Technical Procedure for Drug Chemistry Analysis

1.0 Purpose - This procedure specifies the required elements for the identification of controlled substances.

2.0 Scope - This procedure applies to general casework samples in the Drug Chemistry Sections of the State Crime Laboratory.

3.0 Definitions

- **Homogenous** – Uniform.
- **Residue** – An amount of material which cannot be readily removed from the container in which it was submitted.

4.0 Equipment, Materials and Reagents – See Drug Chemistry Section technical procedures.

5.0 Procedure

5.1 Examination Documentation

5.1.1 The electronic FA worksheet is provided as a controlled form and shall be used as designed for casework. Forensic Scientists shall record notes which will allow another Forensic Scientist to repeat the analysis under conditions as close as possible to the original, evaluate the data, interpret the results, and form an independent conclusion.

5.1.2 The Drug Chemistry FA worksheet is a generic worksheet for controlled substances and clandestine laboratory casework. The comments section shall be used for explanation of tests if needed. Excel spreadsheets are an acceptable format to record and add lists of weights or to organize data. These shall be imported and approved in the Case Record Object Repository for the Case Record.

5.1.3 The "Notes" section of the FA worksheet is provided for detailed descriptions of evidence or other necessary information not addressed in 5.1.1 or 5.1.2.

5.1.4 There will be instances when plain paper is needed for note taking. Clandestine laboratory field work is one example. This is an acceptable practice as long as the notes are properly labeled, retained, and promptly scanned into the Case Record Object Repository. Any tests or analysis conducted shall include information that is included in the controlled worksheet.

5.1.5 Date(s) of examination shall be noted as "Date started" and "Date completed." The completion date reflects the date when all data has been incorporated into a recorded conclusion.

5.2 Laboratory facilities provide sufficient environmental conditions to conduct all tests included in the Section technical procedures with no further consideration required.

5.3 Standards and Controls

5.3.1 Forensic Scientists are responsible for using documented Drug Chemistry Section technical and administrative procedures outlined for the identification of controlled substances.

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5.4 Calibrations - See Drug Chemistry Section technical procedures.

5.5 Application of Procedure on Evidence

5.5.1 Analytical Schemes

5.5.1.1 There are four general analytical schemes to be used for controlled substances after the physical examination of the drug form is conducted.

5.5.1.2 Pharmaceutical Preparation (see below for scheme).

5.5.1.3 Residue/Paraphernalia/Liquids (see below for scheme).

5.5.1.4 General Unknowns/Powders/Clandestine Tablets (see below for scheme).

5.5.1.5 Marijuana (see below for scheme).

5.5.1.6 It should be noted that sample size or other circumstances may require a rearrangement or modification of one or more steps.

5.5.1.7 A Forensic Scientist may encounter exhibits that require specialized analysis. For these cases the flowchart for general unknowns shall be followed and any deviations from the technical procedures shall be approved by the Drug Chemistry Technical Leader or his/her designee in accordance with the Laboratory Procedure for Authorizing Deviations.

(ANALYTICAL SCHEMES FOLLOW)

