
	Kilpatrick, G. A. **GHB.** State Police-San Francisco.
	Bell, S. **Derivatization.** *Forensic Chemistry.* pages 203-205
	Bommarito, C. **Analytical Profile of Gamma-Hydroxybutyric Acid (GHB).** *Journal of the Clandestine Laboratory Investigating Chemists Association*. Vol. 3, No. 3, July 1993, pages 10-12
	Pearson, J.R., Reid, E.F., & Rowe, J.E. **The Preparation of ϒ-Butyrolactone from Readily Available Starting Materials.** *Journal of the Clandestine Laboratory Investigating Chemists Association.* Vol. 19, No. 1, January 2009, pages 8-13

Articulate

Date	Tasks
	The theory of derivatization and why it is performed in the differentiation of GHB and GBL
	How to recognize when GHB may be present in a sample
	The reason for washing a liquid sample suspected of containing GHB and/or GBL with chloroform
	How heat or pH may affect a sample containing GHB and/or GBL
	Proper reporting results for both dry and liquid samples

Tasks

Date	Tasks (If samples are available)
	Demonstrate derivatization procedure on a dry sample
	Demonstrate derivatization procedure on a liquid sample
	Demonstrate ability to identify GBL if present in a liquid sample

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Training Procedures for Color Tests (DR-10, DR-11, DR-13)

Goals

- To establish guidelines for preliminary screening tests that respond to particular functional groups on substances causing characteristic color changes. These examinations can give the analyst a basis as to which extractions and/or examinations are necessary for further conclusive instrumental analysis.

Literature Reading

Date	Literature
	Protocol DR-10 (Color Tests: Marquis)
	Protocol DR-11 (Color Tests: Cobalt Thiocyanate)
	Protocol DR-13 (Color Tests: Bates)
	Clarke's Analysis of Drugs and Poisons, Third Edition, pages 279 -300

Articulate

Date	Task
	The specificity of color tests and their role in drug analysis
	Where all color tests are to be performed
	Reasons why a color test may be negative for a compound even when the compound is present in a sample
	Indications of when a reagent may need to be discarded and new reagent made
	The procedure for performing a negative control and when it is necessary
	The procedure for performing a positive control and when it is necessary

Tasks

Tasks			
	Marquis Test	Cobalt Thiocyanate	Bates' Test
Demonstrate the procedure for making the reagent			
Demonstrate the quality control verification and documentation procedure			
Demonstrate the procedure for performing the test			
Based on the observed results of the color test, articulate a suitable extraction procedure			

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Cocaine Free-base Determination by Hexanes Solubility (DR-21)

Goals

- To establish a knowledge of cocaine and cocaine base.
- To establish guidelines to differentiate cocaine hydrochloride from cocaine free base based on their solubility in hexanes.

Literature Reading

Date	Literature
	Protocol DR-21 (Cocaine Free Base Determination by Hexane Solubility)
	Gahlinger, P.M. *Illegal Drugs, A Complete Guide to Their History, Chemistry, Use and Abuse.* pages 240-254 (PDF: Cocaine)
	Cocaine. *NIDA InfoFacts*. www.drugabuse.gov, 01/10/2013
	Recommended Methods for Identification and Analysis of Cocaine in Seized Materials. United Nations Office on Drugs and Crime, 2012
	Crack Cocaine Recipe, www.hyperreal.org, 1992
	Drug Identification Bible. 2022/2023, Cocaine, pages 585-599

Articulate

Date	Tasks
	Why cocaine hydrochloride and cocaine base need to be differentiated
	What color tests can be used to indicate the presence of cocaine or cocaine base
	The procedure if a sample is negative for cocaine base
	The difference between cocaine base and cocaine HCl

Tasks

Date	Tasks
	Demonstrate the difference in solubility of cocaine hydrochloride and cocaine base using both methanol and hexanes
	Demonstrate the difference in reactivity of cocaine hydrochloride and cocaine base with the Cobalt Thiocyanate color test and Bates Test

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Identification of Lysergic Acid Diethylamide (DR-101)

Goals

- To establish a knowledge of Lysergic Acid Diethylamide (LSD).
- To familiarize the analyst with procedures used in the identification of LSD in different forms.

Literature Reading

Date	Literature
	Protocol DR-101 (Identification of Lysergic Acid Diethylamide)
	Drug Identification Bible. 2022/2023, LSD, pages 627-630
	Recommended Methods for Testing Lysergide (LSD). United Nations Office on Drugs and Crime, 1989 (Modified PDF version)
	Smith, F., *Handbook for Drug Analysis*. 2005, pages 186-187

Articulate

Date	Tasks
	Presumptive test for LSD on a sample
	Which GC/MS methods would be used for a LSD sample and reagent blank
	Explain how to sample blotter paper
	What report wording is used when analyzing suspected LSD

Tasks

Date	Tasks
	Analyze LSD, LAMPA and a mixture of LSD & LAMPA to demonstrate the differences of the compounds on the GC and GC/MS

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Gas Chromatography Analysis (Flame Ionizing Detector) (DR-30)

Goals

- To gain knowledge of the theory of gas chromatography and how to use it as a non-confirmatory test in the analysis of submitted samples.
- To establish guidelines for the gas chromatograph maintenance.
- To demonstrate a gas chromatograph is working properly by using quality assurance and quality control methods.
- The analyst will learn how to interpret data from this type of analysis.

Literature Reading

Date	Literature
	Protocol DR-30 (Gas Chromatography Analysis (flame ionization detector))
	Basic Operation of the Gas Chromatograph (Appendix I of Training Manual)
	Bell, S. *Forensic Chemistry.* pages 192-200 (PDF: GC and MS)

Articulate

Date	Tasks
	Theory of Gas Chromatography
	The theory of the injection port
	The theory of expansion volumes and how to determine the appropriate injection volume
	The theory of megabore columns used in the gas chromatograph (DB-1 and DB-50)
	The theory of the flame ionizing detector
	The theory of split ratios and why it is used with the instrument
	The theory of different methods used for analysis, such as Drug1, Extend1 and Method 1 and/or any other methods being used for analysis
	The theory of the make-up gas
	The theory of retention time and how it applies to gas chromatograph analysis
	Controls
	When standard ladders are to be run
	When methanol blank and cocaine standards are to be used
	The proper corrective procedure if the retention time of the cocaine standard exceeds plus or minus 2% of the standard ladder
	What, if any, type of extraneous peaks are allowed in cocaine standard
	What constitutes contamination/carryover in methanol blanks
	What are the acceptable levels or sizes of contamination/carryover peaks allowed
	The proper corrective procedure if contamination occurs during methanol blank runs

	The proper corrective procedure if the instrument fails to produce a satisfactory chromatogram for the cocaine standard
	Misc.
	When must a standard be run on the gas chromatograph
	The maximum number of days between running a standard and a sample on the gas chromatograph
	When changing of the liner and septa is required
	When changing of the gold seal is required
	When cleaning of the flame ionization detector is required
	When cleaning of the injection port is required
	Articulate reasons that GC data may be "rejected"
	What happens to sample after analysis through instrument? • Where does the waste from split vent go? • Where does sample go after leaving the jet?

