# Education and Training Outline for Forensic Drug Practitioners

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INTRODUCTION

The need for training has been recognized by the ENFSI Drugs Working Group as essential to improve the performance of laboratories to meet internationally accepted standards and to provide their clients (law enforcement, judiciary/regulatory and health authorities) with reliable data.

The purpose of this Training Manual Outline is to provide a source to qualified persons involved in delivering drug training courses, for a uniform formal training program for forensic drug practitioners.

Forensic practitioners carry out a variety of roles (all or in part) that have been recognized and should be defined in their organizations. These roles are fundamentally four, Scene of crime examiner, Analyst/Assistant, Reporting analyst and Reporting Scientist (as defined in ENFSI “Guidance on the assessment of competence for forensic practitioners”, QCC-CAP-006).

The primary duty of a forensic practitioner is the analysis of physical evidence and the forming of an opinion based on the results of analysis. The duties which forensic practitioners are involved in within the frame of their roles and which need to be covered by training include:

- Evidence handling (obtaining, protecting, processing, testing, transporting, ensuring chain of custody)
- Evidence analysis (-all or in part- directing or carrying out casework examinations or analytical tests and development of laboratory examination strategy : identification, quantification, comparison, interpretation of the analysis results, implementation of good laboratory practices, writing the analysis report)
- Court testimony (skillful presentation of factual evidence for the court and defense of analytical findings)
- Participation in field investigations (initial assessment at a crime scene, e.g. clandestine laboratories and the subsequent collection of material for a detailed scientific examination)
- Technical and scientific support for law enforcement agents, prosecutors and/or the judiciary (communication, training, joint investigative teams)

Objectives of the Drugs Training Course outlined herein:

Upon completion of the training outlined herein, the trainees will have the requisite knowledge and skills to establish a standard of professional competency, as described in training records and comprising of (all or in parts):

- knowledge of:
  - background information on drugs of abuse (morphology, basic chemistry, abuse patterns and pharmacology)
  - control regime of the most common drugs of abuse encountered on the illicit market (nationally/internationally)
  - production or synthesis of drugs of abuse and their key precursors
  - theory, principles and applications, of a variety of instrumentation and analytical techniques, including preventive maintenance and troubleshooting, possibilities, limitations and pitfalls
  - protocol for the qualitative and quantitative analysis
  - procedures applied in the laboratory and in the scene of crime, including chain-of-custody, as well as procedures related to law (court testimony)
  - quality management system and practices of the laboratory
  - health, safety and security related issues

- ability in:
  - preparation of samples and handling of evidence, choosing the best case approach
  - performing accurate qualitative and quantitative analysis independently and proficiently
  - application of quality system, practices and protocol(s) in daily routines
  - implementation of analytical schemes and methodologies
  - correct interpretation of the results obtained
  - reporting, communication of analytical findings, presentation and defending them in court

This training curriculum aims to cover completely the topics relevant for forensic practitioners, depending on role(s) recognized by the respective organizations. However, it does not attempt to completely cover all the methodology available to the drug analyst. The selection of methods to solve particular analytical
problems is the responsibility of the analyst, depending on the availability of other national scientific and laboratory facilities, on local crime trends, and on current workloads. If this training curriculum is used for international training, it should be recognized that it is unlikely that all topics can be covered completely. Some choice needs to be made with respect to which modules are covered or which ones are prioritized.

The chapters of the training manual follow a common structure, including objectives, suggestions for modes of instruction (training aids), key references (hyperlinked, where available), and suggestions for trainee assessment.

As education and training is an ongoing and periodical process so as to maintain the competence, this outline will undergo revision in periodic intervals.

Definitions used in this Training Manual Outline

Knowledge: Theoretical understanding of the scientific approach and the principal behind the analysis itself. It implies an understanding of the underlying theory of the particular analysis/examination (e.g. mechanisms, reactions, limitations, etc.). Knowledge is acquired through a formal and informal learning process.

Ability: Practical ability to carry out an analysis/examination properly. Ability is acquired through practice.

Awareness: Familiarity with a particular issue. It implies the need to know certain information in order to be able to take it into account in a relevant and appropriate manner.

Competence: The ability to perform the task of a certain role. A competent person has the knowledge and the ability to apply this knowledge, has the skills, the right behaviour and the attitudes for the role. Qualification, experience and training, although important, do not guarantee competence.

Competence Assessment: A formal assessment to check whether or not an individual meets the standards of performance.
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- Dr. Irene Breum Müller, Institute of Forensic Medicine, University of Copenhagen, Denmark
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- Jerry Massetti
- Scott Vajdos
- Garth Glassburg
- Eric Person

The ENFSI DRUGS WORKING GROUP
Dr. Udo Zerell (chairman)
I. FUNDAMENTAL DRUG CHEMISTRY OVERVIEW

I.1. INTRODUCTION TO DRUG CHEMISTRY - What is a Drug

I.1.1. Objectives

Familiarity with, definitions, nomenclature, sources and chemical classifications of drugs
I.1.1.1. Nomenclature including IUPAC, general names and street names
I.1.1.2. Structural knowledge and relationship of isomers, analogues, homologues, derivatives
with respect to chemical and legal aspects
I.1.1.3. Knowledge of natural, semi-synthetic and synthetic sources of drugs
I.1.1.4. Knowledge of how drugs can be classified as acids, neutrals and bases
I.1.1.5. Knowledge of how drugs can be classified by pharmacological effects
I.1.1.6. Familiarity of the effect of solubility and salt forms to the drug identification process

I.1.2. Modes of Instruction – Training Aids

I.1.2.1. Studying of suggested references/assignments
I.1.2.2. Demonstrations of samples
I.1.2.3. Clarification on questions
I.1.2.4. Discussion

I.1.3. References

I.1.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences.
I.1.3.5. “Information about drugs,” UNODC
I.1.3.6. “Get the facts about drugs”, UNODC, May 2008
I.1.3.8. Drugs of Abuse Information, National Institute on Drug Abuse

I.1.4. Assessment

I.1.4.1. Study questions (oral, written)
I.1.4.2. Courtroom exercise (mini-mock trial)
II. DRUGS OF ABUSE

II.1. CANNABIS

II.1.1. Objectives

II.1.1.1. Familiarity with the illicit cannabis products:
   II.1.1.1.1. Description of the cannabis plant and illicit cannabis products (names and synonyms, botany, physical appearance, morphological, microscopical and chemical characteristics, herbal products, cannabis resin, liquid cannabis)
   II.1.1.1.2. Breeding of cannabis plant (outdoor/indoor/industrial production, harvesting, yield)
   II.1.1.1.3. Production of illicit cannabis products (herbal/resin/liquid cannabis)
   II.1.1.1.4. Chemical constituents of forensic significance of illicit cannabis products
   II.1.1.1.5. Pharmacology of cannabis products
   II.1.1.1.6. Legal aspects concerning cannabis in national/EU/international legislation, including hemp grown for fiber

II.1.1.2. Familiarity with Cannabis Receptor Agonists (cannabinomimetic compounds, e.g. ‘spice’ products), including legal aspects

II.1.1.3. Familiarity with the protocol for the analysis of illicit cannabis products (including sampling, physical examination, microscopy, extraction, presumptive (colour) tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls).

II.1.1.4. Ability to perform identification of illicit cannabis products

II.1.1.5. Pharmacology of cannabis products

II.1.1.6. Ability to perform identification of cannabinoids (cannabinomimetic compounds)

II.1.1.7. Ability to perform quantification of constituents of illicit cannabis products

II.1.2. Modes of Instruction – Training Aids

II.1.2.1. Studying of suggested references/assignments

II.1.2.2. Clarification on questions

II.1.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

II.1.2.4. Demonstrations of samples and of analysis by trainer, with explanations

II.1.2.5. Interpretation of results and discussion including limitations

II.1.2.6. Application of qualitative/quantitative analysis on known samples by trainee

II.1.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

II.1.2.8. Discussion

II.1.3. References


II.1.3.2. “Recommended methods for the identification and analysis of cannabis and cannabis products”, UNODC, ST/NAR/40, September 2009


II.1.3.4. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

II.1.3.5. “Analysis of Drugs Manual”, United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences


II.1.3.7. “Controlled Substances Training Manual”, Virginia Department of Forensic Science, DFS Document 221-D200, Revision 2, December 2014

II.1.3.8. “The Analysis of Controlled Substances”, Michael.D. Cole, John Wiley & Sons Ltd., The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England


II.1.3.16. “Clandestine Manufacture of Substances under International Control”, UNODC, ST/NAR/10/Rev.3.