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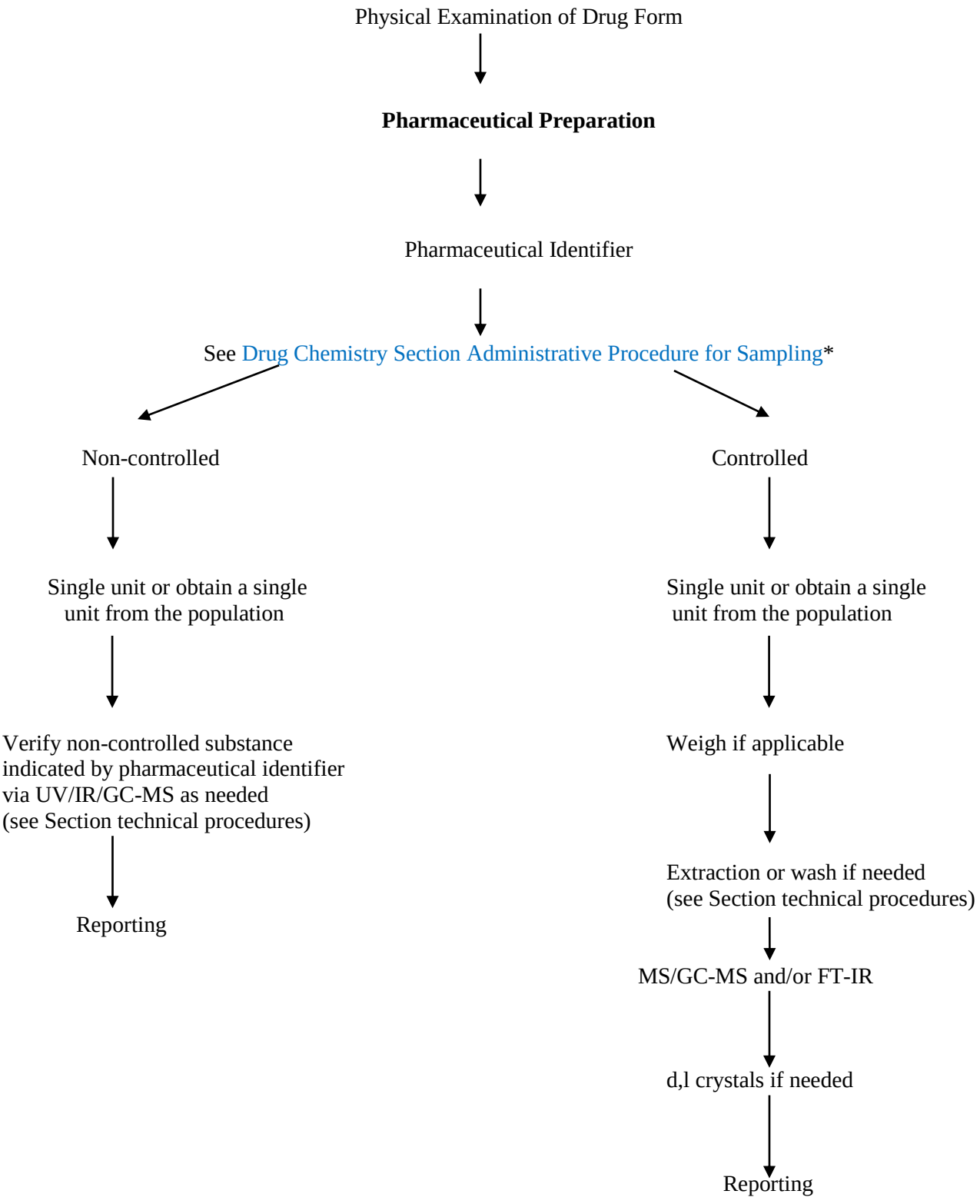

* Sample size or other circumstances may require rearrangement or modification of one or more steps.