Tasks

Date	Tasks
	Maintenance
	Change the liner and septum and reset macro counts
	Change the gold seal, clean the injector port and septa nut and reset macro counts
	Clean the flame ionization detector
	Change a column when necessary
	Change the split vent filter and line
	Demonstrate syringe replacement
	Demonstrate proper wash and waste bottle volumes
	Extract standard ladder, run on GC and update macros
	Record any maintenance performed on the proper maintenance log
	Use of the Instrument
	Properly prepare a sample in an auto-sampler vial
	Properly load a sample for analysis on the gas chromatograph, including entering information in sequence log
	Demonstrate the proper use of controls: • MeOH blank • Cocaine standard • Reagent blank

	Spectral Interpretation
	The analyst will review instrumental data and discuss with the trainer what is and is not acceptable for casework analysis • Samples outside of the 2% retention time window • Demonstrate calculating the 2% window based on the retention time of a standard • Peak separation • Acceptable/unacceptable chromatography
	Properly interpret the data obtained and explain how to apply this data if further analysis is required
	Demonstrate the proper reporting of results available from gas chromatographic data

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Analysis of Mushrooms to Determine the Presence of Psilocyn or Psilocybin (DR-45)

Goals

- To establish guidelines for the differentiation of psilocyn and psilocybin for identification.

Literature Reading

Date	Literature
	Protocol DR-45 (Analysis of Mushrooms to Determine Presence of Psilocyn or Psilocybin)
	Drug Identification Bible. 2022/2023, Peyote & Psilocybin Mushrooms, pages 657-663
	Recommended Methods for Testing Peyote Cactus (Mescal Buttons)/Mescaline and Psilocybe Mushrooms/Psilocybin. United Nations Office on Drugs and Crime, 1989 (Modified PDF version)

Articulate

Date	Tasks
	Why psilocyn and psilocybin need to be differentiated
	What happens to psilocyn and psilocybin when injected into the gas chromatograph in methanol
	The different methods that can be used to differentiate psilocyn and psilocybin

Reagent Preparation

Date	Tasks
	Prepare Mushroom TLC Reagent

Thin Layer Chromatography Examination

Date	Tasks
	Articulate proper procedure and specificity for TLC with a sample suspected to contain psilocyn or psilocybin
	Demonstrate the preparation and analysis of a sample using TLC
	Demonstrate the two ways for visualization of a TLC plate for a sample suspected to contain psilocyn and/or psilocybin
	Establish interpretation criteria of TLC test results, such as height of a sample/standard, and color of spots
	Articulate familiarization with Rf value
	Articulate other procedure(s) that has to be performed in conjunction with TLC with a sample suspected to contain psilocyn or psilocybin

Derivatization of Sample

Date	Tasks
	Articulate proper procedure and specificity for derivatization with a sample suspected to contain psilocyn or psilocybin
	Demonstrate derivatization of a sample suspected to contain psilocyn and/or psilocybin

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

PDF Examination Documentation Procedure (DR-50)

Goals

- To establish guidelines for generating, storing, transferring and attaching instrumental data into the BEAST Image Vault.
- The analyst will learn the security and tracking features associated with this process.

Literature Reading

Date	Tasks
	Protocol DR-50 (PDF Examination Documentation Procedure)
	Review DRQM-11 Examination Documentation

Articulate

Date	Tasks
	Articulate the security and tracking features associated with this process (creation, merging, and uploading of PDFs)
	What the validation code is and where it comes from
	Articulate the manner for archiving PDFs

Tasks

Date	Tasks
	Set up PDF folders on the instrument computer
	Establish a method of transferring PDFs from the instrument computer to the analyst's computer
	Demonstrate transferring PDF files from the instrument computer to the analyst's computer
	Acquire PDF editing software
	Demonstrate the merging of PDFs
	Demonstrate the naming of PDFs
	Demonstrate uploading a PDF file into the BEAST Image Vault
	Demonstrate removing a PDF file from the BEAST Image Vault

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Drug Analysis by FTIR (DR-60)

Goals

- To learn the theory of FTIR and how to use it as a confirmatory test in the analysis of submitted samples.
- To familiarize the analyst with how to maintain the FTIR instrument and ensure that it is working properly by using quality assurance and quality control methods.
- The analyst will learn how to interpret data from this type of analysis.

Literature Reading

Date	Literature
	Protocol DR-60 (Drug Analysis by FTIR)
	Thermo Scientific. **FT-IR Glossary**. (PDF)
	Thermo Scientific. **Introduction to Fourier Transform Infrared Spectroscopy** (PDF)
	LCGC ChromAcademy. **Introduction to Infrared Spectroscopy.** (PDF)
	Perkin Elmer, **FT-IR Spectroscopy Attenuated Total Reflectance (ATR).** (PDF)
	Bell, S. **Spectroscopy.** *Forensic Chemistry.* pages 149-159
	Bell, S. **Infrared Spectroscopy.** *Forensic Chemistry.* pages 161-169
	Hugel, J., Meyers, J.A. & Lankin, D.C. **Analysis of the Hallucinogens, Infrared (IR) Spectroscopy.** *Handbook of Forensic Drug Analysis.* 2005, pages 154-164
	Clarke's Isolation and Identification of Drugs. Vol. I, 3rd Edition, pages 328-344

Articulate

Date	Tasks
	Theory of FTIR
	Theory and definition of FTIR
	Define: • Wavelength • Wavenumber • Interferometer • Constructive Interference (pertaining to FTIR) • Destructive Interference (pertaining to FTIR)
	Explain how the following pertain to FTIR • Gain • Resolution • Single beam spectrum

	• Sensitivity
	Describe the components of the FTIR and their function
	The differences between transmission and reflectance modes
	What wavelength range is analyzed using FTIR
	Explain evanescent wave as it pertains to FTIR ATR
	How the interferometer functions
	Describe what a laser is and its function in FTIR, including its travel path within the FTIR
	What is a background and why is it collected
	Describe what ATR is
	How the ATR functions including: • What the crystal is made of and why it doesn't interfere with analysis • Why CO_2 and H_2O can still appear in a spectrum after background scans have been collected
	Describe what the FTIR does to the sample during analysis
	Why FTIR on tablets can be difficult
	Controls
	When spectra of a polystyrene standard will be obtained and what will it be compared to
	The proper corrective procedure when the polystyrene standard fails
	When a background spectrum will be collected
	List ways contamination may be identified on the stage crystal and the tower arm
	What steps are taken to ensure the ATR is free from contamination
	Describe the spectra of a "blank"
	Misc.
	Describe how to prepare a sample for FTIR analysis using the ATR
	Explain how humidity can affect the spectra and the quality of the match
	Explain how to remove moisture from a sample
	What must be done if analysis by FTIR does not indicate a controlled dangerous substance

Tasks

Date	Tasks
	Maintenance
	Demonstrate the analysis of a polystyrene standard which is to be analyzed using the "OSBI Macro," before casework is performed.
	Demonstrate proper cleaning of the ATR
	Demonstrate checking the humidity levels inside the instrument
	Use of the Instrument
	Demonstrate preparation of a sample for analysis
	Demonstrate collection of background scans
	Demonstrate collection of scans using the ATR accessory
	Spectral Interpretation
	Review instrumental data and discuss what is and is not acceptable for casework analysis
	Articulate why a second sample would be taken and what documentation is needed to be included in the casefile
	Articulate reasons that FTIR data may be "rejected"
	Determine if CO_2 and/ or H_2O are present in the scans
	Determine if another compound is present in the scans
	Demonstrate proper report writing

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Requirements Prior to Drug Analysis Using FTIR

Sample Analysis

Date	Tasks
	Analyze at least 30 practice samples and record all results; document using an Excel spreadsheet and archive in analyst's folder on QA server

Evaluation of Training

Date	Tasks
	Complete and review a competency test, with accurate results
	Complete and review a written test with a minimum score of 80%. Will be graded by TM and the Supervisor or Appointee. Score _____
	AND/OR
	Complete a technical questions session with a minimum score of 80%, with Technical Manager or Appointee Average Score _____

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Gas Chromatograph Mass Spectrometer Methods for Drug Analysis (DR-70)

Goals

- To learn the theory of gas chromatography mass spectrometer and how to use it as a confirmatory test in the analysis of submitted samples.
- To familiarize the analyst with how to maintain the gas chromatograph mass spectrometer instrument and ensure that it is working properly by using quality assurance and quality control methods.
- The trainee will learn how to interpret data from this type of analysis.

