1. Scope

1.1. This procedure provides general guidelines for the receipt, analysis, and disposition of toxicological evidence for cases assigned to the Toxicology Unit (TX) within the the Division of Scientific Services' (DSS) forensic laboratory.

2. Procedure

2.1. Sample Collection and Evdience Receipt Requirements

2.1.1. The proper selection, collection, and submission of biological specimens for toxicological analyses is important for the scientifically sound interpretation of analytical data. However, specimens may be limited and submitting agencies may not be able to obtain recommended minimal amounts. In cases where limited sample amounts are received by the DSS laboratory, the type and amount of specimen may influence which analyses will be performed. In such situations analysts will work with FSE2 or higher, and possibly the submitting agencies, to decide which analytical path will be pursued.

2.1.2. For toxicology cases, the preferred collection tube is a grey-top Vacutainer® which contains a mixture of sodium fluoride and potassium oxalate in order to enhanace the stability of the analytes. Expiration dates on such tubes are only for vacuum integrity and do not reflect on the quality of the tube or its components after samples have been captured within the container.

2.1.3. The most common types of toxicological specimens for antemortem analyses are urine and blood (sometimes plasma or serum will be submitted). Prior to sampling, containers should be inverted or swirled to ensure homogeneity. If blood samples are found to be clotted, such clots may need to be homogenized/broken-up (as best as possible) before sampling occurs. Appropriate case notes will be taken for documentation of events.

2.1.3.1. NOTE: Postmortem samples may be received however this is rare and will follow the same analytical scheme as DFC cases listed below. Consult with a FSE2 or higher prior to starting analysis.

2.1.4. All specimen labels must be compared to the information on the case requisition. Any discrepancies must be clearly documented. If a discrepancy could greatly affect the quality of results (e.g., the name of the subject on the requisition is different from the name on the tubes), the discrepancy must be investigated before testing begins.

2.1.5. Every specimen received by the Toxicology Unit must be given a unique identifier in LIMS (sub-item). Specific information regarding the colored tops of multiple tube submissions, approximate volume of sample in each tube, and other information may be recorded within the 'Notes' portion of LIMS-plus for each item of evidence.

2.1.6. When multiple blood or urine samples are submitted, the earliest specimen should be itemized first.

2.1.7. Samples collected by the hospital during normal course of treatment may be received asmultiple tubes. When the specimens have been reportedly collected at the same time, from the same location/person then they may be considered the same item and be given the same item number during accessioning (e.g., Item #: 001-001 – blood within three (3) tubes), if they will not be used for testing. Situations where it is not clear whether multiple samples of evidence should be considered one item or multiple items will involve the appropriate FSE2 (or higher) for a decision to be made. Any clarification or justification for non-routine actions and/or decisions will be appropriately recorded in both batch notes and case notes.

2.1.8. Urine samples may be aliquoted to generate a working tube for subsequent analysis. This aliquot will be sub-itemized in LIMS and tracked following normal chain of custody procedures.

2.1.9. At least approximately 1 mL will remain in the original sample container if an aliquot is created.

2.1.10. If less than 10 mL of urine is submitted, the aliquot will be retained with original container after testing is complete.

2.1.11. If greater than 10 mL of urine is submitted, the aliquot may be discarded after testing is complete.

2.1.12. Any specimen with an unusual or atypical condition (e.g., urine suspected to be dunked in toilet bowl) must be documented within the case record.

2.1.13. Such evidence will typically be received through the Evidence Receiving Unit of the DSS laboratory. Proper seal of evidence refers to a condition of packaging which ensures evidence is prevented from cross contamination, there is no sample loss, and any attempt at deleterious change of the evidence would be noticeable.

2.2. **Chain of Custody**

2.2.1. Evidence transfers will be documented within the laboratory information management system (LIMS) software (e.g., LIMS-Plus) following normal laboratory procedures.

2.2.2. When performing an evidence transfer, a “Note” should be entered in the chain of custody to include the reason for the transfer. (i.e. THC or Accessioning)

2.2.3. In the unusual circumstance that an extract from a specimen will be retained (e.g., all the blood evidence has been consumed and the extract needs to be saved), then the extract will be sub-itemized (e.g., Item #: 001-001-01-01) and recorded within LIMS-plus (i.e., CoC recording).

2.3. **Sample Storage**

2.3.1. Due to the nature of biological material, specimens will be kept refrigerated or frozen. Specimens not under active examination shall be properly sealed. Cases located in Chem-29 and/or Chem-31 are considered under active examination. Refrigerators and freezers for storage of active cases are located in the Toxicology Unit. Long-Term evidence storage areas that are in limited controlled laboratory spaces are not required to be locked.