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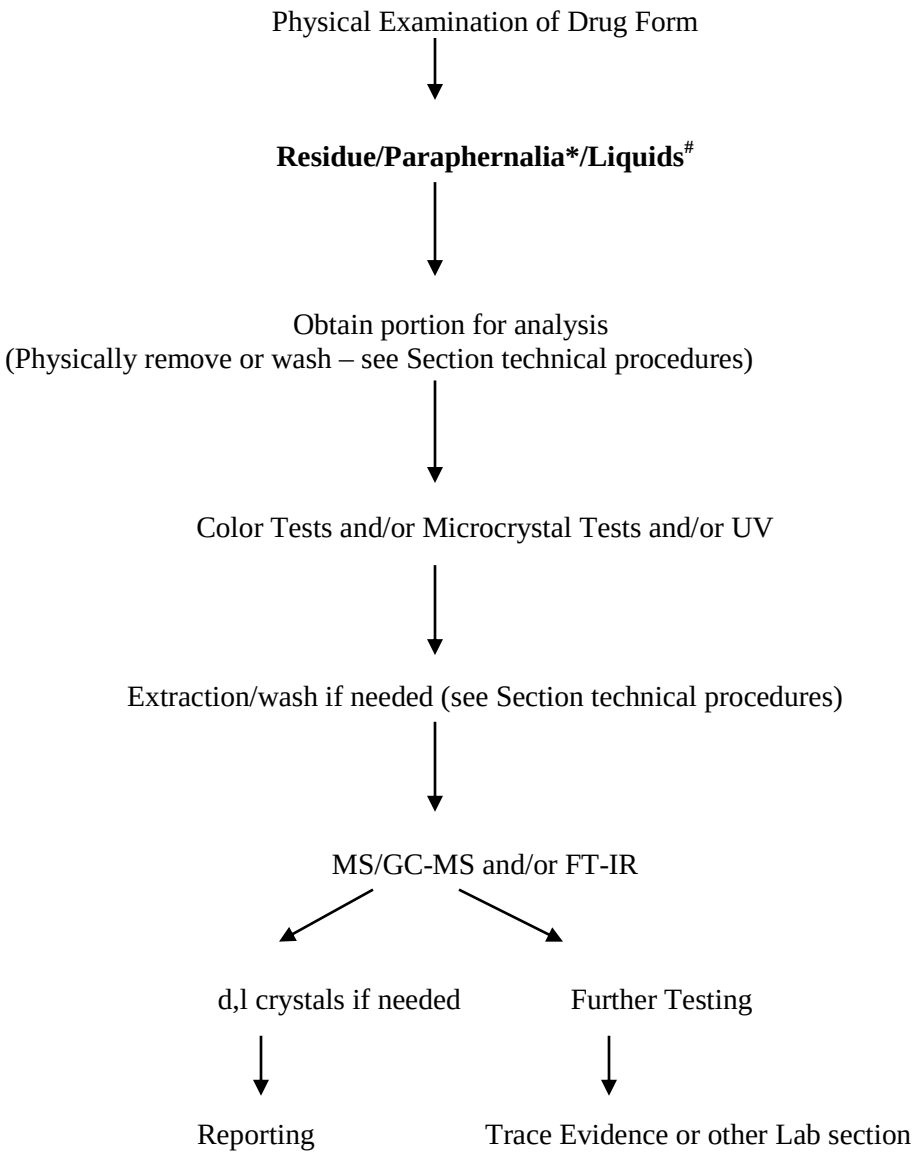

* Sample size or other circumstances may require rearrangement or modification of one or more steps.
#Refer to Drug Chemistry Section Administrative Procedure for Sampling if applicable when exhibit is a liquid pharmaceutical preparation.

