

# Toxicology Section Service Manual

The Division of Forensic Sciences (DOFS) Toxicology Section provides state and local law enforcement officials and medical examiners with vital information about human biological samples and specifically whether drugs, alcohol or poisons may have played a role in the commission of a crime or a death. By analyzing such samples as blood, urine, stomach contents and tissues, DOFS toxicologists are able to establish whether traces of alcohol, drugs or poisons are present, and if so, in what quantity.

The Toxicology Section provides five primary services:

1. Tests for alcohol content in biological fluids, tissues and liquids
2. Tests for drugs in biological fluids and tissues (i.e. blood, urine, liver, etc.)
3. Tests for volatiles (gases and vapors) in biological materials
4. Tests for carbon monoxide in blood
5. Tests for poisons in biological fluids, tissues and source materials

The Toxicology Section will not process routine drug screening samples from probationers. These samples will only be accepted for analysis if a new criminal charge is pending on the individual. Documentation of the pending criminal charge must be submitted with the sample.

The toxicology section manager is Lisa Holt. She may be reached at 404-270-8231.

## Alcohol Analysis

The Toxicology Section performs alcohol concentration determinations on biological fluids, tissues and liquid specimens. Biological specimens must involve cases resulting from suspected violation of the Uniform Rules of the Road, Boating Under the Influence, or cases arising from a death investigation. Liquid specimens can be analyzed for alcohol concentration or proof. Typically, analysis for ethanol (drinking alcohol), methanol (wood alcohol), isopropanol (rubbing alcohol), and acetone (nail polish remover) is conducted using Headspace Gas Chromatography Mass Spectrometry (HS-GC/MS).

1. **BLOOD ALCOHOL:** Blood specimens tested for the presence of alcohols. Analysis of blood to determine alcohol concentration results is reported in compliance with the legal definition of alcohol concentration in O.C.G.A. All DUI blood samples should be submitted in DOFS approved **Blood Alcohol Collection Kits**.
2. **ALCOHOL CONTENT:** Biological specimens other than blood, such as chest fluid and tissues, are analyzed for the presence of alcohols. In death investigations blood and urine may be unsuitable for analysis or not available for collection. In these cases other possible specimens would include vitreous humor, bile, or tissues (e.g. liver, kidney, etc.). Results may be reported as alcohol content in grams per 100 ml. or else "positive" or "negative" for alcohol. Decomposition of biological samples may produce alcohol and the interpretation of alcohol concentration in these specimens is problematic.
3. **PROOF DETERMINATION:** The analysis of suspected moonshine or other liquids to determine the proof of alcohol present in a sample.
4. Alcohol determinations **will not** routinely be performed on urine samples.

# Toxicology

The toxicology service comprises testing of biological specimens for drug, especially those that might impair driving performance and or have a significant mortality risk. Enzyme Immunoassay (EIA), Gas Chromatography/ Mass Spectrometry (GC/MS) and Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS) are used to perform screening and confirmation tests. Selection of test protocols is driven by the type of case submitted for testing, information provided by the submitting agency and the type/quantity of evidence submitted for testing. **DOFS has discretion over items analyzed and methods of analysis utilized.**

Toxicology testing is broadly divided into two categories: DUI Toxicology and Postmortem Toxicology.

1. **DUI Toxicology:** Traffic toxicology involves the determination of whether or not drugs, both illicit and prescription, may have been present and/or a factor during the alleged criminal offense. These cases refer to a situation in which the victim and/or subject are living, such as DUI, or vehicular homicide. Specimens submitted are limited to blood and urine. The presence or absence of drugs can be the key piece of evidence investigators need to confirm or refute events.

**NOTE: This service is not performed on traffic cases unless blood alcohol concentration is less than 0.08 gm % or involves a death and has been requested.**

2. **Drug Facilitated Sexual Assaults (DFSA)** are also handled by the traffic toxicology group. Blood and urine are both tested for drugs if submitted. Urine is an extremely important specimen to collect and test because there is often a significant time between the incident and specimen collection. Testing for GHB can also be performed when requested.
3. **Postmortem Toxicology:** Postmortem toxicology aids in determining if drugs played a role in a **death**, as well as the types of drugs (illicit and/or prescription) and the quantities of those drugs. A wide variety of specimens can be submitted for post-mortem analysis. Blood, urine, vitreous humor, bile, gastric contents, and liver are common specimens tested. The type of case determines the protocol for testing. **The toxicology section has discretion to modify testing requests based on case circumstances and evidence submission.**

Examples of case types commonly requiring the test for drugs service:

- DUI/Drugs cases
- Motor vehicle crashes
- Seizure-related cases
- Sexual Assaults
- Unattended deaths – cause unknown
- Drownings
- Fire deaths
- Homicides
- Sudden Infant Death Syndrome (SIDS) cases
- Suicides
- Suspected overdoses

# Volatile Determinations

Specimens such as blood and lung tissue can be submitted for Volatile Analysis. Volatile substances boil at temperatures less than that of water. These substances include such compounds as anesthetics (e.g. Nitrous Oxide), refrigerants (e.g. Freons), solvents (e.g. toluene), petroleum distillates, adhesives, and even gases such as butane or propane.

Case examples involving test for volatiles requests:

- DUI subjects with gas/vapor delivery paraphernalia (e.g. cans of keyboard cleaner)
- Victims possessing gas/vapor paraphernalia or witnesses indicating volatile substance abuse
- Cases involving suspected therapeutic overdoses
- Exposure to volatile compounds on the job or in the home

# Carboxyhemoglobin (CO)

Carbon monoxide is the most frequently encountered poison. Carbon monoxide (CO) is a colorless and odorless poison that displaces oxygen from hemoglobin to form carboxyhemoglobin.