II.1.3.17. “Clandestine Laboratory Guide for Agents and Chemists”, U.S. Department of Justice, Drug Enforcement Administration, Office of Science and Technology

II.1.3.18. AOAC Methods (1980) Section 40.012 and 40.013 (page 686)


II.1.3.20. “Drugs of Abuse”, DEA Publication, 2005


II.1.3.24. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009


II.1.3.27. "Synthetic cannabinoids and 'Spice' drug profile” EMCDDA

II.1.4. Assessment

II.1.4.1. Study questions (oral, written)

II.1.4.2. Preparation of samples and reagents (practical)

II.1.4.3. Distribution and application of analysis on unknown samples (practical)

II.1.4.4. Courtroom exercise (mini-mock trial)
II. DRUGS OF ABUSE

II.2. OPIUM ALKALOIDS AND OPIUM DERIVATIVES (HEROIN)

II.2.1. Objectives

II.2.1.1. Familiarity with the opium, opium alkaloids and opium derivatives (heroin), including semi-synthetic opioids (oxycodone, hydrocodone, etc):

II.2.1.1.1. Description/recognition of illicit opium products (botany, physical appearance, morphological and chemical characteristics, opium preparations)

II.2.1.1.2. Production of illicit opium products (isolation of morphine from opium, manufacture of heroin from morphine)

II.2.1.1.3. Chemical constituents of forensic significance of illicit opium products and derivatives, including by-products, adulterants and diluents, comparative analysis / establishing links between samples

II.2.1.1.4. Structures and pharmacology of constituents of opium, opium derivatives (heroin) and semi-synthetic opioids

II.2.1.1.5. Legal aspects concerning opium, opium derivatives (heroin) and semi-synthetic opioids in national/international Legislation

II.2.1.2. Familiarity with the protocol for the analysis of illicit opium, opium products, opium derivatives (heroin) and semi-synthetic opioids (including sampling, physical examination, microscopy, extraction, presumptive (colour/anion) tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls)

II.2.1.3. Familiarity with additional analytical techniques for the analysis of illicit opium, opium products, opium derivatives (heroin) and semi-synthetic opioids

II.2.1.4. Ability to perform identification of illicit opium, opium products, opium derivatives (heroin) and semi-synthetic opioids

II.2.1.5. Ability to perform quantification of constituents of illicit opium, opium products, opium derivatives (heroin) and semi-synthetic opioids

II.2.2. Modes of Instruction – Training Aids

II.2.2.1. Studying of suggested references/assignments

II.2.2.2. Clarification on questions

II.2.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

II.2.2.4. Demonstrations of samples and of analysis by trainer, with explanations

II.2.2.5. Interpretation of results and discussion including limitations

II.2.2.6. Application of qualitative/quantitative analysis on known samples by trainee

II.2.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

II.2.2.8. Discussion

II.2.3. References


II.2.3.4. “Methods for Impurity Profiling of Heroin and Cocaine”, UNODC, ST/NAR/35, October 2005

II.2.3.5. “Some Aspects of the Gas Chromatographic (GC) Analysis of Heroin”, UNODC, SCITEC/5, February 1989

II.2.3.6. “Clandestine Manufacture of Substances under International Control”, UNODC, ST/NAR/10/Rev.3.

II.2.3.7. “Clarke’s Analysis of Drugs and Poisons”, Moffat, Anthony C; Osselton, M David; Widdop, Brian; Watts, Jo, 4th ed., (2011), Pharmaceutical Press.

II.2.3.8. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences.

II.2.3.9. “Analysis of Drugs Manual”, United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

II.2.3.10. “The Analysis of Controlled Substances”, Michael.D. Cole, John Wiley & Sons Ltd., The
II.2.3.13. “Clandestine Laboratory Guide for Agents and Chemists”, U.S. Department of Justice, Drug Enforcement Administration, Office of Science and Technology
II.2.3.15. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 15, August 2014 (or latest revision).
II.2.3.18. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009

II.2.4. Assessment
II.2.4.1. Study questions (oral, written)
II.2.4.2. Preparation of samples and reagents (practical)
II.2.4.3. Distribution and application of analysis on unknown samples (practical)
II.2.4.4. Courtroom exercise (mini-mock trial)
II. DRUGS OF ABUSE

II.3. COCAINE

II.3.1. Objectives

II.3.1.1. Familiarity with the coca plant and illicit materials containing cocaine:

II.3.1.1.1. Description/recognition of coca plant and illicit materials containing cocaine (botany, physical appearance, morphological and chemical characteristics)

II.3.1.1.2. Production of illicit materials containing cocaine (isolation of cocaine from coca leaf, production of coca paste, cocaine base, “crack”) and manufacture of cocaine

II.3.1.1.3. Chemical constituents of forensic significance of coca plant and illicit materials containing cocaine, including by-products, adulterants and diluents, comparative analysis / establishing links between cocaine samples

II.3.1.1.4. Structures, physical data and pharmacology of constituents of illicit materials containing cocaine

II.3.1.1.5. Legal aspects concerning coca plant and illicit materials containing cocaine in national/international Legislation

II.3.1.2. Familiarity with the protocol for the analysis of illicit materials containing cocaine (including sampling, physical identification, extraction, presumptive (colour/odour/microcrystal) tests, anion tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls)

II.3.1.3. Familiarity with additional analytical techniques for the analysis of cocaine

II.3.1.4. Ability to perform identification of cocaine in illicit materials

II.3.1.5. Ability to perform quantification of constituents of illicit materials containing cocaine

II.3.2. Modes of Instruction – Training Aids

II.3.2.1. Studying of suggested references/assignments

II.3.2.2. Clarification on questions

II.3.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

II.3.2.4. Demonstrations of samples and of analysis by trainer, with explanations

II.3.2.5. Interpretation of results and discussion including limitations

II.3.2.6. Application of qualitative/quantitative analysis on known samples of illicit materials containing cocaine by trainee

II.3.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

II.3.2.8. Discussion

II.3.3. References


II.3.3.2. “Recommended methods for the Identification and Analysis of Cocaine in Seized Materials”, UNODC, ST/NAR/7/Rev.1, March 2012


II.3.3.4. “Methods for Impurity Profiling of Heroin and Cocaine”, UNODC, ST/NAR/35, October 2005

II.3.3.5. “Clarke’s Analysis of Drugs and Poisons”, Moffat, Anthony C; Osselton, M David; Widdop, Brian; Watts, Jo, 4th ed., (2011), Pharmaceutical Press.

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II.3.3.7. “Analysis of Drugs Manual”, United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

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II.3.3.12. “Clandestine Laboratory Guide for Agents and Chemists”, U.S. Department of Justice, Drug Enforcement Administration, Office of Science and Technology

II.3.3.13. “Clandestine Manufacture of Substances under International Control”, UNODC, ST/NAR/10/Rev.3.


II.3.3.17. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009


II.3.4. Assessment

II.3.4.1. Study questions (oral, written)

II.3.4.2. Preparation of samples and reagents (practical)

II.3.4.3. Distribution and application of analysis on unknown samples (practical)

II.3.4.4. Courtroom exercise (mini-mock trial)
II. DRUGS OF ABUSE

II.4. AMPHETAMINE TYPE STIMULANTS (ATS)

II.4.1. Objectives

II.4.1.1. Familiarity with the Amphetamine Type Stimulants:
   a. Non-ring substituted amphetamines (e.g. amphetamine, methamphetamine, cathine, cathinone, methcathinone, fenetylline)
   b. Methylenedioxy substituted amphetamines (e.g. MDA, MDMA, MDEA, FLEA, MBDB)
   c. Other ring substituted amphetamines (also in section “Hallucinogens”)
      - 2,4,5-Ring substituted phenethylamines (e.g. 2C-B, 2C-T, 2C-T-2, 2C-T-7, 2C-C, 2C-I)
      - 2,4,5-Ring substituted amphetamines (e.g. TMA-2, STP/DOM, DOB, DOC, DOI, DOET)
   - Other ring substitution patterns (phenethylamines and amphetamines) (e.g. Mescaline, PMA, PMMA, DMA, TMA, 4-MTA)

II.4.1.1.1. Classification and respective definitions
II.4.1.1.2. Description of compounds, physical and chemical characteristics, stereochemistry
II.4.1.1.3. Illicit ATS manufacture, including synthesis of amphetamine, methamphetamine and ring-substituted ATS (XTC-group etc)
II.4.1.1.4. Pharmacology of Amphetamine Type Stimulants
II.4.1.1.5. Legal aspects concerning Amphetamine Type Stimulants in national/international Legislation

II.4.1.2. Familiarity with the protocol for the analysis of Amphetamine Type Stimulants (including sampling, physical description, extraction, presumptive (colour/microcrystal/anion) tests, optical isomer analysis, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls)

II.4.1.3. Familiarity with additional analytical techniques for the analysis of Amphetamine Type Stimulants
II.4.1.4. Ability to perform identification of ATS in illicit materials
II.4.1.5. Ability to perform quantification of ATS in illicit materials

II.4.2. Modes of Instruction – Training Aids

II.4.2.1. Studying of suggested references/assignments
II.4.2.2. Clarification on questions
II.4.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions
II.4.2.4. Demonstrations of samples and of analysis by trainer, with explanations
II.4.2.5. Interpretation of results and discussion including limitations
II.4.2.6. Application of qualitative/quantitative analysis on known samples of ATS by trainee
II.4.2.7. Application of qualitative/quantitative analysis on unknown samples of ATS by trainee
II.4.2.8. Discussion

II.4.3. References

II.4.3.4. “Colour tests for precursor chemicals of Amphetamine-Type Substances: The use of colour tests for distinguishing between Ephedrine-Derivatives”, UNODC, SCITEC/20, December 2005
II.4.3.5. “Colour tests for precursor chemicals of amphetamine-type substances: Systematic study of colour tests for saffrole and saffrole-rich essential oils”, UNODC, SCITEC/21, December 2007
II.4.3.6. “Clandestine Manufacture of Substances under International Control”, UNODC, ST/NAR/10/Rev.3.
II.4.3.8. “A practical guide to methamphetamine characterization/impurity profiling: Method procedures, mass spectral data of selected impurities, and literature reference”, UNODC, SCITEC/17, August 2000
II.4.3.9. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences.
II.4.3.10. “Analysis of Drugs Manual”, United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
II.4.3.12. “The Analysis of Controlled Substances”, Michael D. Cole, John Wiley & Sons Ltd., The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England
II.4.3.15. “Clandestine Laboratory Guide for Agents and Chemists”, U.S. Department of Justice, Drug Enforcement Administration, Office of Science and Technology
II.4.3.18. “Psychotropic Substances of the Amphetamine Type used by Drug Addicts in Bulgaria - Synthesis and Medicinal Forms Analytical Methods of Identification”, UNODC, SCITEC/10, September 1994
II.4.3.20. “Studies on Fenetylline, Part I: Selected Methods for Identification in Illicit Samples”, UNODC, SCITEC/8, October 1990
II.4.3.25. “Rapid and sensitive technique for the differentiation of the optical isomeric forms of methamphetamine and amphetamine”, Cunningham, M. D. (1973). Microgram, vol. 6, No. 6, pp. 87-95