*****Prior to beginning, the trainee must complete GC training (DR-30)*****

Literature

Date	Literature
	Protocol DR-70 (Gas Chromatograph Mass Spectrometer Methods for Drug Analysis)
	Basic Operation of the Mass Spectrometer (Appendix II of Training Manual)
	Isomers (Appendix V of Training Manual)
	Hugel, J., Meyers, J.A. & Lankin, D.C. **Analysis of the Hallucinogens, Mass Spectrometry.** *Handbook of Forensic Drug Analysis.* 2005, pages 176-185
	Pavia, D.L., Lampman, G.M., Kriz, G.S. **Mass Spectrometry.** *Intro to Spectroscopy*. 2001, pages 390-398 and 446-448
	Optional: Prall, J. D. & Cardone. **Gas Chromatography/Mass Spectrometric (GC/MS) Analysis of Drugs Using Spectral and Retention Index Matching**. DEA Central Lab, Dallas, TX and FAA Toxicology and Research Lab, OKC, OK. (No date and reference available)

Articulate

Date	Tasks
	Theory of Mass Spectrometry
	Theory of different methods and when to use for analysis, i.e. drug100, drug200, LSD, extnd100, low100, meth100, and/or any other methods being used for analysis
	Theory of split ratio and why it is used with the instrument
	Theory of capillary columns used in the mass spectrometer
	Theory of splitting of the molecule and the function of the ion source
	Theory of the quadrupole mass filter and how it functions
	Theory of electron multiplier
	Theory of retention time and retention index, and how it applies to the GC/MS

	What is the hydrocarbon ladder and what role does it play in the retention index
	How the retention index is calculated
	The maximum allowed difference of the calculated Retention Index Difference
	Controls
	When solvent blank runs are to be run
	When a Cocaine standard is to be run
	The proper corrective procedure if the retention index of the Cocaine standard exceeds plus or minus 2%
	The proper corrective procedure if contamination occurs during the daily solvent blank run
	The proper corrective procedure if contamination occurs during a casework reagent blank run
	When the Tune Eval/Autotune are to be run
	The proper corrective procedure if erroneous assignment of mass values to fragments in a sample, standard, or autotune
	The proper corrective procedure for the failure to produce a satisfactory cocaine spectrum for the cocaine standard
	The proper corrective procedure if contamination peaks are found on the autotune (m/e 18, 44, etc)
	When running the hydrocarbon ladder is required
	When changing the liner and septum are required
	When changing the gold seal is required and the difference between the GC and the GC/MS
	Misc.
	The theory of a mass spectral library and where the libraries come from
	When does a standard have to be run
	What information has to be retained with a new standard
	What information about the standard is listed on each mass spectra printout
	Articulate reasons that data from the GC/MS may be “rejected”
	What happens to sample after analysis through instrument? • Where does the waste from split vent go? • Where does sample go after leaving the mass spec?
	Define: • Structural Isomers • Stereoisomers • Enantiomers/Optical Isomers • Diastereomers/Geometric Isomers

Tasks

Date	Tasks
	Maintenance
	Demonstrate how to record maintenance performed in the instrument maintenance log
	Demonstrate how to prepare and run the hydrocarbon ladder and ensure the appropriate retention times have been updated in the macro
	Demonstrate changing liner and septum, resetting macro counts
	Demonstrate changing gold seal, cleaning injection port and septa nut, and resetting macro count
	Demonstrate how to autotune instrument, interpret the data and save the PDFs
	Demonstrate how to vent the mass spec
	Demonstrate how to disassemble and clean ion source, replace filaments, and reassemble
	Demonstrate how to pump down the mass spec
	Demonstrate how to change the split vent filter and line
	Demonstrate how to change a column
	Use of the Instrument
	Demonstrate how to properly dilute or concentrate a sample for GC/MS analysis
	Demonstrate how to properly load a sample for analysis on the GC/MS, including entering information in the Sequence log
	Demonstrate the proper use of controls: • Reagent Blanks • Cocaine Standards
	Articulate the requirements for Reagent Blanks and the Cocaine Standard • What constitutes an acceptable Blank? • What constitutes an acceptable Cocaine Standard? • What methods are used and when/why?
	Demonstrate the interpretation and comparison of the mass spectral data received from the instrument
	Demonstrate how to perform a background subtraction and articulate when a background subtraction is needed.
	Demonstrate how to perform a manual scan. Articulate when a manual scan may be needed and what documentation is required if a manual scan is performed.
	Demonstrate the proper reporting of results from the data received from the instrument

	Spectral Interpretation
	The trainee will review instrumental data and discuss with the trainer what is and is not acceptable for casework analysis • Peaks past the molecular ion peak • Background subtraction • Complete spectra • Extra/absent ions in a spectrum • Calculate retention index difference

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Administrative and Technical Reviewing of Casework

Goals:

- To provide the trainee with knowledge and skills necessary to perform Administrative and Technical Reviews on another Analyst's casework

Literature

Date	Literature
	Review OSBI QP 31, Reviews
	Review DRQM-12 Case Reviews

Tasks

Date	Tasks
	Discuss with Trainer how to perform a Technical Review of a Drug Case
	Discuss how different prosecutorial charges affect the identification of certain compounds (i.e. pseudoephedrine vs. ephedrine, trafficking, distribution, etc.)
	Observe three Analysts perform Admin/Tech Reviews (5 cases each Analyst)
	Name of Analyst 1:
	Name of Analyst 2:
	Name of Analyst 3:

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Requirements Prior to Drug Analysis

Sample Analysis

Date	Tasks
	Perform the visual examination on approximately 25 green leafy samples that includes both negatives and positives, analyze using thin layer chromatography, and record all results; document using an Excel spreadsheet and archive in the analyst's folder on QA server. *All results must be accurate; if not then documentation of trainee & trainer review must be completed with explanation of possible differences & TM notified.*
	Complete a competency for the calibrated pipettes. A satisfactory competency test will be within 10% of the expected value. The Technical Manager or trainer will prepare the competency and record the expected value.
	Analyze approximately 100 provided samples on the GC and GC/MS, to include positive and negative controlled dangerous substances and record all results; document using an Excel spreadsheet and archive in the analyst's folder on QA server. *All results must be accurate; if not then documentation of trainee & trainer review must be completed with explanation of possible differences & TM notified.*
	Analyze approximately 70 practice drug cases, on the GC and GC/MS, and record all results; document using an Excel spreadsheet and archive in the analyst's folder on QA server. *All results must be accurate; if not then documentation of trainee & trainer review must be completed with explanation of possible differences & TM notified.*
	Perform a training technical review on 50 cases. These cases will be routed to the trainee in the BEAST using the route for training purposes code. The technical review will be documented on an Excel spreadsheet. The reviews done by the trainee will be compared to the official technical review by the TM or the Trainer.