Case types commonly involving testing for carbon monoxide requests:

- Fire deaths
- Accidental death from combustion engine exhaust
- Suicide from automobile exhaust
- Homicides (fire related)
- Improperly used heating/cooking devices
- Improperly vented/operating heating systems

# Poison Determination

Poisonings may involve a large list of potential substances including pesticides, heavy metals, various gases, and cleaning solutions. While homicidal poisonings can occur, most commonly they are encountered in suicides or accidental ingestions.

Classical poisons such as arsenic, cyanide and strychnine continue to be of interest but are rarely used. Ethylene Glycol (antifreeze) and gamma-hydroxybutyric acid (GHB, date rape drug) are more commonly encountered. Poisons typically require an experienced toxicologist who specializes in this type of analysis. **Poison cases are rare and complicated, so consultation with the toxicology department is highly recommended.**

Case examples involving test for poisoning requests:

- Accidental poisoning
- Attempted homicides/suicides
- Homicides
- Suicides

In suspected poisoning cases it is essential to document potential poison sources and access to poisons as part of the scene investigation.

# Evidence Guidelines

## Collection

Collect toxicology samples as soon as possible after the offense – in death cases before embalming. Package specimens in well-sealed, leak-proof containers surrounded with absorbent materials – biological specimens are a potential biohazard. Blood tubes should be sealed and kept cold, but **DO NOT FREEZE**. Refer to previous information for Safety Considerations in Packaging/Handling Biohazards. **NEVER** expose specimens to hot temperatures in back windows or trunks of vehicles.

Whenever possible, use of the DOFS approved blood alcohol collection kits or urine kits is strongly encouraged.

## Labeling & Submission

For a valid chain-of-custody, all items of evidence must be labeled with the following information:

- Name of victim or subject
- Initials or name of specimen collector
- Date and time collected

The most important reason for submitting complete and descriptive information to the laboratory is to ensure that the submitter receives the best possible service for the particular case. The laboratory is guided by the information submitted.

A Submission Form must be submitted for each case with complete and descriptive information provided – this does not have to be lengthy, but it must be informative. For example: "GSW or gunshot wound" is much more informative than "suicide".

**NOTE: The scope of analysis is determined by the information provided to the laboratory.**

# Minimum Sample Requirements

**It is always better to collect more specimen than will be required for testing than too little sample. Insufficient sample will result in incomplete testing.**

## Requirements by Specimen Type

Matrix	Volume Requirement
Blood	Two 7 cc (or larger) grey-stoppered tubes (14 cc total minimum) (Grey stoppered tubes are preferred over purple or red stoppered)
Urine	Approximately 30 cc in plastic, screw-capped bottle
Vitreous or Bile	Minimum 1 cc in grey-stoppered tubes
Stomach Contents	A large plastic container of appropriate volume, sealed well (too much is better than an insufficient quantity)
Lung Tissue	Place in a sealed well (e.g. paint can), or sealed glass jar, of one pint or one quart volume and freeze (DO NOT use plastic containers)
Kidney/Liver/Tissue	Approximately 5 grams, unembalmed if possible
Other	Contact toxicology section for guidelines

## Requirements by Toxicology Service

Service	Specimen Requirements
Alcohol	<b>Blood</b> - Whenever possible, grey-stoppered tubes.
Alcohol Content	Whenever possible, liquid specimens (e.g. chest fluid, vitreous humor) should be in grey-stoppered tubes Solid specimens (e.g. liver, tissue, hematoma) at least 5g in sealed container.
Proof Determination	A minimum of 200 CC (~6 oz) of liquid in a sealed leak proof container.
Toxicology –DUI	<b>Blood</b> - Whenever possible, grey-stoppered tubes <b>Urine</b> - sealed plastic bottle
Toxicology – DFSA	<b>Blood</b> – Whenever possible, grey-stoppered tubes <b>Urine</b> – It is important to collect urine in sexual assault cases. Package in a sealed plastic bottle.
Toxicology – Post	<b>Blood</b> - Whenever possible, grey-stoppered tubes <b>Other Fluid</b> - Whenever possible, grey-stoppered tubes <b>Urine</b> - sealed plastic bottle <b>Tissue</b> - at least 5g in sealed container. <b>Gastric Contents</b> – large sealed plastic container
Volatile Analysis	<b>Blood</b> - Whenever possible, <b>FULL</b> grey-stoppered tubes. <b>Lung Tissue</b> - about one pint, well-sealed (e.g. paint can) container. <i>AVOID PLASTIC CONTAINERS</i> <b>Source Materials</b> - Propellant cans, glues, towels/rags, or gas cylinders which are suspected sources should be collected and immediately placed in a sealed container to prevent loss of volatile substances. These items should be submitted to the laboratory with the biological samples

Carbon Monoxide	<b>Blood</b> - Whenever possible, grey-stoppered tubes. There must be red blood cells present. <b>Serum and plasma are unacceptable samples as they do not contain red blood cells.</b>
Poisons	
Ethylene Glycol (antifreeze)	<b>Blood</b> - Whenever possible grey-stoppered tubes <b>Urine</b> - sealed plastic bottle
Arsenic	<b>Gastric contents</b> <b>Tissue (liver/kidney)</b>
Strychnine Cyanide	<b>Blood</b> - Whenever possible, grey-stoppered tubes
GHB	<b>Blood</b> - Whenever possible, grey-stoppered tubes <b>Urine</b> - sealed plastic bottle
Other	<b>CONTACT TOXICOLOGY</b>