II.4.4. Assessment
II.4.4.1. Study questions (oral, written)
II.4.4.2. Preparation of samples and reagents (practical)
II.4.4.3. Distribution and application of analysis on unknown samples (practical)
II.4.4.4. Courtroom exercise (mini-mock trial)
II. DRUGS OF ABUSE

II.5. LSD AND HALLUCINOGENS (MESCALINE, PSILOCYBIN/PSILOCIN)

II.5.1. Objectives

II.5.1.1. Familiarity with the products containing LSD, Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines, Mescalin (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc, also referred to in section “ATS”):

II.5.1.1.1. Description/recognition of illicit products containing LSD, Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines, Mescalin (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc)

II.5.1.1.2. Illicit production/manufacture of LSD, Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines, Mescalin (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc)

II.5.1.1.3. Chemical compounds, structures and pharmacology of LSD products. Chemical constituents of forensic interest in and pharmacology of Peyote Cactus, Mescal Buttons and Psilocybe Mushrooms, as well as other substituted tryptamines and other hallucinogenic phenethylamines

II.5.1.1.4. Legal aspects concerning LSD, Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines, Mescalin (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc) in national/international Legislation

II.5.1.2. Familiarity with the protocol for the analysis of LSD products (including physical identification, sampling, extraction, presumptive tests –fluorescence/colour/crystal tests-, TLC, GC, GC/MS, HPLC, FT-IR, analytical challenges)

II.5.1.3. Familiarity with the protocol for the analysis of Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines (including physical -macroscopic and microscopic characteristics- identification, sampling, extraction, presumptive -colour- tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, special pitfalls)

II.5.1.4. Familiarity with the protocol for the analysis of Mescalin (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc) (including physical -macroscopic and microscopic characteristics- identification, sampling, extraction, presumptive -colour- tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, special pitfalls)

II.5.1.5. Familiarity with additional analytical techniques for the analysis of LSD and hallucinogens (substituted tryptamines and hallucinogenic phenethylamines)

II.5.1.6. Ability to perform identification of LSD, Mescalin, Psilocybin/Psilocin, and other substituted tryptamines and hallucinogenic phenethylamines, in illicit materials, including Peyote Cactus, Mescal Buttons and Psilocybe Mushrooms

II.5.1.7. Ability to perform quantification of LSD, Mescalin, Psilocybin/Psilocin and other substituted tryptamines and hallucinogenic phenethylamines, in illicit materials, including Peyote Cactus, Mescal Buttons and Psilocybe Mushrooms

II.5.2. Modes of Instruction – Training Aids

II.5.2.1. Studying of suggested references/assignments

II.5.2.2. Clarification on questions

II.5.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

II.5.2.4. Demonstrations of samples and of analysis by trainer, with explanations

II.5.2.5. Interpretation of results and discussion including limitations

II.5.2.6. Application of qualitative/quantitative analysis on known samples of illicit materials containing LSD and hallucinogens by trainer

II.5.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

II.5.2.8. Discussion

II.5.3. References

II.5.3.2. "Recommended Methods for Testing Lysergide (LSD)", UNODC, ST/NAR/17, January 1989
II.5.3.3. "Recommended Methods for Testing Peyote Cactus (Mescal Buttons)/Mescaline and Psilocybe Mushrooms/Psilocybin", UNODC, ST/NAR/19, December 1989
II.5.3.8. "The Analysis of Controlled Substances", Michael D. Cole, John Wiley & Sons Ltd., The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England
II.5.3.10. "Controlled Substances Training Manual", Virginia Department of Forensic Science, DFS Document 221-D200, Revision 2, December 2014 (or latest revision).
II.5.3.12. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
II.5.3.13. "Analysis of Drugs Manual", United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
II.5.3.20. "Clandestine Laboratory Guide for Agents and Chemists", U.S. Department of Justice, Drug Enforcement Administration, Office of Science and Technology

II.5.4. Assessment

II.5.4.1. Study questions (oral, written)
II.5.4.2. Preparation of samples and reagents (practical)
II.5.4.3. Distribution and application of analysis on unknown samples (practical)
II.5.4.4. Courtroom exercise (mini-mock trial)
II. DRUGS OF ABUSE

II.6. OTHER DRUGS AND PHARMACEUTICALS

II.6.1. Objectives

II.6.1.1. Familiarity with the illicit materials and pharmaceutical preparations containing controlled substances, as well as “designer” or new drugs, namely:
- benzodiazepine derivatives
- barbiturate derivatives
- synthetic opioids (pethidine, fentanyl and analogues, methadone, d-propoxyphene etc)
- GHB / GBL
- PCP and analogues, ketamine
- etc

II.6.1.1.1. Description/recognition of illicit materials and pharmaceutical preparations (physical appearance, morphological characteristics, markings)

II.6.1.1.2. Production/manufacture of illicit materials containing controlled substances

II.6.1.1.3. Chemical constituents of forensic significance of illicit materials and pharmaceutical preparations containing controlled substances

II.6.1.1.4. Structures and pharmacology of illicit materials and pharmaceutical preparations containing controlled substances

II.6.1.1.5. Legal aspects concerning illicit materials and pharmaceutical preparations containing controlled substances in national/international Legislation

II.6.1.2. Familiarity with the protocol for the analysis of illicit materials and pharmaceutical preparations containing controlled substances (including sampling, physical identification, presumptive tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls)

II.6.1.3. Familiarity with additional analytical techniques for the analysis of other drugs and pharmaceuticals

II.6.1.4. Ability to perform identification of illicit materials and pharmaceutical preparations containing controlled substances

II.6.1.5. Ability to perform quantification of illicit materials and pharmaceutical preparations containing controlled substances

II.6.2. Modes of Instruction – Training Aids

II.6.2.1. Studying of suggested references/assignments

II.6.2.2. Clarification on questions

II.6.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

II.6.2.4. Demonstrations of samples and of analysis by trainer, with explanations

II.6.2.5. Interpretation of results and discussion including limitations

II.6.2.6. Application of qualitative/quantitative analysis on known samples of illicit materials containing pharmaceuticals and other drugs by trainee

II.6.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

II.6.2.8. Discussion

II.6.3. References


II.6.3.6. “Studies on Colour Tests for Field Detection of Narcotic Drugs and Psychotropic Substances under International Control (No. II). Screening Colour Test and Specific Colour Test for the..."
Detection of Non-barbiturate Sedatives and Hypnotics: Methaqualone and Mecloqualone”, SCITEC/13, December 1996

II.6.3.7. “The Analysis of Controlled Substances”, Michael D. Cole, John Wiley & Sons Ltd., The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England


II.6.3.15. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

II.6.3.16. “Analysis of Drugs Manual”, United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

II.6.3.17. “Clandestine Laboratory Guide for Agents and Chemists”, U.S. Department of Justice, Drug Enforcement Administration, Office of Science and Technology


II.6.3.23. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009

II.6.4. Assessment

II.6.4.1. Study questions (oral, written)

II.6.4.2. Preparation of samples and reagents (practical)

II.6.4.3. Distribution and application of analysis on unknown samples (practical)

II.6.4.4. Courtroom exercise (mini-mock trial)
II. DRUGS OF ABUSE

II.7. PROHIBITED SUBSTANCES IN DOPING CONTROL

II.7.1. Objectives

II.7.1.1. Familiarity with the illicit materials and pharmaceutical preparations containing substances prohibited in doping control, as described in the WADA list including:

- Anabolic agents (e.g. steroids) such as stanolone, methanedienone, nandrolone deconroate, testosterone, testosterone propionate
  - Familiarity with steroids classification (androgens, estrogens, adrenals) and steroid preparations
  - Descriptions of steroid formulations (oils, tablets, suspensions)
  - Chemical constituents of forensic significance
  - Structures and pharmacology of steroid preparations
  - Legal aspects concerning steroids
  - Familiarity with the protocol for analysis of steroids, for example, the advantages and limitations of the utilization of extractions, Kovat’s indices, TLC, IR and GC/MS.