Evaluation of Training

Date	Tasks
	Complete and review a written test with a minimum score of 80%. Will be graded by TM and the Supervisor or Appointee. Score _____
	Complete and review a competency test, with accurate results
	Complete a technical questions session with a minimum score of 80%, with Technical Manager or Appointee Average Score _____
	Complete a mock trial session, with approval from Technical Manager

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Liquid Nitrogen Safety

Liquid Nitrogen is the liquefied form of nitrogen gas. When nitrogen is in the gas phase, it is mostly inert gas that is colorless, odorless, and tasteless. In the liquid phase, nitrogen is very cold (-196 C or -320 F), which makes it ideal for keeping things cool. Because of its extremely cold temperature, any exposure to your skin can cause severe frostbite. On vaporization, liquid nitrogen expands by a factor of almost 700, so 1 liter of liquid nitrogen becomes 24.6 cubic feet of nitrogen gas. This can cause explosion of a sealed container, or it can displace oxygen in the room and cause suffocation without warning. Liquid nitrogen should always be stored in a vented container in a well-ventilated room. Oxygen may condense on the surface of liquid nitrogen causing it to be highly reactive with organic materials. This can cause ordinarily noncombustible materials to burn rapidly when it comes in contact with oxygen enriched liquid nitrogen. When handling liquid nitrogen, always wear thermal gloves and a protective face shield. Never dispose of liquid nitrogen by pouring it on the floor as it could displace enough oxygen to cause suffocation. Nitrogen gas is colorless and odorless, the cloud that forms when liquid nitrogen is poured on the floor is condensed water vapor from the air, not nitrogen gas.

Goals

- To become knowledgeable of the hazards of liquid nitrogen
- To learn the safety precautions to utilize when handling liquid nitrogen
- To learn how to properly use/transfer liquid nitrogen

Literature Reading

Date	Literature
	Safety Data Sheet for liquid nitrogen
	OSBI Policy 121.1 Appendix I, personal protective equipment required when handling liquid nitrogen

Articulate

Date	Tasks
	Why is liquid nitrogen used in the laboratory
	What are three hazards of liquid nitrogen
	What personal protective equipment must be used when handling liquid nitrogen
	What is the proper type of container to use to transport liquid nitrogen
	What first aid is necessary if liquid nitrogen spills on skin or eyes
	How do you report a liquid nitrogen injury if it occurs
	Why is there a safety release valve on the cryogenic cylinder
	Why must you never use a tight-fitting cap on a dewar of liquid nitrogen

Tasks

Date	Tasks
	Trainer will demonstrate the proper technique for transferring liquid nitrogen from the cryogenic cylinder to a small dewar.

Evaluation of Training

	Demonstrate how to properly transfer liquid nitrogen

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Gas Chromatograph Infrared Detector Methods for Drug Analysis (DR-75)

Goals

- To learn the theory of gas chromatography infrared detector and how to use it as a confirmatory test in the analysis of submitted samples.
- To familiarize the analyst with how to maintain the gas chromatograph infrared detector instrument and ensure that it is working properly by using quality assurance and quality control methods.
- The trainee will learn how to interpret data from this type of analysis.

*****Prior to beginning, the trainee must complete GC (DR-30), FTIR training (DR-60), and Liquid Nitrogen Safety*****

Literature

Date	Literature
	Protocol DR-75 (Gas Chromatograph Infrared Detector Methods for Drug Analysis)
	IRD3 Operations Manual, Rev 1-3, ASIC
	Essential FTIR Operations Manual for GC IRD Users, Rev 0-3
	IRD 3 Hardware & Schematic Overview

Tasks

Date	Tasks
	Maintenance
	Demonstrate how to fill the GCIRD with liquid nitrogen
	Use of the Instrument
	Demonstrate how to properly load a sample for analysis on the GCIRD, including entering information in the Sample Table
	Demonstrate the proper use of controls: • Reagent Blanks • Cocaine Standards
	Demonstrate the interpretation and comparison of data

Requirements Prior to Drug Analysis using the GCIRD

Date	Tasks
	Sample Analysis
	Analyze approximately 30 practice samples and record all results; Documents will be archived in analyst's folder on QA server
	Evaluation of Training
	Complete and review a competency test, with accurate results

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Controlled Substances Technician

The Controlled Substances Technician's job is to assist the analysts and supervisors in the Controlled Substances Unit. This may include a variety of duties, including but not limited to: making reagents, checking scales & refrigerator temperatures, instrument maintenance and preparation of sampling apparatuses. Education and Experience Requirements: At a minimum, the Controlled Substances Technician is required to have graduated from high school or have an equivalent diploma. It is preferred the Technician has attended or is currently attending an accredited college or university, with preferred coursework in chemistry, forensic science, criminalistics, toxicology or a closely related natural science.

The Controlled Substances Technician will complete portions of the same sections of this training manual as a Chemist in the Controlled Substances Unit. The trainee will date when each assignment is completed. The trainee and trainer will sign/date the Approvals and initial/date the Checklist when the required sections have been completed. Required sections will be listed in the Checklist.

The trainer will demonstrate to the Controlled Substances Technician some of the tasks that will be required duties; there may be no associated section in the training manual and no reading associated with those tasks. By signing off on the Checklist, the trainee has demonstrated their ability of completing the task to the trainer.

A competency test must be completed, with anticipated results, prior to being released to create items that could be used for testing. The competency may include testing performed by an authorized analyst of the item(s) used for testing.

The Technician may be authorized to perform some duties before all sections of the Checklist are completed.

Section	Trainee Initials	Trainer Initials	Date
Weights and Measures Utilized			
Read DR-3			
Read DR-4 (DR-4 Attachments not required)			
Demonstrate how to properly use & document weights:			
Bench Scale			
Large Capacity Scale			
Analytical Scale			
Complete a 31-day Measurement Study on the three scales			

Thermometers			
All sections			
Extractions & Handling			
Literature Reading			
Solution Preparation 0.45 N Sodium Hydroxide			
Solution Preparation Concentrated Sodium Bicarbonate			
Solution Preparation Concentrated Sodium Hydroxide			
Determination of pH of solution			
Demonstrate the procedure for basic extraction			
Color Tests			
Read DR-10			
Read DR-11			
Read DR-13			
Solution Preparation Marquis Reagent			
Demonstrate the quality control verification and documentation for Marquis Reagent			
Solution Preparation Cobalt Reagent			
Demonstrate the quality control verification and documentation for Cobalt Reagent			
Demonstrate the quality control verification and documentation for Bate's Test			
Gas Chromatography			
Read DR-30			
Maintenance Section of Training Manual			
Analysis of Mushrooms			
Preparation Mushroom TLC Reagent			
Preparation Ehrlichs			
Demonstrate the verification of the TLC Reagent and Ehrlichs			
Drug Analysis by FTIR			
Read DR-60			
Maintenance Section of Training Manual			
Gas Chromatograph Mass Spectrometer			
Read DR-70			

Maintenance Section of Training Manual			
Miscellaneous			
Recycling (shredded paper, cardboard, etc)			
Refill the hydrogen generator bottles			
Check temperatures on the refrigerators			
Gases			
Checking Eyewashes and documenting			
Printing reports			
Checking Safety Showers and documenting			
Decontaminating phones and documenting			
Checking oven temperatures			

Upon signing the approval, the trainee and trainer will review the above information and ensure the trainee has demonstrated knowledge and understanding of the above topics.

Approval

Trainee _____ Date _____

Trainer/
Supervisor _____ Date _____

Comments _____

Appendix I - Basic Operation of the Gas Chromatograph

In order to achieve maximum resolution between similar compounds on the gas chromatograph (GC), basic understanding of certain variables should be understood. Clear separation must be obtained for the mass spectrometer (MS) to distinguish between a mixture of molecular compounds and a single molecular compound. The capillary gas chromatograph has four methods to separate different molecules: pressure, length of column, type of column, and temperature. By making use of all of these variables together, most compounds will separate well.

