Laboratory Services Bureau

TRACE/FIRE DEBRIS SECTION

PROVIDING THE HIGHEST QUALITY FORENSIC SCIENCE SERVICES TO THE CITY OF PHOENIX

The Trace Evidence / Fire Debris Section (TR/FD) is one of the most diverse sections in the LSB where Forensic Scientists are responsible for the analysis of a wide range of evidence that may be recovered from a scene, suspect, or victim. Forensic Scientists in this section have a unique blend of analytical and comparative skills that require attention to detail and an understanding of a variety of instrumentation. Trace evidence is generally thought of as any type of evidence that can be transferred or exchanged between two surfaces or objects. This exchange of material can often link a suspect, victim, crime scene, or object. Typically this evidence is so small that suspects don't realize they have even left it behind, which makes this evidence invaluable to an investigation.

Trace evidence includes:

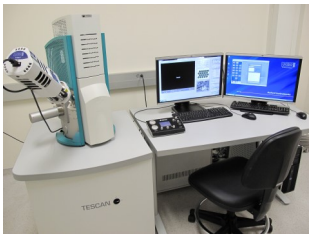
⇒ Gunshot residue
⇒ Footwear and Tire Impressions
⇒ Fire debris
⇒ Fibers
⇒ Tape
⇒ Paint
⇒ Glass
⇒ Physical match
⇒ Low Explosives
⇒ General physical/chemical unknowns

Due to the diversity of subdisciplines, Forensic Scientists in Trace are members in a variety of professional organizations. Most notably is The American Society of Trace Evidence Examiners (ASTEE).

The **PRIMARY SERVICES** provided by the TR/FD Section include:

Gunshot Residue (GSR):

Gunshot residue consists of small metallic particles (composed of antimony, barium, and lead) formed during the discharge of a firearm. During the discharge of a firearm these small particles can be deposited on the shooter's hands or anyone or anything in the close proximity to the shooter. Forensic Scientists in Trace use a scanning electron microscope with energy dispersive spectroscopy (SEM/EDS) to confirm the morphology and composition of these particles.



Footwear and Tire Impressions:

Footwear and tire impressions are a valuable piece of evidence that is often overlooked at a crime scene. Impressions from a crime scene are collected by Crime Scene Response personnel through photography, adhesive lifts, electrostatic lift, or casting. These unknown impressions are compared to known impressions made by the suspect's shoes or tires. Forensic Scientists look for class (size and tread design) and randomly acquired (or individual) characteristics. Randomly acquired characteristics are any imperfections or irregularities produced during the manufacturing process or caused by use of the shoe/tire such as imbedded rocks, scratches, and tears in the outsole or tread. These randomly acquired characteristics are unique to the shoe/tire and distinguish it from all other objects.

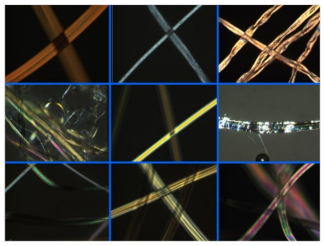
Fire Debris:

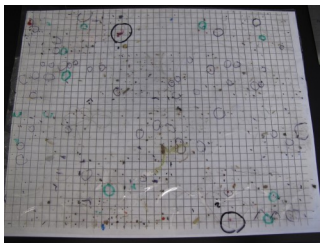
Fire investigators are called to scenes where a suspicious fire has occurred and collect evidence to determine if an accelerant was present. Evidence submitted by the Phoenix Fire Department in sealed metal cans or glass mason jars are extracted to determine if an ignitable liquid residue is present. Analysis of these samples is accomplished by using a gas chromatograph/mass spectrometer (GC/MS).

