DARLENE ON DRUGS

Part 3: WSP Toxicology Testing Methods

Washington State Office of Public Defense

What is the Washington State Patrol Toxicology lab?

The Washington State Patrol Toxicology Lab consists of two facilities that are part of the Forensic Laboratory Services Bureau. The Division Commander oversees the Division, which has a staff of 45 members, including the State Toxicologist, Management, Forensic Scientist Supervisors, Forensic Scientists, Quality Assurance personnel, Property and Evidence Custodians, and Administrative staff.

Who do the Toxicology labs serve?

The Toxicology Labs are responsible for analyzing biological samples for the presence of drugs and alcohol. The Labs conduct testing for coroners, medical examiners, law enforcement agencies (including prosecutors), and the State Liquor and Cannabis Board. The labs receive approximately 16,000 cases per year, of which approximately 65 percent are law enforcement DUI cases, and 35 percent are coroner/medical examiner cases. The Crime Lab handles all other types of requests for analysis, and the Impaired Driving Section handles all DUI Breath test-related issues.

What's the difference between a coroner and a medical examiner?

While both coroners and medical examiners investigate deaths, the key difference lies in their training and selection process: coroners are often elected officials (not necessarily medical doctors) focusing on legal and administrative aspects, while medical examiners are appointed physicians (forensic pathologists) who focus on the medical aspects of death investigation, including performing autopsies.

Do Toxicology Labs charge agencies for their services?

No, the labs offer their services free of charge to agencies that request analysis.

Where are the Toxicology Labs located?

There are two Toxicology Laboratories in Washington State, located in Seattle and Federal Way.

How do Toxicology Labs receive samples for analysis?

Requests for Analysis and accompanying samples are received in two primary ways: either delivered in person or sent through a common carrier, such as USPS, UPS, or FedEx. When samples are shipped via a common carrier, the packages require a receipt signature.

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What is a Request for Analysis?

A Request for Analysis is an official form used by the Washington State Toxicology Laboratory. This form is primarily completed by the agency requesting the analysis. It contains essential biographical information about the subject, as well as case details for identification purposes. Additionally, the form includes space to document the chain of custody and any relevant laboratory information related to the sample. You can view a blank example of this form **HERE.**

Who first handles a Request for Analysis and its sample?

The first person to handle a Request for Analysis and the sample is a property evidence custodian. They receive these items and confirm that the sample matches the request. After verification, the sample is sent to Accessioning.

What is Accessioning?

Accessioning refers to the process of formally recording a new item into a library, museum, or other collection. In the context of Toxicology Labs, accessioning involves a staff member taking photographs of the samples as they are received. The staff member then verifies that each sample matches the accompanying Request for Analysis before uploading the information into the laboratory information management system (LIMS).

What happens when the samples get to the toxicologist?

The toxicologist first verifies that the sample corresponds with the Request for Analysis. They then inspect the sample to ensure it is intact, undamaged, and not otherwise compromised. Generally, tubes with red tops are used for death investigations, while tubes with gray tops are used for DUI investigations. Other colors may indicate that the samples come from different facilities, such as hospitals.

What is drug scope testing?

Drug scope is the extent of testing a laboratory is performing. This includes the variety of instrumentation, the number of compounds it will test for, and how they will be reported. For the Washington State Toxicology Laboratory, there is limited testing for DUI submissions that is outlined on their website.

What is extraction?

Toxicological extraction is the process of isolating substances, such as drugs and alcohol, from complex biological samples, including blood, urine, or tissue, for analysis in forensic toxicology and related fields.

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How do the Toxicology Labs determine which drugs to test for?

For driving under the influence case submissions, the Toxicology Labs conduct limited testing. Initially, they screen for ethanol (alcohol) using Gas Chromatography and for THC using Liquid Chromatography/Tandem Mass Spectrometry. If the test results show ethanol levels at or above 0.09 g/100 mL or THC levels at or above 7.0 ng/mL, these results are reported without any further testing.

Additional testing can be requested, but this request is limited to the following substances: Amphetamines, Benzodiazepines, Cocaine, Opiates/Opioids, and Methadone. For more information see the formal written guidance **HERE**.