Pressure regulation is controlled at the injection port and can be varied to meet certain applications by a feature called EPC (Electronic Pneumatic Control). There are three modes EPC can be used to separate types of molecules in a sample: split, splitless, and pulsed split.

Split Mode: During a split injection, a liquid sample is introduced into a heated inlet where it vaporizes rapidly. A small amount of the vapor enters the column while the major portion exits from the split / purge vent. Split injections are primarily used for high concentration samples when you can afford to lose most of the sample out of the split / purge vent. It is also used for samples that cannot be diluted.

Splitless mode: In this mode, the purge valve is closed during the injection and remains so while the sample is vaporized in the liner and transferred to the column. At a specified time after the injection, the purge valve opens to sweep any vapors remaining in the liner out the split vent. This avoids solvent tailing due to the large inlet volume and small column flow rate. Since the entire sample gets transferred onto the column, this mode is primarily used for samples of low concentration.

Pulsed Split: The pressure pulse modes increase inlet pressure just before the beginning of a run and returns it to the normal value after a specified amount of time. The pressure pulse sweeps the sample out of the inlet and into the column faster, reducing the chance for sample decomposition in the inlet. This is helpful for large molecular weight compounds that tend to linger around in the inlet and thus tend to get purged in other EPC modes. This method can also help to increase sensitivity by placing a larger amount of sample on the column while decreasing the possibility of samples staying in the injection port and causing contamination.

The resolving power of a column can be dependent on the length of the column. The longer the column, the greater the resolving power. Longer columns allow for more interaction from each molecule in the sample with the stationary phase. Resolution between similar compounds with small differences can be achieved by increasing the length. Columns can be purchased in many lengths, but the growing trend is toward smaller columns since larger columns are more expensive and greater resolution by other factors can compensate for less resolution from the column.

Capillary columns are a glass tube with a silianized coating containing different functional groups. Hundreds of different types of columns exist, each with a different type of functional group that will separate different compounds of interest. Some stationary phases can select for nonpolar, polar, and even compounds with lone pairs of electrons. The silianized layer thickness has a direct effect on the retention and elution temperature for each sample compound. Thicker films retain compounds longer by maximizing the amount of time the compounds spend in the stationary phase. Thinner films allow compounds to pass through the column faster, most likely with less separating ability.

Temperature variations in the injection port and on the column are important for separation by capillary gas chromatography. The injection port is usually set at 290°C, which vaporizes samples upon introduction to the GC. The injection port is not part of the column; it's a chamber where the liquid sample can change into the gas phase before entering the column. The oven, that contains the column, is relatively cool at a starting temperature of 190°C less than that of the injection port. This is hot enough to allow the volatile solvent to remain as a gas, but cold enough to cause the less volatile compounds to return to a liquid state. Once the sample becomes a liquid, it deposits itself on the column and won't migrate until the oven temperature heats up to the compounds boiling temperature. When the sample is once again in its gas phase, it travels through the column's stationary phase and mobile phase, jumping between the two. Separation has occurred through the difference in boiling points and through the amount of time different molecules spend in the stationary phase while traveling through the column.

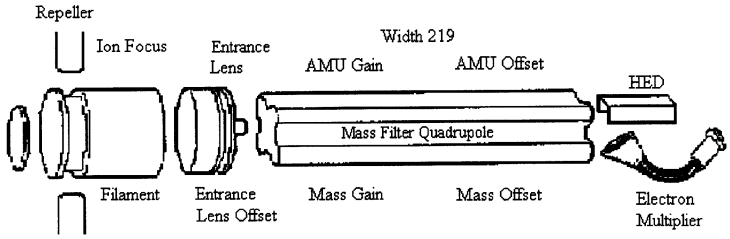
By utilizing these four variables, separation of compounds can be achieved in most cases. Observation of the retention time is valuable in determining the identity of a compound, by comparison with a known standard. Changing just one of these variables can influence the retention time of a compound. The chromatograph should not contain wide peaks, since two or more compounds could resemble one peak. Ideally, sample concentration should be enough to give a single, narrow peak.

References:

1. Missouri State Highway Patrol Forensic Laboratory Chemistry Training Manual.
2. Hewlett-Packard GC/MS Product Software, August 1996.

Appendix II - Basic Operation of the Mass Spectrometer

In order to interpret a tune report, basic understanding of the MS is necessary. The following is a brief explanation of how the Electron Impact (EI) ionization method works. The molecules come off of the GC column and are subjected to electron bombardment, which causes them to fragment and become charged. A repeller is used to direct the ions to the focusing lenses in the ion source and then to the quadrupole mass filter. The mass filter allows selected ion masses to reach the detector. It separates ions based on their masses allowing only ions of a specific mass to reach the detector at a given time. The quadrupole filters by applying to each pair of quadrupole rods, a combination of radio frequency (Rf) and direct current (DC) voltages. One rod pair receives Rf voltage 180 degrees out-of-phase with the other pair, while an equal but opposite DC potential is applied to each rod pair. Under these conditions, at any particular set of Rf and DC voltage values, only ions of a specific mass to charge (m/z) will traverse the length of the open space between the rods. All other ions are neutralized as they strike the surface of the rods. During a typical run, the MS scans for masses ranging from 40 – 550 atomic mass units (amu). It scans for each mass unit in that range starting at the highest amu, working downward, throughout the duration of the run, with the exception of the solvent delay in which the MS is turned off. For instance, at the beginning of the scan, the mass filter selects only for masses of 550 amu, then it selects for masses of 549, and so on. This whole selection process takes place about three times a second. After each ion passes through the quadrupole, it is amplified by the electron multiplier, before reaching the detector. The detector counts the ions of each mass and plots the data on the mass spectrum (abundance vs. mass size). The quadrupole mass filter can select ions in two modes: Scan and SIM. Scan mode selects ions in the whole mass range specified, whereas SIM selects for specific mass units. The Scan mode has a lower sensitivity since most of the ions in a sample collide with the quadrupole rods. However, since samples are generally unknown, the filter mode utilized at the OSBI is the Scan mode to detect the entire spectrum of ions.

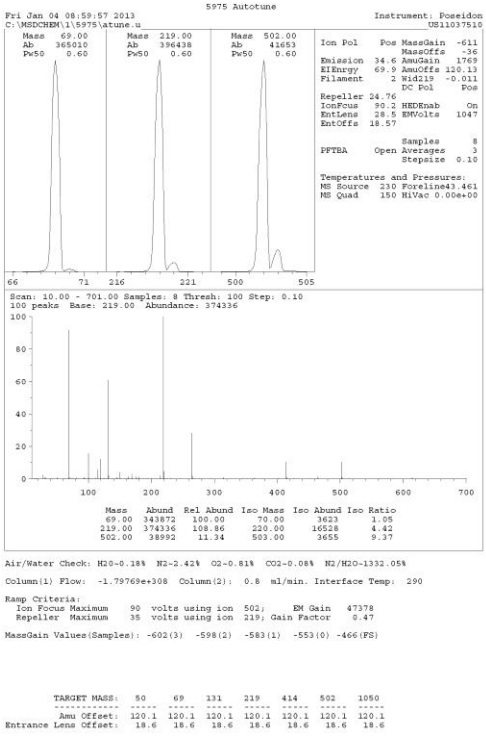


Tuning

Tuning is the process for optimizing the performance of the Mass Selective Detector (MSD). The goal of tuning is to maximize sensitivity while maintaining acceptable resolution (the ability to distinguish between a mass and its isotope), ensuring accurate mass assignment, and providing the desired relative abundances across the spectrum. The Mass Spec (MS) uses Perfluorotributylamine (PFTBA) because its mass spectrum has ions in the low (69), medium (219), and high (502) mass range. The mass spectrum of PFTBA is shown on the bottom of the tune report. The instrument looks specifically for masses 69, 219, and 502 in the spectrum of PFTBA, and plots these values along a mass axis (the x-axis of the mass spectrum). The instrument

