## E8 Trace Evidence Overview for Attorneys: Sourcing and Resolution

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After attending this presentation, attendees will gain a fundamental understanding of the principles of trace evidence, the nature of this core forensic evidence, and the concepts of sourcing and resolution in its analysis.

This presentation will impact the forensic science community by improving the criminal justice process, where attorneys have a better understanding of how forensic science works—particularly the concepts and issues surrounding trace evidence—how to best utilize their evidence in adjudication, and the use of evidence in investigative and intelligence work.

Trace evidence is the umbrella term for any evidence that because of its size or texture is easily transferred from one location to another and persists for some period of time, until it is lost, collected, or ignored. Trace evidence reveals associations between people, places, and things involved in alleged criminal activities. The fundamental precept in trace evidence, and arguably all of forensic science, is the Exchange Principle. Initially described by Edmund Locard, it posits that:

> ...none can act with the intensity induced by criminal activities without leaving multiple traces of his passing...The clues I want to speak of here are of two kinds: Sometimes the criminal leaves traces at a scene by his actions; sometimes, alternatively, he picked up on his clothes or his body traces of his location or presence. (Locard E., L'enquête criminelle et les méthodes scientifiques, *Flammarion*, Paris, 1920, page139. Translated by Frank Crispino.).

Thus, transfer can be one-way, two-way, or multiple; an increase in the number, types, varieties, amounts, and locales can disproportionately increase the incriminating or exculpatory value of the evidence.

All of the transfers of interest to a forensic scientist occurred during the commission of the alleged crime and, therefore, are past events. Forensic science uses the physical remnants of those past criminal activities to reconstruct events with as high a level of resolution and accuracy as the evidence, analysis, and circumstances allow (think "short-term archaeology"). Some evidence types have higher resolution than others (DNA vs. ABO blood groups, for example) although the quality of the evidence may change that resolution. It is critical to remember that simply because one method's result may have a lower resolution than another does not mean that the method is "bad"–within the limits of the method, it may have rendered the best possible answer

("That letter of the alphabet could be a "B" but it's fuzzy" vs. "It is an R.").

Trace evidence analysis encompasses chemical, material science, biological methods, and primarily microscopy. The analysis process occurs in two phases: identification and comparison. Identification is classical categorization and set theory: something is or isn't nylon, is or isn't bottle glass, is or isn't automotive paint, etc. This level of information is called class-level evidence. Once identified, crime-scene evidence is then compared to one or more known or reference samples to determine if there is a common-source between the two samples. In this context, "common source" has a wide range of potential meanings, including manufacturer, production facility, batch or lot number, to as- used condition of the final item (damage, wear, alterations, etc.). Biologically, this level of sourcing (another way to think of resolution) runs the gamut from taxonomic class (as in animal hairs) to the individual (DNA). Other natural materials that occur as evidence, such as soil or pollen, have their own levels of resolution, depending on the processes that produced them (fill dirt vs. untilled alluvial soils).

More than "could have" evidence, trace materials occupy a critical link in the criminal justice system to reconstruct events, support, or refute allegations or statements, and to associate people, places, and things involved in criminal activities.

**Trace evidence, Sourcing, Resolution**

 ** Presenting Author*