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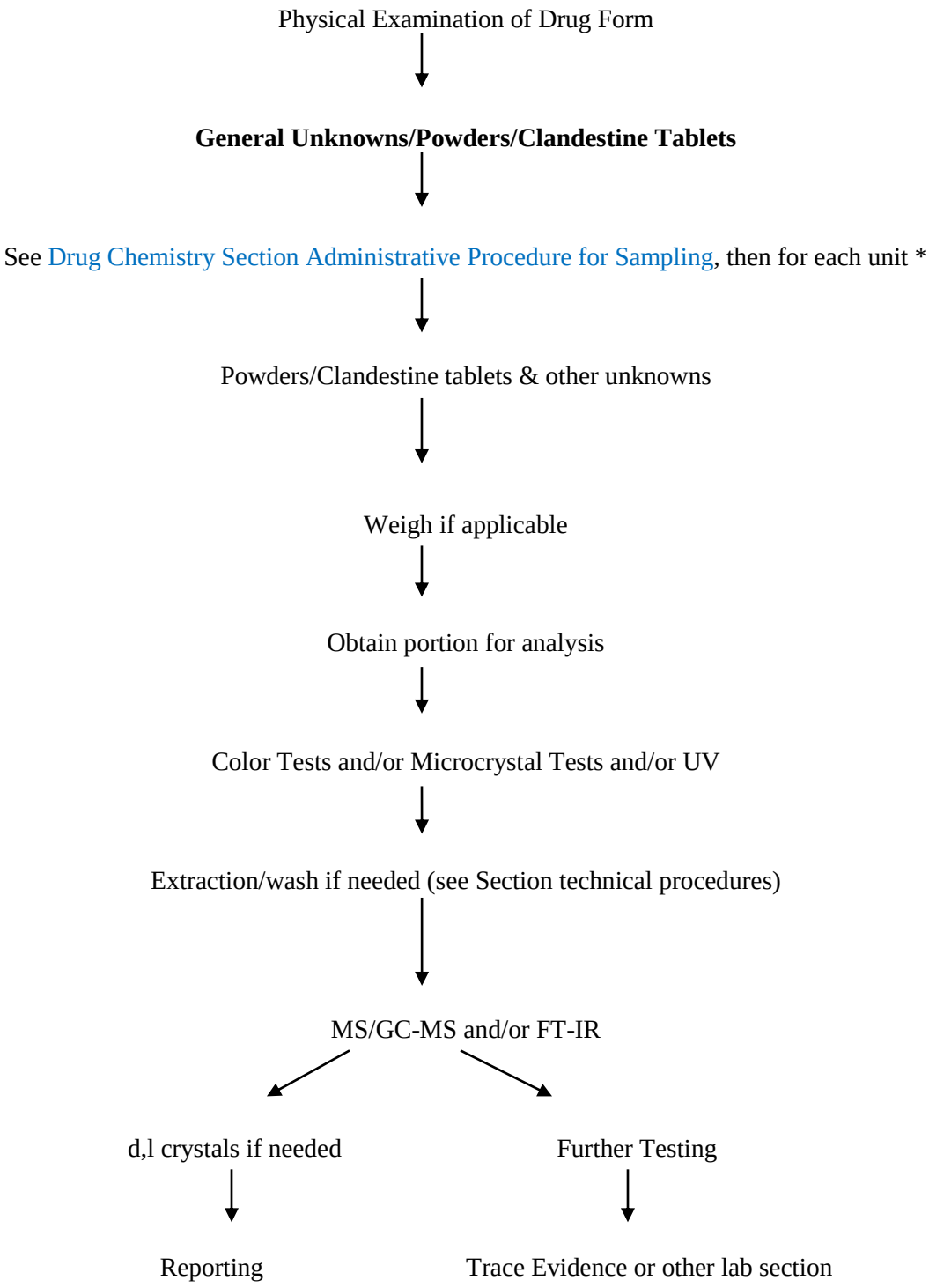

* Sample size or other circumstances may require rearrangement or modification of one or more steps.