aligns its internal mass axis to match the PFTBA mass axis. Resolution is determined by the ability of the instrument to distinguish two peaks, one mass unit apart. This resolution is displayed on the tune report by the peaks in the upper left-hand corner. The peak graph displays the mass of the peak, the abundance of that ion, and the peak width at 50% of the height (Pw50), as shown in the upper left portion of the graph. The x-axis of this graph is the mass assignment. By increasing the Pw50, the area at the base of the graph increases, and a larger range is allowed for the selected mass assignment (i.e. 69, 219, or 502). If made too large, the base area could encompass a range more than its peak range and label the isotope mass with the selected mass. This would achieve greater sensitivity, but the resolution would be very low since it could not distinguish the selected mass from its isotope. It is for that reason that the peak width must be between 0.4 and 0.6. While viewing the tune report, look for clear separation between the selected mass and its isotope.

On the upper right of the printout, there are numerous parameters displayed. These values are automatically assigned while using autotune to optimize the MSD performance. These values can be manually changed by using manual tune, but is not recommended for normal use.



Ion Pol: This is the polarity of the field lens. A positive field pushes the ions out of the ion source. *(5975)*

Emission: The amount of current running through the filament. The higher the current the greater the electron bombardment but decreases a filament life. Too low of a current will result in less ionization and reduced sensitivity.

ElEnrgy: The electron energy of the electron leaving the filament. *(5975)*

Filament: The MS contains two filaments in case one burns out.

Repeller: Sets the voltage of the repeller (part of the ion source). The repeller is a positive potential that repels the ions, pushing them out of the source. If the repeller is set too low, too few ions will leave the source, resulting in poor sensitivity and poor high mass response. If it is set to high, too many ions at too high a velocity will leave the source. This results in poor mass filtering and poor low mass resolution.

IonFcus: Sets the voltage of the ion focus lens (part of the ion source). Ion focus affects Ion abundance. Generally, the offset is ramped during the tuning to find the ion focus offset that results in the best ion abundance.

EntLens: Refers to the entrance lens gain, a value used to determine a mass dependent voltage that is applied to the entrance lens. The entrance lens is the final lens through which ions pass before they enter the mass filter quadrupole. Typically, during tuning, the entrance lens voltage is ramped to find the setting that provides the maximum abundance.

EntOffs: This is a constant voltage that is applied to the entrance lens. Increase the offset to increase abundance of ions at low masses without substantially decreasing the abundance of ions at high masses.

PFTBA: The status of the valve containing the PFTBA. This valve will open and close automatically for tuning.

MassGain: Sets the value of the mass axis gain, which is a multiplicative factor used in the equation to calibrate the mass axis. Mass gain adjusts the reported value of a given mass to the correct number. The mass that appears in a report has had a linear correction applied to it. This may be thought of as a calibration curve where the uncorrected mass is plotted along the x-axis and the reported mass is plotted along the y-axis. The calibration curve is a straight line with a slope that is proportional to the mass gain. Mass gain has a greater effect on mass assignments at the high end of the mass scale than at the low end.

MassOffs: This is an additive factor used in the equation to calibrate the mass axis.

AMUGain: Atomic mass unit gain affects the width of the mass peak by adjusting the ratio of DC voltage to RF voltage on the mass filter. A higher value gives narrower peaks, but affects peaks at high masses more than those at low masses.

AMUOffs: This affects the width of the mass peaks by adjusting the ratio of DC voltage of the mass filter quadrupole. A higher value gives narrower peaks at all masses.

Wid219: Affects the width of the mass peak at 219 amu. The value entered for this parameter is approximately the value of the correction applied at mass 219. For instance, if a peak width adjustment has been performed and the values are: Mass 69 Pw0.60, Mass 219 Pw0.63, Mass 502 Pw0.60, then entering a value of –0.03 for the Wid219 parameter, followed by a peak width adjustment, should result in the peak widths of all masses being set very close to 0.60 amu.

DC Pol: Sets the polarity of the direct current applied to the quadrupole mass filter. This parameter is set at the optimum polarity at the factory and should not be changed for normal use.

HEDEnab: The High Energy Dynode sets the voltage to focus the ions into the detector, which is located off-axis, hidden from photons and electrons coming from the source. The optimal HED voltage depends on the electron multiplier setting. Thus, the electron multiplier voltage is usually set first. Then the HED voltage is ramped to determine the setting that provides the greatest abundance. The older instruments assigned a value to this parameter, which use to be called X-ray lens, however the HP 5975 MSD does not have an X-ray lens and just indicates "on" or "off". *(5975)*

EMVolts: The electron multiplier increases the abundance of all ions in the scan range going to the detector.

Samples: The log2 of the number of samples to be taken and averaged at each mass during a scan.

Averages: The number of profile scans to be averaged for each scan reported.

Stepsize: The mass axis increment used for a profile Scan. The larger the number, the faster scans are taken, at a cost of resolution.

Temperatures and Pressures:

MS Source/ MSQuad: Displays temperature settings for the Source and Quadrupole. *(5975)*

Foreline: The pressure between the rough pump and the diffusion pump. This area will either state the pressure of the foreline if the MSD uses a diffusion pump or the speed of the turbo pump. *(5975)*

HiVac: Displays the high vacuum pressure. *(5975)*

On the Display of the mass spectrum of PFTBA, other parameters are listed:

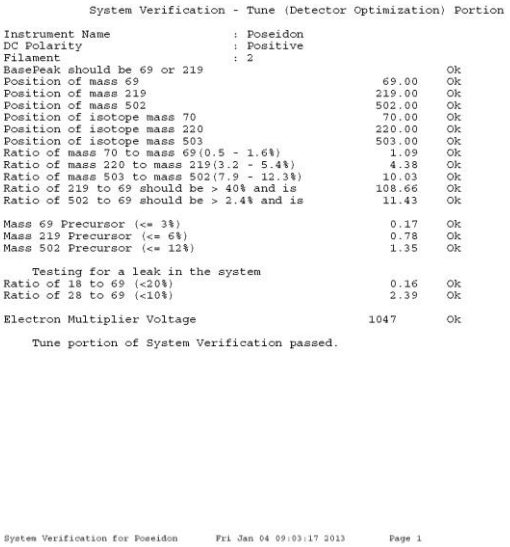
Scan: 10.00-700.00 amu is the scan range during the tune. Typically when drug samples are scanned, this parameter is approximately 40-550 amu.

Samples: The log2 of the number of samples to be taken and averaged at each mass during a scan. If the number is 8, log2 would be 256 scans.

Threshold: Abundance's below this value will be ignored for scanning. This determines what signal will be accepted as peaks.

Base: Shows the base peak in the sample.

Abundance: Abundance of the base peak.