- Additional Prohibited Substances and Methods including:
  - Peptide hormones, growth factors
  - Beta-2 agonists
  - Hormone antagonists and modulators
  - Diuretics and other masking agents

II.7.1.1.1. Description/recognition of illicit materials and pharmaceutical preparations (physical appearance, morphological characteristics, markings)

II.7.1.1.2. Production/manufacture of illicit materials containing substances prohibited in doping control

II.7.1.1.3. Chemical constituents of forensic significance of illicit materials and pharmaceutical preparations containing substances prohibited in doping control

II.7.1.1.4. Structures and pharmacology of illicit materials and pharmaceutical preparations containing substances prohibited in doping control

II.7.1.1.5. Legal aspects concerning illicit materials and pharmaceutical preparations containing substances prohibited in doping control in national/international Legislation

II.7.1.2. Familiarity with the protocol for the analysis of illicit materials and pharmaceutical preparations containing substances prohibited in doping control (including sampling, physical identification, presumptive tests, GC/NPD, GC/MS, LC/MS, analytical challenges, special pitfalls)

II.7.1.3. Familiarity with additional analytical techniques (electrophoresis, ELISA, RIA-IRMA) for the analysis of substances prohibited in doping control

II.7.1.4. Ability to perform identification of illicit materials and pharmaceutical preparations containing substances prohibited in doping control

II.7.1.5. Ability to perform quantification of illicit materials and pharmaceutical preparations containing substances prohibited in doping control

II.7.2. Modes of Instruction – Training Aids

II.7.2.1. Studying of suggested references/assignments

II.7.2.2. Clarification on questions

II.7.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

II.7.2.4. Demonstrations of samples and of analysis by trainer, with explanations

II.7.2.5. Interpretation of results and discussion including limitations

II.7.2.6. Application of qualitative/quantitative analysis on known samples of illicit materials containing substances prohibited in doping control by trainee

II.7.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

II.7.2.8. Discussion
II.7.3. References


II.7.3.5. Ayotte C, Pascaul J A, Gmeiner G, et al. Harmonization of the method for the identification of recombinant erythropoietins (i.e. epoetins) and analogues (e.g. darbepoetin and methoxyxypolyethylene glycol-epoetin beta). WADA technical document TD2009EPO, September 15, 2009.

II.7.3.6. WADA Laboratory Committee, Decision Limits for the Confirmatory Quantification of Threshold Substances, WADA technical document TD2010MRPL, September 01, 2010.


II.7.3.22. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences.


II.7.4. Assessment

II.7.4.1. Study questions (oral, written)
II.7.4.2. Preparation of samples and reagents (practical)
II.7.4.3. Distribution and application of analysis on unknown samples (practical)
II.7.4.4. Courtroom exercise (mini-mock trial)
III. PRODUCTION/MANUFACTURE OF DRUGS OF ABUSE

III.1. PRECURSORS (Substances Frequently Used in the Illicit Manufacture of Narcotic Drugs or Psychotropic Substances)

III.1.1. Objectives

III.1.1.1. Familiarity with the substances frequently used in the illicit production/manufacture of narcotic drugs or psychotropic substances:
   III.1.1.1.1. Description/recognition of the scheduled chemical substances used in the illicit production/manufacture of drugs of abuse, including their CAS and HS numbers, synonyms, physical appearance, chemical structure, properties, and their legitimate and illicit uses
   III.1.1.1.2. Information on the essential precursors / raw materials, chemicals / reagents, and solvents known to have been used in the illicit production/manufacture of the most frequently trafficked/abused narcotic drugs and psychotropic substances, including common alternative or substitute chemicals and pre-precursors
   III.1.1.1.3. Information on the production/manufacture of controlled substances, including description/recognition of synthetic and production routes and the processes used in clandestine laboratories
   III.1.1.1.4. General information on the physical characteristics and safety requirements for the handling and storage of precursors, chemicals / reagents and solvents under international control
   III.1.1.1.5. Legal and scientific issues related to the destruction of seized narcotic drugs, psychotropic substances, precursors and essential chemicals, as well as to clandestine laboratory investigations

III.1.1.2. Familiarity with the protocols for the analysis of the chemical substances most frequently used in the illicit production/manufacture of drugs of abuse (including mixtures, isomers and “markers”): sampling, physical identification, presumptive tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls

III.1.1.3. Familiarity with additional analytical techniques for the analysis of the chemical substances most frequently used in the illicit production/manufacture of drugs of abuse

III.1.1.4. Ability to perform identification of the chemical substances most frequently used in the illicit production/manufacture of drugs of abuse

III.1.1.5. Ability to perform quantification of the chemical substances most frequently used in the illicit production/manufacture of drugs of abuse

III.1.2. Modes of Instruction – Training Aids

III.1.2.1. Studying of suggested references/assignments
   III.1.2.2. Clarification on questions
   III.1.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions
   III.1.2.4. Demonstrations of samples and of analysis by trainer, with explanations
   III.1.2.5. Interpretation of results and discussion including limitations
   III.1.2.6. Application of qualitative/quantitative analysis on known samples of chemical substances most frequently used in the illicit manufacture of drugs of abuse by trainee
   III.1.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee
   III.1.2.8. Discussion

III.1.3. References

III.1.3.1. “Understanding clandestine synthetic drugs”, UNODC, June 2001
III.1.3.2. “Data Sheets on Substances Frequently Used in the Illicit Manufacture of Narcotic Drugs or Psychotropic Substances”, SCITEC/9/REV.2, 2009.
III.1.3.3. “Basic Information on Essential Chemicals/Precursors of the 1988 Convention for Use by Law Enforcement Officers”, UNODC, SCITEC/11, April 1996
III.1.3.4. “Colour tests for precursor chemicals of Amphetamine-Type Substances: The use of colour tests for distinguishing between Ephedrine-Derivatives”, UNODC, SCITEC/20, December 2005
III.1.3.5. “Colour tests for precursor chemicals of amphetamine-type substances: Systematic study of colour tests for safrole and safrole-rich essential oils”, UNODC, SCITEC/21, December
III.1.3.6. “Clandestine Manufacture of Substances under International Control”, UNODC, ST/NAR/10/Rev.3.

III.1.3.7. “Clandestine Laboratory Guide for Agents and Chemists”, United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences


III.1.3.9. “Chemicals used in the Clandestine Production of Drugs”, US Department of Justice, Drug Enforcement Administration, Office of Diversion Control, Drug and Chemical Evaluation Section

III.1.3.10. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

III.1.3.11. “Analysis of Drugs Manual”, United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences


III.1.3.14. “Multilingual Dictionary of Precursors and Chemicals frequently used in the Illicit Manufacture of Narcotic Drugs and Psychotropic Substances under International Control” (MLD), UNODC, ST/NAR/1A, 2009


III.1.3.18. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009

III.1.4. Assessment

III.1.4.1. Study questions (oral, written)

III.1.4.2. Preparation of samples and reagents (practical)

III.1.4.3. Distribution and application of analysis on unknown samples (practical)

III.1.4.4. Courtroom exercise (mini-mock trial)
III. PRODUCTION/MANUFACTURE OF DRUGS OF ABUSE

III.2 CLANDESTINE LABORATORIES

III.2.1. Objectives

III.2.1.1. Knowledge of the substances used in the clandestine production/manufacture of narcotic drugs and psychotropic substances:
- III.2.1.1.1. Essential precursors/raw materials
- III.2.1.1.2. Chemicals/reagents
- III.2.1.1.3. Solvents
- III.2.1.1.4. Knowledge of synonyms, physical appearance and characteristics, hazardous properties, legitimate and illicit use, storage and handling conditions for the substances used in the production/manufacture of drugs
- III.2.1.1.5. EU Voluntary Monitoring List
- III.2.1.1.6. Pre-precursors and alternative or substitute chemicals
- III.2.1.1.7. Awareness of classification in national, EU, international legislation

III.2.1.2. Knowledge of the production/manufacture of controlled substances:
- III.2.1.2.1. Production/manufacture of the substances under control most frequently encountered in the illicit market
- III.2.1.2.2. Various synthesis/processing schemes and routes
- III.2.1.2.3. Precursors, reagents and solvents used, respectively, per substance produced/manufactured
- III.2.1.2.4. Hazards and yields of synthetic route
- III.2.1.2.5. Synthesis of precursors

III.2.1.3. Knowledge of the investigation and dismantling of clandestine laboratories:
- III.2.1.3.1. Risk assessment (incl. criminal hazards, physical hazards, chemical hazards) in a clandestine laboratory
- III.2.1.3.2. Risk management (use of detection devices and personal protective equipment)
- III.2.1.3.3. Processing of a clandestine laboratory:
  - Registration
    - Documenting
    - Collection of evidence
    - Sampling
    - Storage and transport of samples and evidence
- III.2.1.3.4. Disposal of chemicals and cleanup of laboratory site

III.2.2. Modes of Instruction – Training Aids

III.2.2.1. Studying of suggested references/assignments
III.2.2.2. Clarification on questions
III.2.2.3. Demonstrations by trainer with explanations (in mock laboratory or real cases)
III.2.2.4. Practical exercise on investigation, risk assessment, risk management, processing of the laboratory, registration, documenting, sampling, disposal
III.2.2.5. Discussion

III.2.3. References

III.2.3.1. “Understanding clandestine synthetic drugs”, UNODC, June 2001
III.2.3.2. “Data Sheets on Substances Frequently Used in the Illicit Manufacture of Narcotic Drugs or Psychotropic Substances”, SCITEC/9/REV.2, 2009.
III.2.3.3. “Clandestine Manufacture of Substances under International Control”, UNODC, ST/NAR/10/Rev.3.
III.2.3.5. “Clandestine Laboratory Guide for Agents and Chemists”, United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
III.2.3.6. “Chemicals used in the Clandestine Production of Drugs”, US Department of Justice, Drug Enforcement Administration, Office of Diversion Control, Drug and Chemical Evaluation Section
III.2.3.7. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice,
III.2.3.8. “DRCHIS: Drugs geRelateerd CHe micalien Informatie Systeem”, A. Elissen, M.L. Hordijk, Dutch National Criminal Intelligence Division, May 1999


III.2.4. Assessment

III.2.4.1. Study questions (oral, written)

III.2.4.2. Practical exercise in a simulated environment of a clandestine laboratory: Investigation, risk assessment, risk management, processing of the laboratory, registration, documenting, sampling

III.2.4.3. Courtroom exercise (mini-mock trial)
IV. ANALYTICAL TECHNIQUES

IV.1. SEPARATIONS AND EXTRACTIONS OF ILLICIT MATERIALS

IV.1.1. Objectives

IV.1.1.1. Knowledge of the principle/theory of Separations and Extractions in drug analysis:
- IV.1.1.1.1. Awareness of the factors which affect separations
- IV.1.1.1.2. Knowledge of the criteria for selection of solvent systems, including safety and cost
- IV.1.1.1.3. Familiarity with extraction techniques
- IV.1.1.1.4. Awareness of possible problems and likely causes/solutions
- IV.1.1.1.5. Use of solubility to separate mixtures of drugs and diluents
- IV.1.1.1.6. Definition of pKa and the Henderson Hasselbach equation
- IV.1.1.1.7. Basic drug extractions using aqueous/organic solvents
- IV.1.1.1.8. Acidic drug extractions using aqueous/organic solvents
- IV.1.1.1.9. Amphoteric drug extractions using aqueous/organic solvents
- IV.1.1.1.10. Neutral drug extractions using aqueous/organic solvents
- IV.1.1.1.11. Specialty (difficult) type extractions

IV.1.1.2. Knowledge of the application of Solid Phase extraction (SPE) in drug analysis.