How is the testing conducted?

The testing begins with something called a Volatile Screen. Using methods like headspace gas chromatography, a volatile drug screen detects and quantifies volatile substances such as ethanol, methanol, isopropanol, and acetone in blood or urine.

What is gas chromatography?

Headspace gas chromatography (GC) is an analytical technique used to separate and detect the chemical components of a sample mixture in order to determine their presence or absence and/or quantities.

How does it work?

A sample is placed in a sealed vial at the Toxicology Labs. These samples are run in batches of about 75, along with a small amount of headspace (the air above the sample). The vial is heated to a specific temperature, allowing volatile compounds to move from the sample into the headspace until equilibrium is reached. After equilibrium is achieved, the headspace is sampled and injected into the Gas Chromatograph in order to separate the volatile compounds based on their physical and chemical properties as they pass through a column. A detector measures the concentration of each separated compound. The resulting chromatogram (a graph of detector signal versus time) is analyzed to identify and quantify the volatile compounds present in the original sample.

This process is based on a scientific principle known as Henry's Law, which states that the amount of a gas that dissolves in a liquid is directly proportional to the partial pressure of that gas above the liquid, assuming the temperature remains constant. Each sample in a batch takes 3 to 5 minutes to run.

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Some of the toxicology reports I receive in discovery mention a method called liquid chromatography tandem mass spectrometry (LC/MS/MS). What exactly is that?

Liquid chromatography-mass spectrometry (LC-MS) is an analytical technique that combines the separation capabilities of liquid chromatography (LC) with the mass analysis features of mass spectrometry (MS). This technique is referred to as "tandem" because mass spectrometry is performed twice. It allows for the identification, quantification, and characterization of compounds in a sample.

How does Liquid Chromatography Mass Spectrometry work?

Liquid Chromatography Mass Spectrometry (LC-MS) is a technique used to analyze compounds in a sample. Put very simply, in this process, a liquid solvent (instead of a gas) pushes the sample through a column where the compounds in the sample separate. Once they exit the column, the compounds are shot with electrons, breaking them apart; this is the mass spectrometry portion of the technique. In a tandem process, the compounds are shot with electrons a second time. The mass spectrometer (electron shooter) detects and measures the abundance of each ion produced. This information helps to identify the compounds and determine their concentrations within the sample.

What is liquid chromatography mass spectrometry time of flight (TOF)?

Liquid Chromatography-Time of Flight Mass Spectrometry (LC-TOF-MS) is a technique that combines the separation capabilities of liquid chromatography (LC) with the high-resolution mass analysis provided by a time-of-flight mass spectrometer (TOF-MS). This method is used to identify and characterize compounds within a sample effectively.

How does it work?

The time-of-flight (TOF) analyzer functions by accelerating ions using a high voltage. The velocity of the ions, and consequently the time it takes for them to travel through the flight tube to reach the detector, is dependent on their mass-to-charge (m/z) ratios.

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Why do the Toxicology Labs use one test or the other?

Laboratories choose a test based on scientific literature and widely accepted instrumentation in the community. Once a test is chosen, it must undergo an extensive validation process before it can be put into production.

Some of the results in a Toxicology report have a ± and a number; what does that mean?

In a toxicology report, if you see a result accompanied by a "±" followed by a number, this indicates the measurement uncertainty. This represents the margin of doubt that exists for the result of any measurement, as well as how significant that doubt is. The calculation of this uncertainty involves complex mathematics. For more information, see the WSP policy on this topic **HERE.**

Are the Toxicology Labs accredited?

Yes, the Washington State Patrol (WSP) Toxicology Laboratory Division (TLD) is accredited by both the American Board of Forensic Toxicologists (ABFT) and the ANSI-ASQ National Accreditation Board (ANAB). This accreditation applies to alcohol and drug testing in biological fluids, ensuring that the laboratory provides high-quality and reliable forensic toxicology services.

To find out more about the labs,
please visit the resources page found at
https://wsp.wa.gov/crime/toxlab-resources/