System Verification - Tune (Detector Optimization) Portion

Instrument Name	: Poseidon	
DC Polarity	: Positive	
Filament	: 2	
BasePeak should be 69 or 219		Ok
Position of mass 69	69.00	Ok
Position of mass 219	219.00	Ok
Position of mass 502	502.00	Ok
Position of isotope mass 70	70.00	Ok
Position of isotope mass 220	220.00	Ok
Position of isotope mass 503	503.00	Ok
Ratio of mass 70 to mass 69(0.5 - 1.6%)	1.09	Ok
Ratio of mass 220 to mass 219(3.2 - 5.4%)	4.38	Ok
Ratio of mass 503 to mass 502(7.9 - 12.3%)	10.03	Ok
Ratio of 219 to 69 should be > 40% and is	108.66	Ok
Ratio of 502 to 69 should be > 2.4% and is	11.43	Ok
Mass 69 Precursor (<= 3%)	0.17	Ok
Mass 219 Precursor (<= 6%)	0.78	Ok
Mass 502 Precursor (<= 12%)	1.35	Ok
Testing for a leak in the system		
Ratio of 18 to 69 (<20%)	0.16	Ok
Ratio of 28 to 69 (<10%)	2.39	Ok
Electron Multiplier Voltage	1047	Ok

Tune portion of System Verification passed.

System Verification for Poseidon Fri Jan 04 09:03:17 2013 Page 1

Tune Evaluation (Tune Eval)

Tune evaluation is a way of verifying the performance of the MSD. First, it will evaluate the most current autotune (ATUNE.U) parameters and when the evaluation is complete, a system verification report is printed.

If all parameters of the autotune are within the predetermined limits, set by Agilent, they will be listed as "OK." If all parameters pass, the instrument can be used for casework. If any of the parameters fail, the reason for failure must be determined and corrected. The Autotune and Tune Evaluation must be run again and pass all parameters before casework can be analyzed on the instrument.

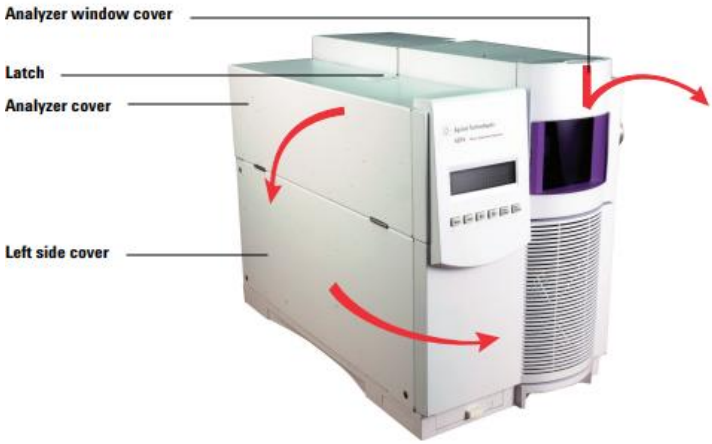
References:

1. Missouri State Highway Patrol Forensic Laboratory Chemistry Section Training Manual.
2. Hewlett-Packard GC/MS Product Software, August 1996.
3. www.agilent.com

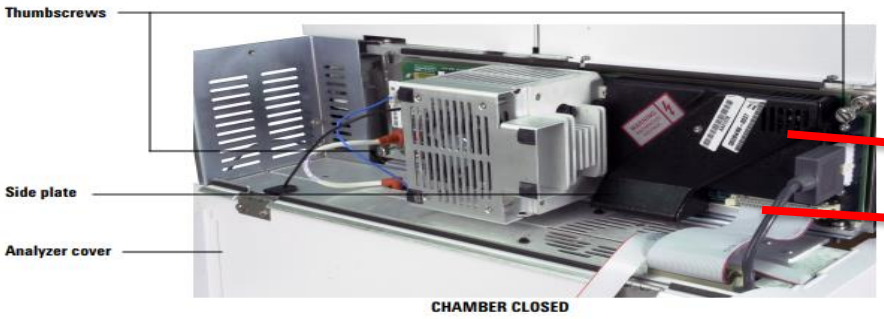
Appendix III – Helpful Tips for The Mass Spectrometer

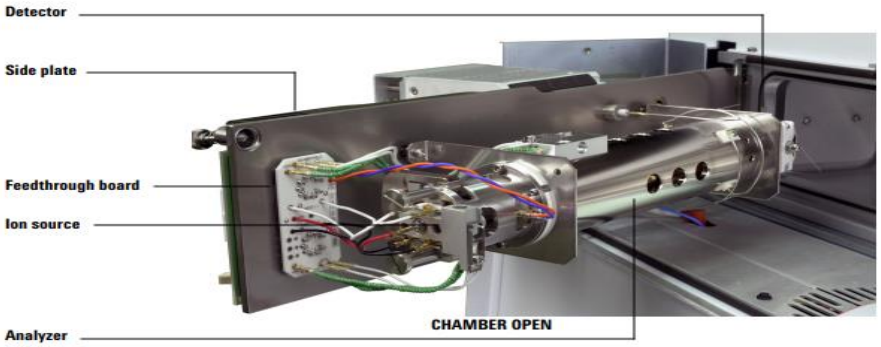
Pump down/Filament/Vent

1. In the Instrument Control view, select **Instrument**, select **MS Vacuum Control** to display the Vacuum Control dialog box or select **View,** select **Tune Vacuum Control**, select **Vacuum** select **MS Vacuum control**
2. Click **Vent**
   2.1. Follow the instructions presented on the screen, and wait until the vent cycle is completed.
   2.2. Let the rough pump cool off approximately 45 minutes if needed unplug the pump
   2.3. Close the software and turn off the MS portion on the instrument
3. Turn the vent valve counterclockwise only 3/4 turns or until you hear the hissing sound of air flowing into the analyzer chamber



4. Disconnect the side board control cable and the source power cable from the side board. Loosen the side plate thumbscrews if they are fastened and gently swing the side plate out





5. Remove the source from the analyzer
6. Disassemble the source and collect the parts to be cleaned. Clean using microgrit /sandpaper. Sonicate metal pieces using methanol approximately 15 minutes. Ensure microgrit is cleaned off before reassembling the source.

   Side note: Ensure the new filaments are placed the correct way!

7. Reinstall the source into the analyzer and close the side plate
8. Reconnect the side board control cable and source power cable to the side board
9. Plug the rough pump back in
10. Make sure the vent valve is closed turn knob clockwise
11. Press the Power on button on the front of the MS while pressing on the side plate to ensure a good seal

12. Start the Masshunter Data Analysis program. In the Instrument Control view, select **Instrument**, select **MS Vacuum Control** to display the Vacuum Control dialog box or select **View,** select **Tune Vacuum Control**, select **Vacuum** select **MS Vacuum control**
13. Select Pump Down
14. Allow ample time for instrument to pump down

Switch Filaments

1. From the Instrument Control menu, select **View**
2. Select **Parameters** next selec**t Manual Tune**
3. Enter the filament number
4. Click Done and save the atune file or select **Save Tune Parameters** from the **File** menu

Manual Tune for air leak

1. From the Instrument Control menu, select **View**
2. Select **Parameters** next select **Manual Tune**
3. Select the **Scan** tab of the **Manual Tune** dialog box and set the Scan Mass Range to Low *m/z* 10 to High *m/z* 100 also check that the **PFTBA** is set to **Closed in** the **Parameters** section**.**
4. Click **Scan,** look at the window labeled scan
5. Do not save atune

Search Drug library

1. From the Instrument Control menu select **View,** select **MSD Chemstation Data Analysis**
2. Select **View** next select **Parametric Retrieval**
3. Enter in the library you would like to search default: *c:\Database\CrDM.I* **Note:** Other library's are available to be searched
4. Choose your search option in the side panel

5975 Series MSD Operation Manual for MassHunter (agilent.com)

Appendix IV - Mass Peaks of Common Contaminants

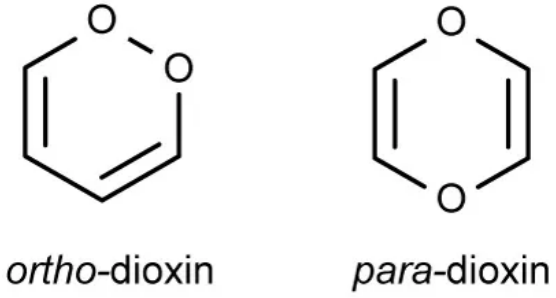
Mass(es)	Compound General Classification	Potential Source
18, 28, 32, 40, 44	Air	H_20, N_2, O_2, Ar, CO_2
18	Cleaning Solvents	Water
31		Methanol
47, 83, 85		Chloroform
77		Benzene or Xylenes
91,92		Toluene
105,106		Xylenes
43, 58		Acetone
85		Freons
73, 147, 207, 222, 281, 295, 341, 355, 429	Dimethylpolysiloxane	Septum or Column bleed
41, 43, 55, 57, 71, 85, 99	Hydrocarbons	Fingerprints or pump oil
149	Phthalates	Plasticizers in tubing, vials, caps, samples

Appendix V – Isomers

Structural isomers: a form of isomers in which molecules with the same Molecular Formula have different bonding patterns and atomic organization.