IV.1.1.3. Knowledge of chromatographic separation techniques:
- IV.1.1.3.1. Use of preparative column
- IV.1.1.3.2. Use of Silica and Fluorosil columns
- IV.1.1.3.3. Column preparation, loading and eluting

IV.1.1.4. Knowledge of the possibilities and limitations of the technique

IV.1.2. Modes of Instruction – Training Aids

IV.1.2.1. Studying of suggested references/assignments
IV.1.2.2. Clarification on questions
IV.1.2.3. Preparation of different extraction solvent reagents including review of safety precautions
IV.1.2.4. Demonstrations by trainer: execution of extraction techniques, with explanations
IV.1.2.5. Interpretation of results and discussion
IV.1.2.6. Application of extractions on reference/known samples by trainee
IV.1.2.7. Application of extractions on unknown samples by trainee
IV.1.2.8. Discussion

IV.1.3. References

IV.1.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences.
IV.1.3.2. “Clarke’s Analysis of Drugs and Poisons”, Moffat, Anthony C; Osselton, M David; Widdop, Brian; Watts, Jo, 4th ed., (2011), Pharmaceutical Press.

IV.1.4. Assessment

IV.1.4.1. Study questions (oral, written)
IV.1.4.2. Application of separation and extraction techniques on reference or known samples
IV.1.4.3. Distribution of and application of separation and extraction techniques on unknown samples (practical)
IV.1.4.4. Courtroom exercise (mini-mock trial)
IV. ANALYTICAL TECHNIQUES

IV.2. PRESUMPTIVE TESTS:
COLOUR (SPOT) TESTS, CRYSTAL TESTS, PRECIPITATION/ANION TESTS

IV.2.1. Objectives

IV.2.1.1. Knowledge of the theory and principles of the colour, crystal and anion tests
IV.2.1.2. Familiarity with the preparation, handling and storage of the reagents
IV.2.1.3. Ability to execute colour/crystal/anion tests on drugs most commonly encountered in the illicit traffic
IV.2.1.4. Ability to interpret the results obtained
IV.2.1.5. Knowledge of the possibilities and limitations of the technique
IV.2.1.6. Knowledge of quality assurance and method validation requirements

IV.2.2. Modes of Instruction – Training Aids

IV.2.2.1. Studying of suggested references/assignments
IV.2.2.2. Clarification on questions
IV.2.2.3. Preparation of different reagents including review of safety precautions
IV.2.2.4. Demonstrations by trainer: execution of the colour/crystal/anion tests, with explanations
IV.2.2.5. Interpretation of results and discussion including limitations
IV.2.2.6. Application of colour/crystal/anion tests on reference/known samples by trainee
IV.2.2.7. Application of colour/crystal/anion tests on unknown samples by trainee
IV.2.2.8. Discussion

IV.2.3. References

IV.2.3.2. “Chemistry and Reaction Mechanisms of Rapid Tests for Drugs of Abuse and Precursor Chemicals”, UNODC, SCITEC/6, February, 1989
IV.2.3.3. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
IV.2.3.7. “Controlled Substances Training Manual”, Virginia Department of Forensic Science, DFS Document 221-D200, Revision 2, December 2014
IV.2.3.8. “Controlled Substances Procedures Manual”, Virginia Department of Forensic Science, DFS Document 221-D100, Revision 15, August 2014
IV.2.3.9. “Studies on Colour Tests for Field Detection of Narcotic Drugs and Psychotropic Substances under International Control (No. II). Screening Colour Test and Specific Colour Test for the Detection of Non-barbiturate Sedatives and Hypnotics: Methaqualone and Mecloqualone”, UNODC, SCITEC/13, December 1996
IV.2.3.10. “The Identification and Analysis of Benzodiazepines under International Control: LC. Colour Tests and Chromatographic Methods”, UNODC, SCITEC/1, December 1987
IV.2.3.12. “Microcrystal Test”, Ono, M., Japan, 1996
IV.2.3.13. “Rapid and sensitive technique for the differentiation of the optical isomeric forms of methamphetamine and amphetamine”, Cunningham, M. D. (1973). Microgram, vol. 6, No. 6, pp. 87-95
IV.2.3.15. "Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories”, ST/NAR/2 Rev. 1, United Nations Office on Drugs and Crime, 2011
IV.2.3.16. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009
IV.2.3.17. “Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41”, UNODC, 2009

IV.2.3.18. U.S. Pharmacopeia National Formulary, USP XX, 1980

IV.2.4. Assessment

IV.2.4.1. Study questions (oral, written)
IV.2.4.2. Preparation of reagents (practical)
IV.2.4.3. Application of colour/crystal/anion tests on unknown sample (practical)
IV.2.4.4. Courtroom exercise (mini-mock trial)
IV. ANALYTICAL TECHNIQUES

IV.3. THIN LAYER CHROMATOGRAPHY (TLC)

IV.3.1. Objectives

IV.3.1.1. Knowledge of the principle/theory of Thin Layer Chromatography in drug analysis:
   IV.3.1.1.1. Awareness of the factors which affect separations (stationary phase, mobile phase, sample, conditions)
   IV.3.1.1.2. Knowledge of the criteria for selection of solvent systems, including safety and cost
   IV.3.1.1.3. Familiarity with visualization techniques
   IV.3.1.1.4. Knowledge of various visualization spray reagents for various applications
   IV.3.1.1.5. Knowledge of possible problems and likely causes/solutions
   IV.3.1.1.6. Knowledge of quality assurance and method validation requirements

IV.3.1.2. Knowledge of the application of Thin Layer Chromatography in drug analysis:
   IV.3.1.2.1. Familiarity with the TLC equipment and associated operational procedures (pre-treatment of plates, selection of suitable solvent systems, application of samples, running the plates, location procedures, visualization, storage of chromatograms)
   IV.3.1.2.2. Ability to design and use multi-development and two-dimensional TLC experiments
   IV.3.1.2.3. Ability to resolve issues such as spot overlapping and tailing
   IV.3.1.2.4. Practice in the use of high-performance TLC (HPTLC)
   IV.3.1.2.5. Experience with preparative techniques
   IV.3.1.2.6. Experience in quantitative TLC
   IV.3.1.2.7. Ability in the execution of TLC to reference/known samples as well as on drugs most commonly encountered in the illicit traffic

IV.3.1.3. Ability to interpret the results obtained

IV.3.1.4. Knowledge of the possibilities and limitations of the technique

IV.3.2. Modes of Instruction – Training Aids

IV.3.2.1. Studying of suggested references/assignments
IV.3.2.2. Clarification on questions
IV.3.2.3. Preparation of different development solvents/visualization reagents including review of safety precautions
IV.3.2.4. Demonstrations by trainer: execution of TLC, with explanations
IV.3.2.5. Interpretation of results and discussion
IV.3.2.6. Application of TLC on reference/known samples by trainee
IV.3.2.7. Application of TLC on unknown samples by trainee
IV.3.2.8. Discussion

IV.3.3. References

IV.3.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
IV.3.3.7. “Controlled Substances Training Manual”, Virginia Department of Forensic Science, DFS Document 221-D200, Revision 2, December 2014
IV.3.3.8. “Controlled Substances Procedures Manual”, Virginia Department of Forensic Science, DFS Document 221-D100, Revision 15, August 2014

IV.3.4. Assessment

IV.3.4.1. Study questions (oral, written)
IV.3.4.2. Preparation of reagents (practical)
IV.3.4.3. Distribution and application of TLC on unknown samples (practical)
IV.3.4.4. Courtroom exercise (mini-mock trial)
IV. ANALYTICAL TECHNIQUES

IV.4. GAS CHROMATOGRAPHY (GC)
including GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

IV.4.1. Objectives

IV.4.1.1. Knowledge of the principle/theory of Gas Chromatography (including GC/MS) in drug analysis:

   IV.4.1.1.1. Awareness of the mechanism of separations, including support materials, stationary phases, carrier gas and operating temperature, and relevant criteria
   IV.4.1.1.2. Familiarity with the various instrumental components and their functions, including injection port, column and detectors (FID, NPD, ECD, MS)
   IV.4.1.1.3. Familiarity with the MS components and their functions, including sample inlet, ionisation, ion separation, ion detection and amplification, output of results
   IV.4.1.1.4. Knowledge of the theory and mechanism of GC/MS as an identification technique, fragmentation process and spectra interpretation
   IV.4.1.1.5. Knowledge of derivatisation techniques, advantages and disadvantages
   IV.4.1.1.6. Knowledge of qualitative and quantitative determinations using GC
   IV.4.1.1.7. Awareness of common operational problems and causes, pitfalls and troubleshooting, preventive maintenance
   IV.4.1.1.8. Knowledge of concept of quality assurance and method validation