The **PRIMARY SERVICES** provided by the TR/FD Section include:

Fibers/Hairs:

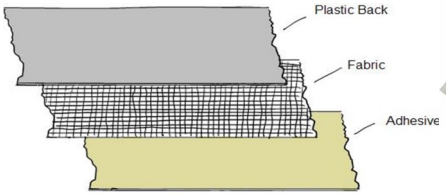
Fiber analysis involves the comparison of unknown fibers collected from a suspect, victim, or crime scene to fibers of known origin. Fiber evidence can be found in a variety of cases, but are generally associated when a struggle or close contact exists between a suspect and a victim. Man-made and natural fibers have distinct physical and optical properties that can be distinguished using polarized light microscopy (PLM). Instrumental analysis using Fourier Transform Infrared Spectroscopy (FTIR) can be used to compare chemical composition between fibers. Fiber evidence can be collected directly using forceps or by sampling a particular area using a tape lift.

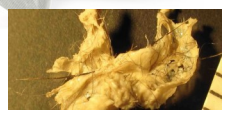




Tape:

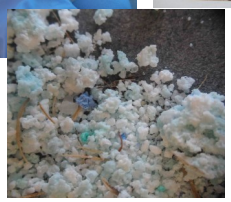
Pressure sensitive tapes (duct tape/electrical tape/packaging tape) can be analyzed in several ways. Physical dimensions, machine or calendaring marks, color, and backing/adhesive chemical composition are commonly used to differentiate between tapes. Tapes can also be used for physical fit determinations.





Physical Fit / General Chemical Unknowns / Other:

Physical match (fit) and general chemical and physical unknowns are more examples of the variety of subdisciplines in the Trace Section. It's not uncommon for a Forensic Scientist in Trace to develop a new method or research a different scientific analysis to analyze the variety of different evidence requested for Trace analysis, the proverbial "catch-all" section. Lamp filament analysis, lachrymator analysis (pepper spray), plastic bags, adhesives, bank dyes, cosmetics, lubricants, acids/bases, or other miscellaneous materials can all be requested for Trace analysis.



FUN FACTS:

◊ The size of a typical GSR particle is 0.5 to 10 microns - the cross section of a human hair is approximately 90 microns.

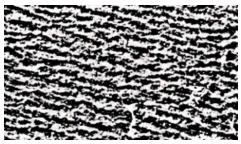
◊ There are eight classifications of ignitable liquids, gasoline (the most prominent) is it's own classification, followed by petroleum distillates, isoparaffinic products, naphthenic-paraffinic products, aromatic products, normal-alkane products, oxygenated solvents, and other/miscellaneous.

◊ Impression evidence (footwear and tire tracks) is the only subdiscipline in Trace where an identification is possible. The mass production of products makes individualization impossible for other materials such as fibers, plastics, or glass.

◊ There are over 17 individual components in gasoline that can be identified by GC/MS.

◊ Nylon, developed by Dupont in 1938, was the first manufactured synthetic fiber to become commercially available in 1951. Now, there are over 200 variants of Nylon.

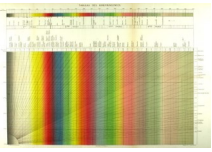
◊ An abrasion pattern on the outsole of a shoe, known as a Schallamach pattern or feathering, can have the appearance of ridge - like design similar to a fingerprint. This pattern can change after only 6 hours of wear.



◊ Approximately 70% of fibers used in textiles are man-made.

◊ Those rocks that get stuck in the tread of your shoe/tire… they're called "stone holds" and can help identify if a shoe has made the questioned impression.

◊ The Michel-Levy interference color chart has been used by microscopists since 1888 and is a valuable tool in relating thickness, retardation, and birefringence for various materials (especially fibers).



◊ GSR particles can travel 3-5 feet to the left or right of the shooter and 10-15 feet in front of the shooter.

◊ Trace analysts use a variety of instruments including: Scanning electron microscope with energy dispersive spectroscopy (SEM/EDS), Fourier Transform Infrared Spectroscopy (FTIR), Gas chromatography/Mass spectroscopy (GC/MS), comparison microscopes, and polarized light microscopy (PLM).

◊ Tire treads are specifically designed to include a noise treatment pattern - tread design elements that vary slightly in pitch to reduce road noise. This pattern usually occurs only once in the circumference of a tire and can help the analyst during examination.

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