- Structural isomers share the same chemical formulas, but their atoms are arranged differently.

- Examples include ortho- para- meta-

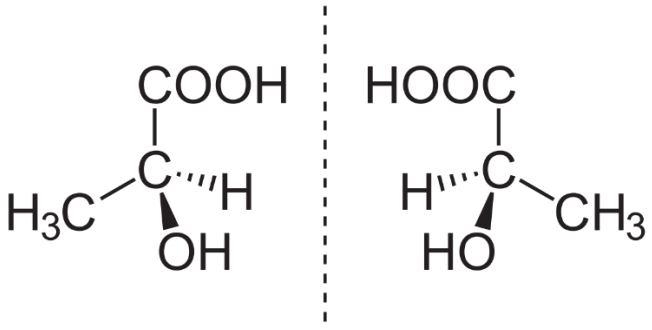


ortho-dioxin *para*-dioxin

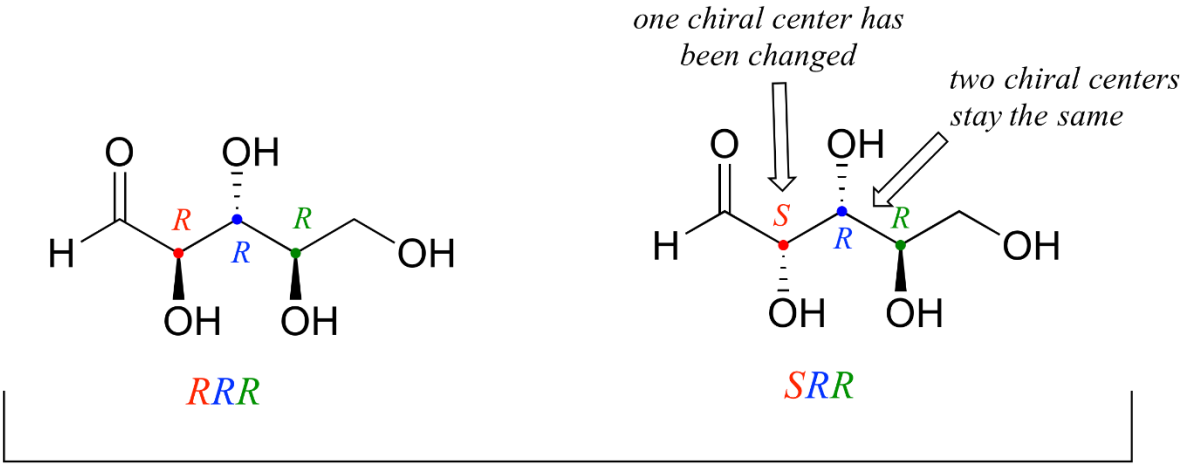
Stereoisomers: a form of isomers in which molecules with the same Molecular Formula have molecular bonds which are always in the same order and only differ in spatial arrangement.

- Isomers that have the same number of the same kinds of atoms but differ in the orientation of their atoms in space. These isomers differ in chemical and physical properties.
- There are two types of stereoisomers: enantiomers and diastereomers.

Enantiomers or Optical isomers: 2 isomer molecules that are chiral, and are <u>mirror images</u> of each other; a pair of chemical compounds whose molecular structures have a <u>nonsuperimposable</u> mirror-image relationship to each other



Diastereomers or Geometric isomers: 2 stereoisomers that are not mirror images; a stereoisomer of a compound having two or more chiral centers that is not a mirror image of another stereoisomer of the same compound



diastereomers

Mock Trial Evaluation Form

Analyst _____ Score _____

Reviewer _____ Date _____

Please rate the trainee's performance during the Mock Trial:

	Excellent (3)	Good (2)	Fair (1)	Poor (0)
Courtroom demeanor and appearance	☐	☐	☐	☐
Ability to convey information in an understandable manner	☐	☐	☐	☐
Poise and professionalism during direct examination	☐	☐	☐	☐
Poise and professionalism during cross examination	☐	☐	☐	☐
Use of court exhibits/visual aids (if applicable)	☐	☐	☐	☐
Testimony based upon scientific principles	☐	☐	☐	☐
Exhibition of knowledge of OSBI testing procedures	☐	☐	☐	☐
Explanation of results	☐	☐	☐	☐

Remarks/Comments/Suggestions/Explanation for Poor Ratings: _____

_____

_____

_____

Additional Reading/Training

This section is intended to list articles/books/journals/etc. that are required reading, additionally training courses can be listed as well.

Date	Literature/Training

Approval

Technical Manager Michella Carter Date 9/19/24

Criminalistics Division Director [signature] Date 09/20/2023

Comments

History

Revision	Issue Date	History
17	09-23-2024	**Introduction:** Added that once training is completed the training notebook will be scanned and uploaded into the analyst's individual folder. **Orientation to OSBI:** Adjusted the wording from read to review because these are covered in the NEGTM. **Weights and Measures:** Reordered the reading to make uncertainty of measurement easier to understand. Combined marijuana with other trafficking levels. Updated 30-day to 31-day for the measurement assurance study. **Cannabis Analysis:** New section. Separated cannabis training from the drug analysis training. Added in training for TLC, literature, and how to sample and analyze different matrices cannabis products come in. Added pipette training. **Drug Analysis:** Removed reading for DR-01. Removed Protocol DR-102 because it was archived in the last protocol update. **Extractions & Handling:** Added NIJ Fingerprint Sourcebook to the literature. Added labeling and packaging to the sample handling section. **Cocaine Solubility:** Removed make cocaine base from cocaine. **Identification of LSD:** Added how to sample blotter paper and what report wording is used when analyzing suspected LSD. **Requirements Prior to Using FTIR:** Removed Form 2 and added documenting on an Excel spreadsheet. **GC/MS Methods for Drug Analysis:** Added reading new document Isomers (Appendix IV). Added articulates to define isomers. **Administrative and Technical Review:** Added trafficking and distribution to the task Discuss how different charges affect the identification of certain compounds.

Requirements Prior to Drug Analysis: Removed Form 1 and 2. Added documenting on an Excel spreadsheet. Added TLC to the visual exam of green leafy substances. Added the requirement to perform 50 training technical reviews. Added a competency requirement for calibrated pipettes.
Controlled Substances Technician: Updated training to remove extra training that is not needed.
Appendix III: New document.
Appendix IV: Renamed Appendix III to Appendix IV so the instrument information was together.
Appendix V: New document. Defining isomers and giving examples.
Form 1 and Form 2: Removed from Training Manual. They are archived in revision 16.