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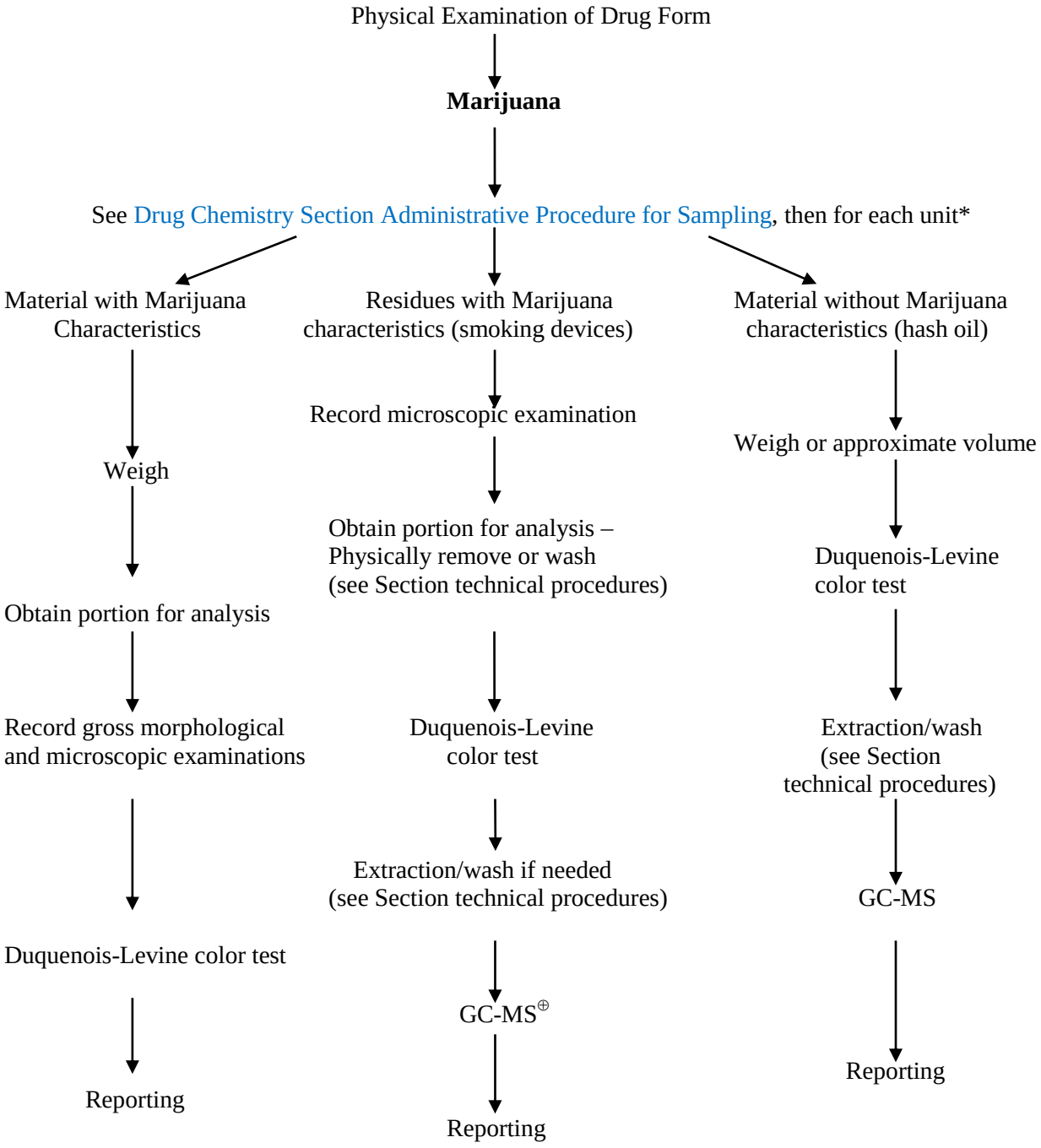

* Sample size or other circumstances may require rearrangement or modification of one or more steps.
⊕ Required if macroscopic characteristics are absent or if another test is inconclusive.

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5.5.2 **Color tests** are used to screen evidence to determine if a controlled substance may be present. (See the Drug Chemistry Section Technical Procedure for Preliminary Color Tests.)

5.5.2.1 A screening test shall be chosen based on its usefulness (i.e., microcrystalline test for cocaine, Marquis for heroin).

5.5.3 **Ultraviolet (UV) spectroscopy** may be used on extracted samples or used on straight material to screen, if it does not contain analytes that interfere with the analyte of interest. (See the Drug Chemistry Section Technical Procedure for Ultraviolet Spectroscopy.)

5.5.3.1 Ultraviolet spectroscopy may be used for cases involving dilution/diversion when known standards are submitted for comparison purposes.

5.5.4 **Microcrystalline tests** may be used to screen evidence or to help identify a controlled substance when used in conjunction with other technical procedures. (See the Drug Chemistry Section Technical Procedure for Polarized Light Microscopy.)

5.5.4.1 When a microcrystalline test is used in conjunction with a confirmatory test (Category A), documented descriptions of the crystals shall be included in the case notes for peer review. When this method is employed, the microcrystalline test will be considered a Category C test.

5.5.4.2 When a microcrystalline test is used as a confirmatory test (Category B), (i.e. not in conjunction with a Category A test), the crystals shall be contemporaneously peer reviewed and a Verification Review will be entered into the case record in FA.