IV.4.1.2. Ability in the application of GC and GC/MS in drug analysis:

   IV.4.1.2.1. Ability to prepare samples and avoid cross contamination
   IV.4.1.2.2. Familiarity with/practice in the GC instrumentation and software,
   IV.4.1.2.3. Familiarity with/practice in the GC/MS instrumentation and software
   IV.4.1.2.4. Familiarity with the operational procedures, including control of instrument
   IV.4.1.2.5. Knowledge of choice criteria and ability to determine suitable conditions and to design experiments aiming at optimum separations
   IV.4.1.2.6. Practice in the application of GC and GC/MS methodology for qualitative and quantitative analysis of drugs most commonly encountered

IV.4.1.3. Capacity of interpretation of the results obtained. Ability to perform library search (GC/MS) and interpret spectra

IV.4.1.4. Understanding the possibilities and limitations of the technique

IV.4.2. Modes of Instruction – Training Aids

   IV.4.2.1. Studying of suggested references/assignments
   IV.4.2.2. Clarification on questions
   IV.4.2.3. Demonstrations by trainer: execution of GC and GC/MS analysis, with explanations
   IV.4.2.4. Interpretation of results and discussion
   IV.4.2.5. Application of GC and GC/MS on reference/known samples by trainee
   IV.4.2.6. Application of GC and GC/MS on unknown samples by trainee, qualitative and quantitative determination
   IV.4.2.7. Discussion

IV.4.3. References

   IV.4.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences.
   IV.4.3.3. “Gas Chromatography” - Analytical Chemistry by Open Learning, Ian A. Fowlis, (Paperback), John Wiley & Sons Ltd, Baffins Lane, Chichester, West Sussex P019, England, 1995.
IV.4.3.11. “Chromatographic Separations” - Analytical Chemistry By Open Learning, Peter A. Sewell, Brian Clarke, David Kealey, John Wiley & Sons Ltd, 1988
IV.4.3.12. “Quantitative analysis using chromatographic techniques” - Analytical Chemistry By Open Learning, Elena Katz, John Wiley & Sons Ltd, 1987
IV.4.3.15. ENFSI DWG Mass Spectral Library
IV.4.3.20. “Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41”, UNODC, 2009
IV.4.3.21. GC instrumental manuals of laboratory.
IV.4.3.22. GC/MS instrumental manuals of laboratory

IV.4.4. Assessment

IV.4.4.1. Study questions (oral, written)
IV.4.4.2. Preparation and GC and GC/MS qualitative analysis of unknown samples (practical)
IV.4.4.3. Preparation and GC and GC/MS quantitative analysis of unknown samples (practical)
IV.4.4.4. Courtroom exercise (mini-mock trial)
IV. ANALYTICAL TECHNIQUES

IV.5. HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) including LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS)

IV.5.1. Objectives

IV.5.1.1. Knowledge of the principle/theory of HPLC incl. LC/MS in drug analysis:
   IV.5.1.1.1. Knowledge of the mechanism of separations, including stationary phases (columns, criteria of choice), mobile phase (types, uses, composition) and temperature
   IV.5.1.1.2. Familiarity with the various instrumental components and their functions including injections port, column and detector (DAD, MS).
   IV.5.1.1.3. Familiarity with the MS components and their functions, including sample inlet, ionisation, ion separation, ion detection and amplification, output of results
   IV.5.1.1.4. Awareness of the mechanism of HPLC incl. LC/MS as an identification technique
   IV.5.1.1.5. Qualitative and quantitative determinations using HPLC and LC/MS
   IV.5.1.1.6. Awareness of common operational problems and causes, pitfalls and troubleshooting, preventive maintenance
   IV.5.1.1.7. Knowledge of quality assurance and method validation requirements

IV.5.1.2. Knowledge of the application of HPLC and LC/MS in drug analysis:
   IV.5.1.2.1. Familiarity with the HPLC and LC/MS instrumentation and software
   IV.5.1.2.2. Familiarity with the operational procedures including control of instrument
   IV.5.1.2.3. Ability to design experiments aiming at selecting operating conditions for optimum separations
   IV.5.1.2.4. Practice in the application of HPLC and LC/MS methodology in the qualitative and quantitative analysis of drugs most commonly encountered

IV.5.1.3. Capacity of understanding and interpretation of the results obtained
IV.5.1.4. Ability to perform library search (LC/MS) and interpret spectra
IV.5.1.5. Understanding the possibilities and limitations of the technique

IV.5.2. Modes of Instruction – Training Aids

IV.5.2.1. Studying of suggested references/assignments
IV.5.2.2. Clarification on questions
IV.5.2.3. Demonstrations by trainer: execution of HPLC and LC/MS analysis, with explanations
IV.5.2.4. Interpretation of results and discussion
IV.5.2.5. Application of HPLC and LC/MS on reference/known samples by trainee
IV.5.2.6. Application of HPLC and LC/MS on unknown samples by trainee, qualitative and quantitative determination
IV.5.2.7. Discussion

IV.5.3. References

IV.5.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
IV.5.3.2. “Clarke’s Analysis of Drugs and Poisons”, Moffat, Anthony C; Osselton, M David; Widdop, Brian; Watts, Jo, 4th ed., (2011), Pharmaceutical Press.
IV.5.3.4. “High-Performance Liquid Chromatography in Forensic Chemistry”, Lurie IS, 1983
IV.5.3.5. “Liquid Chromatography/Mass Spectrometry – Application in Agricultural, Pharmaceutical, and Environmental Chemistry”, Mark A. Brown, Editor, American Chemical Society, Washington DC, 1990
IV.5.3.6. “Chromatographic Separations” - Analytical Chemistry By Open Learning Peter A. Sewell, Brian Clarke, David Kealey, John Wiley & Sons Ltd, 1988
IV.5.3.7. “Quantitative analysis using chromatographic techniques” - Analytical Chemistry By Open Learning, Elena Katz, John Wiley & Sons Ltd, 1987


IV.5.3.15. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009

IV.5.3.16. “Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41”, UNODC, 2009

IV.5.3.17. HPLC instrumental manuals of laboratory

IV.5.3.18. LC/MS instrumental manuals of laboratory

IV.5.4. Assessment

IV.5.4.1. Study questions (oral, written)

IV.5.4.2. Preparation HPLC and LC/MS qualitative analysis of unknown samples (practical)

IV.5.4.3. Preparation HPLC and LC/MS quantitative analysis of unknown samples (practical)

IV.5.4.4. Courtroom exercise (mini-mock trial)
IV. ANALYTICAL TECHNIQUES

IV.6. INFRA-RED SPECTROSCOPY (IR including FTIR)

IV.6.1. Objectives

IV.6.1.1. Knowledge of the principle/theory of IR in drug analysis:
- IV.6.1.1.1. Knowledge of the electromagnetic spectrum
- IV.6.1.1.2. Knowledge of the theory and mechanism of absorption and of vibrational and rotational spectroscopy
- IV.6.1.1.3. The Beer-Lambert Law
- IV.6.1.1.4. Knowledge of the mechanism of IR as an identification technique, (characteristic IR group frequencies and structure/spectra correlations)
- IV.6.1.1.5. Fourier transform infrared spectroscopy (FTIR) and the different techniques (KBr, ATR etc)
- IV.6.1.1.6. Familiarity with the various instrumental components and their functions
- IV.6.1.1.7. Awareness of common operational problems and causes, troubleshooting, preventive maintenance
- IV.6.1.1.8. Knowledge of quality assurance and method validation requirements

IV.6.1.2. Knowledge of the application of IR in drug analysis:
- IV.6.1.2.1. Familiarity with the (FT)IR instrumentation and software (dispersive and interferometric spectrophotometers, data processing)
- IV.6.1.2.2. Familiarity with the operational procedures (sample purification and preparation, identification and interpretation of spectra)
- IV.6.1.2.3. Practice in the application of IR methodology in the qualitative and quantitative analysis of drugs most commonly encountered
- IV.6.1.2.4. Proper use of spectral manipulations (e.g. subtraction, baseline correction, library searching)

IV.6.1.3. Ability to select operating parameters aiming at best results
IV.6.1.4. Practice in the preparation and handling of various kinds of samples
IV.6.1.5. Practice in the application of IR methodology in the analysis of drugs most commonly encountered
IV.6.1.6. Understanding the advantages and limitations of the technique
IV.6.1.7. Capacity of interpretation of the results obtained
IV.6.1.8. Experience in quantitative IR analysis

IV.6.2. Modes of Instruction – Training Aids

IV.6.2.1. Studying of suggested references/assignments
IV.6.2.2. Clarification on questions
IV.6.2.3. Demonstrations by trainer: execution of FTIR analysis, with explanations
IV.6.2.4. Interpretation of results and discussion
IV.6.2.5. Application of FTIR on reference/known samples by trainee
IV.6.2.6. Application of FTIR on unknown samples by trainee, qualitative and quantitative determination
IV.6.2.7. Discussion

IV.6.3. References

IV.6.3.7. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice,
Drug Enforcement Administration, Office of Forensic Sciences


IV.6.15. IR instrumental manuals of laboratory

IV.6.4. Assessment

IV.6.4.1. Study questions (oral, written)