2.4. **Analytical Schemes for Toxicology Testing**

2.4.1. Forensic toxicological examinations are conducted on specimens in order to detect a wide range of drugs and/or other substances. Pertinent case histories should be reviewed during both the accessioning process and when cases are being completed (i.e., technical reviews). For most routine DUI-related cases analysts should only need a brief understanding of the history within requests. Certain cases (e.g., sexual assaults) may require a more thorough review of case history so that adequate analytical plans are developed and followed. Professional judgment will be used to determine the sequence of tests which will be performed. The general analytical schemes within this document can be used for guidance and, in general, will be followed.

2.4.2. Suspected DUI Cases

2.4.2.1. Many examinations within the Unit involve antemortem specimens from driving under the influence (DUI) investigations wherein volatiles and/or impaired-driving drugs are suspected to be present. Submitting agency representatives often request that ethanol/drugs be detected, identified, and possibly quantitated. Such analytes within blood samples may be quantitated, but quantitation within urine specimens will be limited to volatile compounds (e.g., ethanol, methanol, acetone, isopropanol).

2.4.2.2. With the exception of fatalities, motor vehicle accidents resulting in serious bodily injury or boating accidents, submissions where ethanol findings from samples are high (i.e., equal to or over 0.100 g% blood alcohol content (BAC) for adult drivers, equal to or over 0.040 g% BAC for drivers operating commercial vehicles, equal to or over 0.020 g% BAC for drivers under 21 years old), analyses for drugs may be omitted from analytical schemes unless specifically requested. Drug and alcohol analysis shall be performed on all surviving operator samples in fatality cases.

2.4.2.3. Cases submitted where inhalants or nitrous oxide are suspected will receive alcohol analysis regardless of breath alcohol result.

2.4.2.3.1. Nitrous oxide testing in blood may be sent out to outside laboratory if necessary. Urine testing is not available.

2.4.2.4. FSE2 (or higher) should be involved in unusual cases or when uncertainty exists in how to proceed during the scheduling of tests.

2.4.2.5. Due to time requirements for state Per Se hearings related to DUI cases, volatile reports are generally issued prior to full drug reports. While drug reports that are issued after ethanol reports are supplemental reports, it is not a requirement that they be titled as such. When DUI samples are collected at the request of the officer (not drawn during normal course of hospital treatment), duplicate testing will be performed on blood and/or urine samples.

2.4.3. Suspected DFC cases

2.4.3.1 Cases within the Toxicology Unit may involve biological evidence from suspected drug facilitated crime-type investigations (DFC ; formerly known as drug facilitated sexual assaults (DFSA)). Evidence from these cases will often involve the submission of both urine (recommended) and blood samples. All DFC cases will include confirmatory analytical techniques in addition to any presumptive techniques which may be used. Reports involving presumptive testing-only should not be issued for DFC-type cases. Toxicological analyses will begin within sixty (60) days of the request date for all DFC-type cases in order to conform to statutes related to sexual assault evidence. All DFC-type cases will receive testing for alcohol and/or drugs unless outside acceptable times ranges.

2.4.3.1.1 For gamma- hydroxybutyric acid (GHB), blood collection times must be less than eight (8) hours after the time of drugging/incident. Ethanol should not be analyzed within blood specimens if their collection times are greater than twenty-four (24) hours. Blood samples that have been collected after two (2) days of the alleged incident will not be analyzed. Upon approval of the FSE2 (or higher), blood may be tested regardless of the interval between the time of incident and the collection time in order to be able to better interpret the significance of positive urine findings (or if target drugs are known to have longer half-lives).