5.5.5 **Pharmaceutical Identifiers -** Forensic Scientists shall use the markings and characteristics of pharmaceutical preparations to determine the consistency of the units and as a preliminary examination only. These identifications shall be made by using credible reference materials (e.g., *Micromedex*, *The Physician's Desk Reference, The Logo for Tablets and Capsules*, manufacturer's published data, and/or internet pharmacies).

5.5.6 **Extractions/washes -** Non-controlled substances are often mixed with controlled substances and interfere with results. It may be necessary to remove them before proceeding with analysis. (See the Drug Chemistry Section Technical Procedure for Extractions and Separations.)

5.5.7 **Infrared (IR) Spectroscopy (FT-IR)** may be used to screen a sample, or it may be used to identify a controlled substance when used in conjunction with preliminary tests. (See the Drug Chemistry Section Technical Procedure for Infrared Spectroscopy.)

5.5.7.1 FT-IR is used for identification when the controlled substance is not mixed with other substances, or is mixed with other substances in a ratio such that the FT-IR spectrum of the mixture does not interfere with a favorable comparison to the known reference material.

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5.5.8 **Gas Chromatography Mass Spectrometry (GC-MS)** may be used to screen evidence or to identify controlled substances when used in conjunction with preliminary tests. (See the Drug Chemistry Section Technical Procedure for Gas Chromatograph-Mass Spectrometry.)

5.5.8.1 If the controlled substance is mixed with other substances, or in a form that is not compatible with the instrument, refer to the Drug Chemistry Section Technical Procedures for Extractions and Separations, and the Drug Chemistry Section Technical Procedure for Gas Chromatograph-Mass Spectrometry (GC-MS) for suggested sample preparation.

5.5.9 **Gas chromatography (GC)** may be used to identify controlled substances when used in conjunction with other preliminary tests listed in **5.5.11**.

5.5.10 **Sampling -** See the Drug Chemistry Section Administrative Procedure for Sampling to determine sampling selection or sampling plan and population(s).

5.5.11 **Categories of Analytical Techniques**

Listed in order of decreasing discriminatory power from A to C:

Category A	**Category B**	**Category C**
Infrared Spectroscopy	Gas Chromatography	Color Tests
Mass Spectrometry	Liquid Chromatography (HPLC)	Ultraviolet Spectroscopy
	Microcrystalline Tests (Not used in conjunction with a Category A Test)	Microcrystalline Tests (Used in conjunction with a Category A Test)
	Pharmaceutical Identifiers	
	Cannabis Only: Macroscopic Examination Microscopic Examination (Counts as one each)	

5.5.12 When a Category A technique is incorporated into an analytical scheme, then at least one other technique (from either Category A, B, or C) shall be used.

5.5.12.1 This combination must identify the specific drug(s) present.

5.5.12.2 When sample size allows, the second technique shall be applied on a separate sampling.

5.5.12.3 All Category A techniques shall have reviewable data.

5.5.13 When a Category A technique is not used, then at least three different validated techniques shall be used.

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5.5.13.1 This combination shall identify the specific drug(s) present and shall preclude a false positive identification. Two of the three methods shall be based on uncorrelated techniques from Category B.

5.5.13.2 A minimum of two separate samplings shall be used in these three tests.

5.5.13.3 All Category B techniques shall have reviewable data.

5.5.14 Reviewable data includes:

5.5.14.1 Printed spectra and chromatograms.

5.5.14.2 Reference to published data for pharmaceutical identifiers.

5.5.14.3 Contemporaneous documented peer review, photographs, or digital images of microcrystalline tests if used without a Category A Test.

5.5.14.4 Descriptions of microcrystalline test results, if used in conjunction with a Category A Test.

5.5.14.5 For cannabis and botanical materials only: recording of detailed descriptions of morphological characteristics. (See the Drug Chemistry Section Technical Procedure for the Identification of Marijuana for descriptions used in conjunction with the FA worksheet.)

