

Toxicology Overview

The Division of Forensic Sciences (DOFS) Toxicology discipline 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 samples such 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 discipline provides five primary services:

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

The Toxicology discipline 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.

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Alcohol Analysis

The Toxicology discipline also 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.

BLOOD ALCOHOL

Blood specimens tested for the presence of alcohols are analyzed for ethanol, which is drinking alcohol, methanol, which is found in sterno, iso-propanol, which is rubbing alcohol, and acetone which is found in paint thinners and nail polish remover. 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 blood samples will be submitted in DOFS approved **Blood Alcohol Collection Kits**. Alcohol determinations **will not routinely** be performed on urine samples.

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.

PROOF DETERMINATION

The analysis of suspected moonshine or other liquids to determine the proof of alcohol present in a sample.

Carboxyhemoglobin



Carbon monoxide is the most frequently found poison. This service may be requested in order to address the following questions:

- Did the victim die before or during a fire?
- Was the person exposed to a sufficient concentration of carbon monoxide to influence behavior or cause death?
- Was carbon monoxide a factor in influencing the behavior of a driver in a motor vehicle crash?

Case types commonly involving testing for carbon monoxide requests:

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

Poison Determination

"All things are poison and nothing is without poison, only the dose permits something not to be poisonous."
Paracelsus (1493-1541)

Poisons typically require an experienced and well trained-eye to identify. The Toxicology discipline has scientists who specialize in this type of testing to aid in the analysis of undetermined or suspicious death cases.

Poisonings may involve a large list of potential substances including pesticides, heavy metals, various gases, and cleaning solutions. Carbon monoxide is the most frequently observed poison, and a carboxyhemoglobin determination is used to test for the presence of carbon monoxide. The classical poisons which continue to be of interest are arsenic, cyanide, and strychnine. These substances can sometimes be found in victims of homicide, but more commonly encountered in suicides, accidental poisonings, or from environmental exposures. The crime lab also routinely tests for the presence of ethylene glycol (antifreeze) and gamma-hydroxybutyric acid (GHB), a drug commonly associated with date-rape.



The laboratory tests a wide variety of samples for the presence of poisons. Commonly tested samples include blood, urine, stomach contents, and tissues, such as liver.

This service relates to those cases involving:

- Cause of death unknown – possible poisoning/suspicious circumstances
- Attempted poisoning, substance known or found, and motive possibly identified
- Victim known to abuse illicit alcohol – possible lead poisoning
- Strongly suspect arsenic poisoning – clinical lab results may be positive, source of arsenic may have been identified, and suspect and motive may have been identified
- Suicide from cyanide/strychnine poison with containers present at scene and indicators of suicidal intentions present

Case examples involving test for poisoning requests:

- Accidental poisoning
- Attempted homicides/suicides

- Homicides
- Suicides

Toxicology



Specimens submitted for toxicology analysis vary greatly and may include blood, urine, vitreous humor, bile, gastric contents and liver.

Gas Chromatography / Mass Spectrometry (GC/MS) – confirms the presence and quantities of drugs

Immunoassay screens specimens for common drugs of abuse such as cocaine, methamphetamine and

marijuana, as well as some prescription drugs. Liquid Chromatography/Mass Spectrometry/Mass Spectrometry (LCMSMS) may be utilized to perform a comprehensive drug screen. Gas GC/MS or LCMSMS analysis can then be used for confirmation and/or quantitative analysis. .

These tests are used in a large number of case types to address one of the following questions:

- Did the victim die of a drug overdose?
- Was the subject's behavior influenced by the presence of alcohol or drugs?
- Was the victim taking a prescribed medication as directed? (e.g. Was the anticonvulsant concentration in the blood too low?)
- Was the subject driving while affected by a controlled substance or a potentially impairing drug?
- Is the person negative for detectable amounts of the drugs analyzed?

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

- Unattended deaths – cause unknown
- Drownings
- DUI/Drugs cases
- Fire deaths
- Homicides
- Motor vehicle crashes

- Seizure-related cases
- Sudden Infant Death Syndrome (SIDS) cases
- Suicides
- Suspected overdoses

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 drug facilitated sexual assault, 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.**

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.

Volatile Determination



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.

This test may be used to answer the following questions:

- Was the subject driving while intoxicated by a volatile substance?
- Did a gas (e.g. nitrous oxide/propane or natural gas/butane) asphyxiate the victim?
- Did the victim succumb from toxic effects of the volatile solvent or gas (e.g. Trichloroethane or Freon)?
- Case examples involving test for volatiles requests:
- DUI subjects with gas/vapor delivery paraphernalia

- 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

Evidence Submissions

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.

Labeling

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.

The laboratory requirements for submitting samples are as follows:

Specimen Type	Minimum sample requirements
Blood	Two 7 cc (or larger) grey-stoppered tubes (14 cc total minimum)
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	Approximately 5 grams, unembalmed if possible
Hair (for analysis of heavy metal poisoning)	Collect two bundles of head hair ¼ inch in diameter (approximate thickness of pencil) and maximum length possible (cut close to scalp), tie off with a string or a rubber band and label the root end. If victim is deceased, remove roots with the hair.

NOTE: It is better to collect too much of a sample rather than too little.

Biological Sample Requirements for Specific Toxicological Services

Analysis for:	Minimum sample requirements
DUI/Drugs*	Blood Urine <i>*Submission Form required on all suspected marijuana DUI cases</i>
Drugs/Poisons	Blood** Urine Gastric Contents ** RED -stoppered tubes should be used for blood when Fluoride, as in some radiator cleaners, or a pesticide, such as Parathion is the suspected agent. NOTE: Whenever the poisonous agent suspected is considered to be unusual and special packaging may be necessary – PLEASE CALL THE LABORATORY AND SEEK ASSISTANCE.
Gases or Volatiles	Blood Lung Tissue 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.
Arsenic	Urine (without preservative) Hair Suspected source materials such as ant poison, weed killer, and suspect foodstuffs Gastric contents (if available)Kidney and liver (if available) Nails pulled from the root NOTE: In most instances, blood is not an appropriate specimen for arsenic testing.
Carbon Monoxide	Blood – there must be red blood cells present (hemolyzed or non-hemolyzed) NOTE: Whole blood is the only appropriate biological specimen for carbon monoxide. Blood serum is unacceptable because it does not contain red blood

	cells.
Cyanide	Blood Gastric contents Suspected source material such as potassium, cyanide or suspected foodstuffs
Strychnine	Blood Urine Gastric contents (if available)Liver (if available) Any source material such as rodent poison or suspected foodstuffs