IV.6.4.2. Sample preparation and IR qualitative analysis of unknown samples (practical)

IV.6.4.3. Sample preparation and IR quantitative analysis of unknown samples (practical)

IV.6.4.4. Courtroom exercise (mini-mock trial)
IV. ANALYTICAL TECHNIQUES

IV.7. ULTRA-VIOLET/VISIBLE SPECTROSCOPY (UV/VIS)

IV.7.1. Objectives

IV.7.1.1. Knowledge of the principle/theory of UV/VIS in drug analysis:
  IV.7.1.1.2. Parameters that define electromagnetic radiation (frequency, wavelength, wavenumber)
  IV.7.1.1.3. Laws of absorption: The Beer-Lambert Law
  IV.7.1.1.4. Mechanism of UV/VIS as an identification technique, including limitations
  IV.7.1.1.5. The influence of solvents and pH on spectra (wavelength maxima and band intensities)
  IV.7.1.1.6. Mechanism of UV/VIS as an quantitation technique (basic laws, single components, multi-component systems, colourimetric measurements, difference spectrophotometry, derivative spectrophotometry)
  IV.7.1.1.7. Knowledge of quality assurance and method validation requirements

IV.7.1.2. Knowledge of the application of UV/VIS in drug analysis:
  IV.7.1.2.1. Instrumentation (colourimeters, single-beam spectrophotometers, double-beam spectrophotometers, rapid-scanning spectrophotometers, absorption cells)
  IV.7.1.2.2. Preparation and handling of various kinds of samples
  IV.7.1.2.3. Application of UV/VIS methodology in the qualitative analysis of drugs
  IV.7.1.2.4. Application of UV/VIS methodology in the quantitative analysis of drugs
  IV.7.1.2.5. Awareness of common operational problems and causes, troubleshooting, preventive maintenance

IV.7.1.3. Familiarity with the UV/VIS instrumentation and software
IV.7.1.4. Familiarity with the operational procedures
IV.7.1.5. Ability to select operating parameters aiming at best results
IV.7.1.6. Practice in the application of UV/VIS methodology in the analysis of drugs most commonly encountered
IV.7.1.7. Understanding the advantages and limitations of the technique
IV.7.1.8. Capacity of interpretation of the results obtained
IV.7.1.9. Experience in quantitative UV/VIS analysis

IV.7.2. Modes of Instruction – Training Aids

IV.7.2.1. Studying of suggested references/assignments
IV.7.2.2. Clarification on questions
IV.7.2.3. Demonstrations by trainer: execution of UV/VIS analysis, with explanations
IV.7.2.4. Interpretation of results and discussion
IV.7.2.5. Application of UV/VIS on reference/known samples by trainee
IV.7.2.6. Application of UV/VIS on unknown samples by trainee, qualitative and quantitative determination
IV.7.2.7. Discussion

IV.7.3. References

IV.7.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences


IV.7.3.10. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009

IV.7.3.11. “Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41”, UNODC, 2009

IV.7.3.11. UV/VIS instrumental manuals of laboratory

IV.7.4. Assessment

IV.7.4.1. Study questions (oral, written)

IV.7.4.2. Sample preparation and UV/VIS qualitative analysis of unknown samples (practical)

IV.7.4.3. Sample preparation and UV/VIS quantitative analysis of unknown samples (practical)

IV.7.4.4. Courtroom exercise (mini-mock trial)
IV. ANALYTICAL TECHNIQUES

IV.8. SPECIAL TECHNIQUES (NMR, CE, SPME-GC, GC-FTIR)

IV.8.1. Objectives

IV.8.1.1. Knowledge of the principle/theory of special techniques in drug analysis:
   IV.8.1.1.1. General introduction and theory of techniques
   IV.8.1.1.2. Awareness of the mechanism of techniques as an identification means
   IV.8.1.1.3. Familiarity with the various instrumental components and their functions
   IV.8.1.1.4. Awareness of common operational problems and causes, troubleshooting, preventive maintenance
   IV.8.1.1.5. Knowledge of quality assurance and methods validation requirements

IV.8.1.2. Knowledge of the application of special techniques in drug analysis:
   IV.8.1.2.1. Sample preparation
   IV.8.1.2.2. Practice in the application of methodology in the qualitative and quantitative analysis of drugs most commonly encountered
   IV.8.1.2.3. Awareness of common operational problems and causes, troubleshooting, preventive maintenance

IV.8.1.3. Familiarity with the instrumentation and software

IV.8.1.4. Familiarity with the operational procedures

IV.8.1.5. Ability to select operating parameters aiming at best results

IV.8.1.6. Practice in the preparation and handling of various kinds of samples

IV.8.1.7. Practice in the application of methodology in the analysis of drugs most commonly encountered

IV.8.1.8. Understanding the advantages and limitations of the technique

IV.8.1.9. Capacity of interpretation of the results obtained

IV.8.1.10. Experience in quantitative analysis

IV.8.2. Modes of Instruction – Training Aids

IV.8.2.1. Studying of suggested references/assignments

IV.8.2.2. Clarification on questions

IV.8.2.3. Demonstrations by trainer: execution of analysis with explanations

IV.8.2.4. Interpretation of results and discussion

IV.8.2.5. Application of technique on reference/known samples by trainee

IV.8.2.6. Application of technique on unknown samples by trainee, qualitative and quantitative determination

IV.8.2.7. Discussion

IV.8.3. References

IV.8.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences


IV.8.3.5. “Infrared Spectroscopy – Analytical Chemistry by Open Learning” W.O. George, P.S. McIntyre, Editor: David J. Mowthorpe, John Wiley & Sons 1987

IV.8.3.6. “Controlled Substances Training Manual”, Virginia Department of Forensic Science, DFS Document 221-D200, Revision 2, December 2014

IV.8.3.7. “Controlled Substances Procedures Manual”, Virginia Department of Forensic Science, DFS Document 221-D100, Revision 15, August 2014


IV.8.3.11. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009

IV.8.3.11. “Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41”, UNODC, 2009

IV.8.3.12. Instrumental manuals of laboratory

IV.8.4. Assessment

IV.8.4.1. Study questions (oral, written)

IV.8.4.2. Sample preparation and qualitative analysis of unknown samples (practical)

IV.8.4.3. Sample preparation and quantitative analysis of unknown samples (practical)

IV.8.4.4. Courtroom exercise (mini-mock trial)
V. LEGISLATION (UN, EU, NATIONAL)

V.1. Objectives

V.1.1. Knowledge of the International (UN) legislation on drugs and drug precursors (including procedures related to international transfer of reference drug and precursor samples):

V.1.1.1. The Single Convention on Narcotic Drugs, 1961, as amended by the 1972 Protocol amending the Single Convention on Narcotic Drugs, 1961, including national status of treaty adherence

V.1.1.2. Convention on Psychotropic substances, 1971

V.1.1.3. Convention against the Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988, including national status of treaty adherence and the concept of the Limited International Surveillance List for precursors and the concept of the Limited Surveillance List for precursors

V.1.1.4. Classification of drugs and drug precursors in international legislation

V.1.1.5. Interpol procedure for transmission of controlled substances

V.1.2. Knowledge of the European Union (EU) legislation on drugs and drug precursors:


V.1.2.4. Guidance document agreed between the Commission services and the competent authorities of Member States on the implementation of the Community legislation on drug precursors - Version 2 (non-legally binding)


V.1.2.6. Council Decision 2001/419/IAI of 28 May 2001 on the transmission of samples of controlled substances

V.1.2.7. New legal developments on drugs and drug precursors

V.1.2.8. Key EU activities on drugs and drug precursors

V.1.2.9. EU Voluntary Monitoring List

V.1.2.10. Classification of drugs and drug precursors in EU legislation

V.1.3. Knowledge of the national legislation on drugs and drug precursors

V.1.3.1. National legislation (including amendments) on drugs and drug precursors (legal texts, reports and policy)

V.1.3.2. National strategy and action plan on drugs and drug precursors

V.1.3.3. Co-ordination arrangements, mechanisms and national authorities in the field of drugs and drug precursors

V.1.3.4. Structure and organization of forensic agency, field of competence

V.1.3.5. Classification of drugs and drug precursors in national legislation

V.2. Modes of Instruction – Training Aids

V.2.1. Presentation and studying of relevant legal texts

V.2.2. Clarification on questions

V.2.3. Discussion

V.3. References

V.3.1. UNODC Treaties


V.3.3. Online issues of the EU Official Journal from 1998 onwards

V.3.4. Search in the Register of European Council legislative acts
V.3.5. **EMCDDA publications database**
V.3.7. **Access the official databases of national legislation in EU countries**
V.3.8. National legislation on drugs and precursors
V.3.9. Organizational legal texts

**V.4. Assessment**

V.4.1. Study questions (oral)
V.4.2. Courtroom exercise (mini-mock trial)
VI. PROCEDURES

VI.1. Objectives

VI.1.1. Knowledge of the procedures applied in the collection, receipt, protection, handling, storage, analysis of samples/evidence, as well as documentation, evaluation, report writing and communication of results

VI.1.2. Ability to choose the best case approach, preparation of samples and handling of evidence, implementation of analytical schemes and methodology, and reporting of results, for each individual case

VI.1.3. Ability to interpret and handle analytical data and related information so as to create and use respective databases

VI.2. Modes of Instruction – Training Aids

VI.2.1. Studying of, clarification of questions and discussion on documentation of the administrative, organizational and scientific/analytical aspects of laboratory work (e.g. Quality Manual, Best Practices manual, SOP’s etc)