5.5.15 For the use of any method to be considered of value in the identification of the controlled substance, the test shall be considered positive.

5.5.15.1 While negative tests provide useful information for ruling out the presence of a particular drug or drug class, these results have no value toward establishing the positive identification of a drug.

5.5.16 In cases where hyphenated techniques are used (e.g., GC-MS), they will be considered as separate techniques provided that the results from each are used.

5.5.17 Cannabis exhibits tend to have characteristics that are visually recognizable; therefore, macroscopic and microscopic examination of cannabis shall be considered as two separate Category B techniques when observations include documented botanical features as described in the Drug Chemistry Section Technical Procedure for Identification of Marijuana.

- Additional testing shall follow the scheme outlined in Sections **5.5.12** and **5.5.13** set forth in this procedure.

5.5.18 For exhibits that lack sufficient observable macroscopic and microscopic botanical detail (i.e., extracts and residues), tetrahydrocannabinol (THC) shall be identified utilizing the principles in **5.5.12** and **5.5.13** set forth in this procedure.

5.5.19 On rare occasions, a category "A" technique may be used by itself for identification of a newly encountered analyte if data from reference material is not available. A

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verification review from the Technical Leader (or Forensic Scientist Manager) shall be required to document approval for these instances.

- Data obtained from the analyte shall be compared to published reference data from a credible source recognized in the forensic community.
- An analyte in this instance shall be defined as an unusual steroid or new designer drug.

5.5.20 **Weights** - (received and returned) of solids, powders, and plant material shall be recorded in the case notes. (See the Drug Chemistry Section Technical Procedure for Balances.)

5.5.20.1 When the analyst, based upon his/her training and experience believes that individual units of evidence contain small amounts of heroin, the analytical balance shall be used for weight determinations.

5.6 **Reporting** (See the Drug Chemistry Section Administrative Procedure for Sampling for the format to report identified substances for exhibits where sampling or sample selection has occurred.)

5.6.1 The results for identified substances from a single unit exhibit shall be reported with the name of the substance, the Schedule, and the net weight of the material with associated uncertainty.

5.6.1.1 All digits of received weights recorded in the case notes shall be reported with the associated uncertainty. See Procedure for Measurement Assurance and the Drug Chemistry Section Technical Procedure for Balances.

5.6.1.2 Reported gross weights shall be truncated.

5.6.1.2.1 Reported gross weights do not require uncertainty calculations or reporting of uncertainty.

5.6.1.3 The notation "Net Weight of Material - Less than 0.1 gram" is acceptable to report recordable weights less than 0.1 gram when a table top balance is used to obtain the weight. Uncertainty of measurement is not required in this situation. When an analytical balance is used to record weights less than 0.1 gram, all digits recorded and the associated uncertainty of measurement shall be reported.

5.6.1.4 An amount of material which cannot be readily removed from the container in which it was submitted may be reported as a residue.

5.6.1.5 When a sample's infrared spectrum indicates a mixture of a controlled substance(s) and non-controlled substance(s), the ratio will be evaluated based on the training and experience of the Forensic Scientist. If the overwhelming majority of the sample is indicated to be non-controlled, then the reported results shall indicate that the material contains the controlled substance(s).

5.6.1.5.1 Suggested Example:

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Item 1:
Material containing Cocaine – Schedule II.
Net weight of material – 2.51 (+/- 0.0X) grams.

5.6.1.5.2 Suggested Example:
Item 1:
2.51 (+/- 0.0X) grams of material containing Cocaine – Schedule II.

5.6.1.6 When the sample size of an exhibit prohibits complete analysis, the reported results shall be recorded as "Insufficient sample for analysis."

5.6.2 The results for non-controlled substances shall be reported as "No controlled substances identified" and the net weight of the material with associated uncertainty shall be reported if a net weight was recorded.

5.6.2.1 The results for non-controlled clandestine laboratory samples shall be reported as "No controlled substances and/or precursor chemicals indicated" and the net weight of the material with associated uncertainty shall be reported if a net weight was recorded.