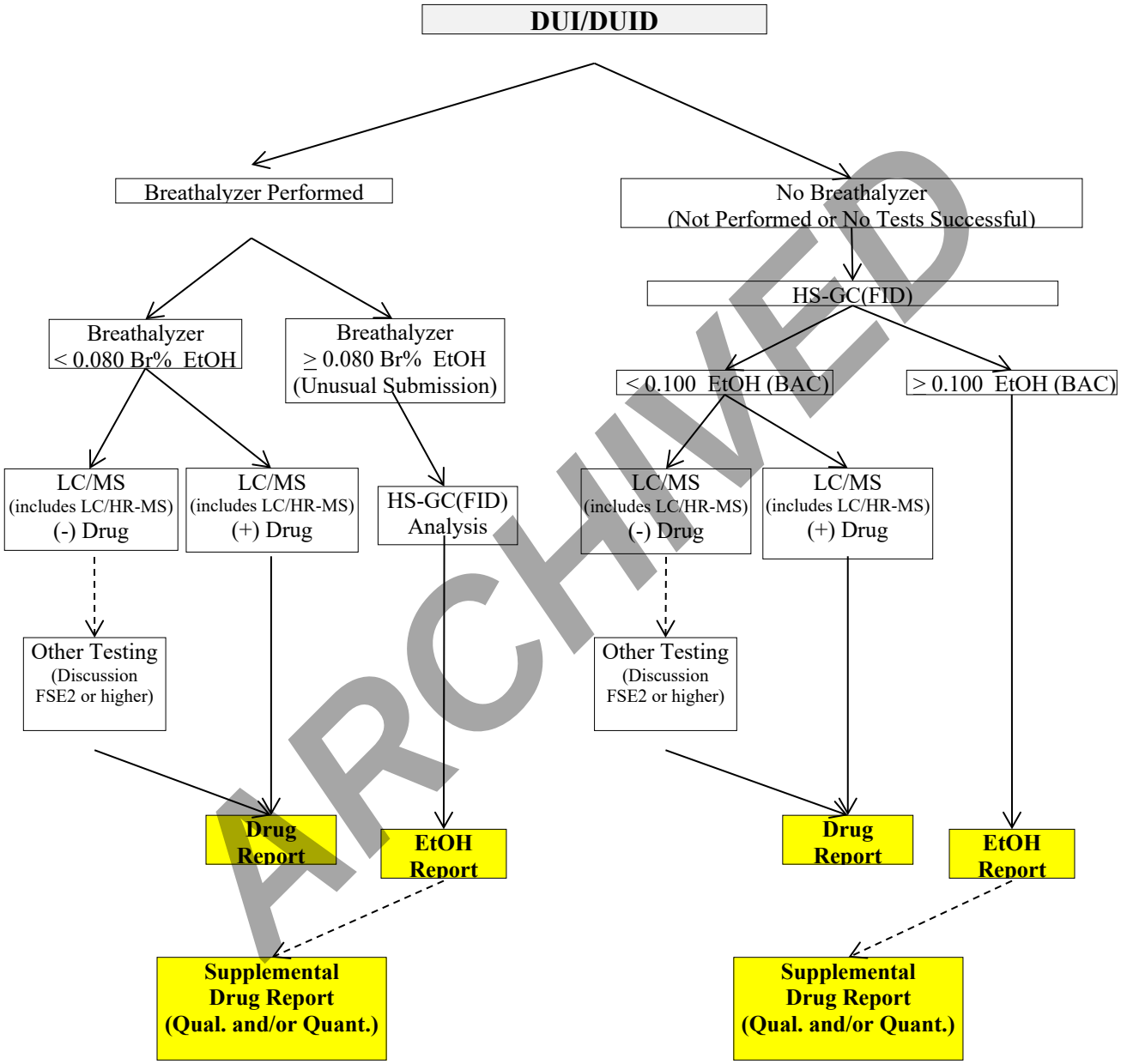
2.4.3.1.2 For gamma-hydroxybutyric acid (GHB), urine collection times must be less than twelve (12) hours from the suspected drugging/incident. Ethanol should not be analyzed within urine specimens if urine specimen collection times are greater than twenty-four (24) hours after the incident. Samples that have been collected five (5) days (120 hours) after the alleged incident will not be analyzed without prior approval from the appropriate FSE2 (or higher).

2.4.3.2 Since DFC-type cases can be unusual and non-routine, the FSE2 (or higher) should be consulted to determine the analytical plan based on the circumstances of the specific case.

2.4.4. Other Cases

2.4.4.1. While the majority of submissions within the DSS laboratory's Toxicology Unit will be from suspected DUI or suspected DFC this procedure doesn't preclude other types of cases involving human biological materials to be examined within the Unit (e.g., special events testing, serum-conversions, proficiency tests).