VI.2.2. Demonstration/guidance by trainer with explanations on standards or protocols implemented with respect to:
- case approach
- general analytical schemes for unknown samples / powders / tablets / capsules / herbal material
- weighing practices
- sampling practices
- choice of analytical methodology
- validation/verification of methods
- application of techniques per substance(s)
- development of SOPs
- equipment performance and control, preventive maintenance
- quality control
- interpretation and reporting of the results
- documents and case records
- handling/storage of samples/evidentiary material
- handling/storage of information, access to databases
- chain of custody
- communication with clients (including communication language, establishing needs, dealing with undue pressure etc)
- health and safety
- responsibilities, duties and skills of the personnel
- education and training of personnel

VI.2.3. Practice in implementation of the (best) practices, (quality assurance) principles and criteria of the laboratory, at technical and management level

VI.2.4. Discussion

VI.3. References

VI.3.1. Procedures Manual(s) of the laboratory
VI.3.5. “Validation of analytical methodology and calibration of equipment used for testing of illicit drugs in seized materials and biological specimen”, United Nations Office on Drugs and Crime, 2009
VI.3.7. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009
VI.3.8. “Recommended Guidelines for Quality Assurance and Good Laboratory Practice” United Nations
VI.3.9. Office on Drugs and Crime, STR/NAR/25, 1995

“Modules in a Forensic Science Process”, International Laboratory Accreditation Cooperation, ILAC-G19-2002


VI.3.27. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences


VI.4. Assessment

VI.4.1. Study questions (oral, written)

VI.4.2. Practical exercise on the implementation of procedures in compliance with the Quality Management System of the laboratory, at all stages of processes
VII. HEALTH AND SAFETY ISSUES

VII.1. Objectives

VII.1.1. Knowledge about safe working practices in the laboratory and at crime scene
VII.1.2. Ability to prevent service-related accidents, injuries, illnesses of personnel and damage to equipment, at laboratory and at crime scene
VII.1.3. Ability to assess and manage risk and emergency situations
VII.1.4. Active participation in implementation of safe working systems including evaluations and review. Consequent development of safety consciousness
VII.1.5. Ability in safety documenting including maintenance of a safety manual, including designated staff, emergency procedures, contact information, training, accommodation, personal protective equipment, general hygiene/safety and biological/radioactivity hazards, risk assessment and risk management

VII.2. Modes of Instruction – Training Aids

VII.2.1. Studying of, clarification of questions and discussion on :
   VII.2.1.1. legal and organisational requirements
   VII.2.1.2. properties of hazardous materials, including incompatibilities
   VII.2.1.3. use/meaning of hazard identification symbols, Risk and Safety phrases
   VII.2.1.4. interpretation of Material Safety Data Sheets
   VII.2.1.5. safety guidelines (in the laboratory and at crime scene), precautions and rules/procedures with respect to handling compressed gases, flammable, toxic and corrosive substances, bio-hazardous materials, glassware, high-intensity light sources (including UV lamps and lasers), etc, including safe transportation, storage and disposal.
   VII.2.1.6. hazards involved with analytical instruments and apparatuses operation (high temperatures, radiation etc)
   VII.2.1.7. dealing with risk and emergency situations
   VII.2.1.8. scientific and technical literature on the issue

VII.2.2. Demonstrations by trainer with explanations on :
   VII.2.2.1. use of (personal) protective equipment and physical barriers that are used both to protect the analyst from the evidence and reagents, and the evidence from the analyst, including capabilities and limitations
   VII.2.2.2. use of fire fighting equipment
   VII.2.2.3. first aid and emergency procedures

VII.2.3. Practice in :
   VII.2.3.1. implementation of safe working procedures in the forensic laboratory and at a crime scene, including handling chemicals as well as unknown and potentially hazardous evidence

VII.2.4. Clarification on questions

VII.2.5. Practical exercise on :
   VII.2.5.1. implementation of risk assessment of hazardous chemicals/material and situations
   VII.2.5.2. implementation of risk management and procedures that have been adopted to maintain health and safety and to provide a safe working environment for the employees

VII.2.6. Discussion

VII.3. References

VII.3.2. “Guidance for the implementation of a quality management system in drug testing laboratories – a commitment to quality and continuous improvement, United Nations Office on Drugs and Crime, ST/NAR/37, 2009
VII.3.3. “Guidelines for the Safe Handling and Disposal of Chemicals Used in the Illicit Manufacture of Drugs”, ST/NAR/36 rev.1, UNODC, 2011,
VII.3.4. “Data Sheets on Substances Frequently Used in the Illicit Manufacture of Narcotic Drugs or Psychotropic Substances”, SCITEC/9/REV.1, April 1993


VII.3.8. “DRCHIS: Drugs geRelateerd CHeimalien Informatie Systeem”, A. Elissen, M.L. Hordijk, Dutch National Criminal Intelligence Division, May 1999

VII.3.9. “Chemicals used in the Clandestine Production of Drugs”, US Department of Justice, Drug Enforcement Administration, Office of Diversion Control, Drug and Chemical Evaluation Section

VII.3.10. Relevant material safety data sheets


VII.4. Assessment

VII.4.1. Study questions (oral, written)

VII.4.2. Practical exercise

VII.4.3. Courtroom exercise (mini-mock trial)
VIII. QUALITY ISSUES

VIII.1. Objectives

VIII.1.1. Awareness of the significance of the quality of analyses and forensic laboratory results for the law enforcement, justice system, crime prevention and health, as well as for the international harmonization and worldwide exchange and coordination of drug information and data

VIII.1.2. Knowledge of the Quality policy of the laboratory

VIII.1.3. Knowledge of the requirements of ISO 17025, as interpreted for forensic laboratories

VIII.1.4. Knowledge of the structure of the Quality Management System of the laboratory or of the Best Practices applied

VIII.1.5. Ability to comply with the technical requirements established in the Quality Management System and/or Quality Standards of the laboratory

VIII.1.6. Ability to comply with the management requirements established in the Quality Management System and/or Quality Standards of the laboratory

VIII.2. Modes of Instruction – Training Aids

VIII.2.1. Presentation by trainer and discussion on :

VIII.2.1.1. national legislative, jurisdictional and regulatory requirements

VIII.2.1.2. institutional and organizational requirements of the laboratory

VIII.2.1.3. client requirements

VIII.2.1.4. external and/or international instructions, recommendations and guidelines

VIII.2.1.5. principles of ethical conduct

VIII.2.2. Studying of, clarification of questions and discussion on :

VIII.2.2.1. Standard ISO/IEC 17025

VIII.2.2.2. Quality Manual, and/or other relevant documentation of the administrative, organizational and scientific aspects of laboratory work (e.g. Best Practices manual, SOP’s etc)

VIII.2.3. Demonstration by trainer with explanations on the laboratory quality management system and the quality standards/protocols implemented with respect to :

VIII.2.3.1. organization of the laboratory

VIII.2.3.2. laboratory environment and accommodation

VIII.2.3.3. responsibilities, duties and skills of the personnel

VIII.2.3.4. equipment choice and performance - calibration

VIII.2.3.5. key stages of the drug testing process :

- case assessment
- sampling
- handling of samples and evidentiary material
- development of methods
- development of procedures
- validation/verification of methods
- quality control (internal-external)
- interpretation and reporting of the results

VIII.2.3.6. chain of custody

VIII.2.3.7. documents and case records

VIII.2.3.8. handling of services and supplies

VIII.2.3.9. dealing with clients, requests and complaints

VIII.2.3.10. audits, corrective and preventive actions

VIII.2.3.11. health and safety

VIII.2.3.12. drug reference materials

VIII.2.3.13. education and training of personnel

VIII.2.3.14. proficiency testing

VIII.2.4. Practice in :

VIII.2.4.1. implementation of the quality assurance principles and criteria of the laboratory, at technical and management level

VIII.2.4.2. use of quality assurance system as a safeguard to legal scrutiny

VIII.2.5. Discussion
VIII.3. References


VIII.3.3. “Validation of analytical methodology and calibration of equipment used for testing of illicit drugs in seized materials and biological specimens”, United Nations Office on Drugs and Crime, 2009


VIII.3.5. “Guidelines on Representative Drug Sampling”, UNODC & ENFSI DWG, ST/NAR/38, April 2009


VIII.4. Assessment

VIII.4.1. Study questions (oral, written)

VIII.4.2. Practical exercise on the implementation of procedures in compliance with the Quality Management System of the laboratory, at all stages of processes

VIII.4.3. Courtroom exercise (mini-mock trial)
IX. COURTROOM TESTIMONY

IX.1. Objectives
IX.1.1. Familiarity of the trainee with the environment of a courtroom
IX.1.2. Familiarity of the trainee with the functions of a courtroom criminal proceeding
IX.1.3. Preparation of a Curriculum Vitae by the trainee
IX.1.4. Familiarity of the trainee with “voir dire” questioning during testimony
IX.1.5. Familiarity of the trainee with presenting expert testimony during direct questioning
IX.1.6. Familiarity of the trainee with defending analytical results during cross-examination

IX.2. Modes of Instruction – Training Aids
IX.2.1. Studying of suggested references/assignments
IX.2.2. Clarification on questions
IX.2.3. Observation of court testimonies by experienced experts
IX.2.4. Practical exercise (mini-mock trials) based on case-studying
IX.2.5. Discussion

IX.3. References
IX.3.5. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
IX.3.8. National, EU and International Legislation on Drugs and Precursors

IX.4. Assessment
IX.4.1. Study questions (oral, written)
IX.4.2. Practical exercise in a simulated environment of a courtroom testimony:
- Direct questioning
- Cross-examination