5.6.3 The number of tablets, capsules, or other dosage units containing controlled substances shall be reported. The number returned shall be included in the case notes.

5.6.4 Liquids containing controlled substances shall be measured by weights or volumes. The amount of the received liquids shall be reported. The amount of the returned liquids shall be included in the case notes.

5.7 Calculations - See Drug Chemistry Section technical procedures.

5.8 Uncertainty of Measurement - See the Drug Chemistry Section Procedure for Measurement Assurance.

6.0 Limitations - See Drug Chemistry Section technical procedures.

7.0 Safety - See State Crime Laboratory Safety Manual.

8.0 References

ASTM Standard E2329-09. "Identification of Seized Drugs." ASTM International: West Conshohocken, PA, 2009, www.astm.org.

"Part III B – Methods of Analysis/Drug Identification." *Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) Recommendations.* 5th Edition. January 29, 2010.

9.0 Records

- FA case files

10.0 Attachments - N/A

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Revision History		
Effective Date	Version Number	Reason
09/17/2012	1	Original Document – Drug Chemistry Policy 2008-DCS-01 and 2008-DCS-02 were combined and edited for conversion to ISO standards.
02/15/2013	2	**2.0** – Scope changed to cover all Drug Chemistry Sections. **5.1.2** – Notation added to allow for wider use of Excel spreadsheets. **5.1.3** – Wording changed to allow for wider use of "Notes" section. **5.5.4.1** and **5.5.4.2** – References to Original Section **5.5.17** updated to reference new Section Number **5.5.14.** **5.5.17** and **5.5.18** – References to Original Sections **5.5.15**. **5.5.9** – "are" used changed to "may be" used. Removed HPLC and reference to HPLC Technical Procedure. (Original section **5.5.11**) **5.5.10** – Notation for determining sampling selection added. (Original section **5.5.12**) (Original Section **5.5.12.1**) Removed – See Drug Chemistry Technical Procedure for Sampling. (Original Section **5.5.12.2**) Removed – See Drug Chemistry Technical Procedure for Sampling. (Original Sections **5.5.12.3 through 5.5.12.6**) Removed – See Drug Chemistry Technical Procedure for Sampling. Sections **5.5.12.3.2**, **5.5.12.3.3**, Section 5.5.12.3.5 partial sentence: "OR homogenize all of the material. And associated bullet point - deleted. (Original Section **5.5.13**) Removed – See Drug Chemistry Technical Procedure for Sampling. **5.5.20** – "Weights" section moved from original **5.5.2** and **5.5.2.1** and reworded. **5.6** - "Reporting Weights" section renamed "Reporting" and moved from original Section **5.5.3**. **5.6.1.1** – Added reference to "associated uncertainty." **5.6.1.3** – Clarification added for use with table top. (Original Section **5.5.3.2**) **5.6.1.5.1** and **5.6.1.5.2** – Measurement assurance data added to example. (Original Sections **5.5.3.5.1** and **5.5.3.5.2**)
05/03/2013	3	**5.5.7.1** - Wording changed - removed not significantly different phrase for clarification; **5.5.9** – clarified other preliminary tests as those listed in 5.5.11
05/10/2013	4	**5.3.1 –** Added reference to section administrative procedures **5.5.1.7, 5.5.10, 5.6** - Revised name of Sampling Plan from

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		Technical to Administrative Procedure **5.5.3.1** – Removed quantitative use of UV
07/31/2013	5	**5.6.1.1** and **5.8** – Updated name of Procedure for Measurement Assurance **5.6.1.3** – Added "Net weight of material - " **5.6.1.5** – Removed "or gas chromatogram", changed their ratio to the ratio **5.6.3** and **5.6.3.1** – Removed sections
11/15/2013	6	Added issuing authority to header
12/18/2013	7	**5.5.1.7** - Analytical scheme for Pharmaceutical Preparations amended to include chemical analysis to verify identity of non-controlled preparations **5.6.2 –** Results for reporting of non-controlled substances changed to allow for only one option of wording, and report weight if recorded

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