Figure 1: Analytical Scheme for DUI Antemortem Cases (Non-Fatal)



Note: LC/MS include screening and confirmation/quantation.
Note: Variations in this (and other) schemes are allowed depending on sample volume, customer requests, and other reasons deemed toxicologically applicable. Such variations will be approved by the appropriate FSE2 (or higher) and recorded in appropriate case file and/or batch paperwork

3. Abbreviations

The following abbreviations may be found in the procedures and case notes within the Toxicology Unit:

ACN	Acetonitrile
α-HYDROXYALP/α-HYDROXYALPRAZ	A-Hydroxyalprazolam
6-MAM (6-AM)	6-Monoacetylmorphine (6-Acetylmorphine)
7 ACLO	7-Aminoclonzepam
AF	Acetylfentanyl
ALPRAZ/ALP	Alprazolam
AMI	Amitriptyline
AMP	Amphetamine
BE	Benzoylecgonine
BL	Blood
BUP/BUPROP	Bupropion
BUPREN	Buprenorphine
BUTAL	Butalbital
BZ	Benzodiazepine
CAL	Calibrator
CARBAM	Carbamazepine
CDP	Chlordiazepoxide
CE	Cocaethylene
CHLORPHEN	Chlorpheniramine
CHLORPROM	Chlorpromazine
CHROMAT	Chromatography
CIT	Citalopram
CLOBAZ	Clobazam
CLON	Clonidine
COD	Codeine
THC-COOH	Delta-9-Carboxy-Tetrahydrocannabinol
CTRL	Control
CUT	Cutoff
CYCLOB	Cyclobenzaprine
DFC	Drug Facilitated Crime
DFE	1,1-Difluoroethane
DFSA	Drug Facilitated Sexual Assault
DI H2O	De Ionized Water
DIAZ	Diazepam

DIPHEN	Diphenhydramine
DMD/NORDIAZ	Nordiazepam
DOX	Doxepin
DOXYL	Doxylamine
DUI	Driving Under The Influence
DUID	Driving Under The Influence Of Drugs
EMIT	Enzyme Multiplied Immunoassay Technique
EPH	Ephedrine
EtOH	Ethanol
FA	Formic Acid
FENT	Fentanyl
FID	Flame Ionization Detector
FLUOX	Fluoxetine
GABA	Gabapentin
GHB	Gamma-Hydroxybutyrate Or Gamma-Hydroxybutyric Acid
HALO	Haloperidol
HS-GC(FID)	Head Space-Gas Chromatrograhy (Flame Ionization Detector)
HYDROC	Hydrocodone
HYDROM	Hydromorphone
IPA	Isopropanol
IR	Ion Ratios
ISTD or IS	Internal Standard
KET	Ketamine
LAMO	Lamotirigne
LC-HRAM-MS	Liquid Chromatography/High Resolution Accurate Mass-Mass Spectrometry
LCMS	Liquid Chromatography Mass Spectrometry
LOD	Limit Of Detection
LOQ	Limit Of Quantitation
LORAZ	Lorazepam
MeCL	Methylene Chloride
MeOH	Methanol
MET	Metabolite
METH	Methamphetamine
MIDAZ	Midazolam
MIRT	Mirtazapine
MOR	Morphine
MOU	Memorandum Of Understanding

MTD	Methadone
NALOX	Naloxone
ND	None Detected (Not Detected)
NEG	Negative
NORBUPREN	Norbuprenorphine
NORFENT	Norfentanyl
NORT	Nortriptyline
O,M or P-FLUOROFENT	O,M Or P-Fluorofentanyl
OCME	Office Of The Chief Medical Examiner
OLANZ	Olanzapine
OP	Opioids
OOR	Out Of Range
QTOF	Quadrupole Time of Flight
OXAZ	Oxazepam
OXCARB	Oxcarbazepine
OXYC	Oxycodone
OXYM	Oxymorphone
PAROX	Paroxetine
PCP	Phencyclidine
PENTO	Pentobarbital
PHENO	Phenobarbital
PHENY	Phenytoin
POS	Positive
PS	Pseudoephedrine
QUET	Quetiapine
RT	Retention Time
S/P	Serum/Plasma
SA	Sexual Assault
SECO	Secobarbital
SER	Serum
SERT	Sertraline
SMA	Sympathomimetic Amines
STIM	Stimulant
TEMAZ	Temazepam
THC	Delta-9-Tetrahydrocannabinol
THC-OH	11-Hydroxy-Delta-9-Tetrahydrocannabinol (11-OH-Thc, OH-Thc)
TOPIR	Topiramate

TRAM	Tramadol
TRAZ	Trazodone
TX	Toxicology
ULOQ	Upper Limit Of Quantitation
UR	Urine
VENLA/VENLAF	Venlafaxine
Volatiles	Methanol, Ethanol, Acetone, Isopropanol
ZOLP	Zolpidem

4. References

Drug Abuse Handbook, Karch, S.B., Ed., CRC Press: Boca Raton, FL, 1998

Principle of Forensic Toxicology, 5th ed., Levine, B. Ed, Springer Nature, Switzerland AG, 2020.