



OSBI Criminalistics Division

GUNSHOT RESIDUE INFORMATION

INTRODUCTION

Gunshot residue (GSR), also known as primer residue, is the term applied to the microscopic particles of metal and metal compounds that are emitted by a firearm at the time it is discharged. These particles are derived from the primer composition, but may also contain contributions from other cartridge components such as the cartridge case and the projectile. GSR is NOT the residue of partially burned gunpowder grains, which may be visible to the naked eye and may be referred to by Firearm Examiners as gunpowder residue. The principle identification characteristic of a GSR particle is the presence of all three of the elements lead, barium, and antimony. These particles may be deposited on any surface near the firearm at the time of discharge, including the hands and clothing of the shooter and any bystanders in proximity to the gun.

EXAMINATION

Samples are collected from the surfaces to be sampled using special GSR kits provided by the OSBI. These kits may be obtained from the OSBI Forensic Science Center in Edmond or OSBI regional laboratories. The kits contain metal sampling disks, referred to as stubs, covered with double-sided adhesive carbon tape. The adhesive stub is lightly pressed onto the surface to be sampled, collecting most particles present. Particles of interest are located and identified by SEM/EDS (Scanning Electron Microscopy/Energy Dispersive Spectroscopy).

GSR particles are chemically stable, and samples collected for SEM/EDS examination can be stored for a period of years prior to analysis. The examination is non-destructive, and the samples can be re-examined if necessary. ***This time frame should not be confused with the actual collection time after an incident.***

INTERPRETATION

GSR is known to be rapidly lost from the hands of a shooter in the minutes and hours following the incident. Particles on clothing or other items will also be lost through ongoing activities but usually persist for longer periods of time. The OSBI Trace Evidence Unit does not routinely analyze samples taken from active, living individuals when collected more than four to six hours after an incident.

GSR analysis cannot be used to determine firing angles or distance. As the materials released from a firearm during discharge will include residues carried over from previously used ammunition, GSR analysis cannot associate the residues found with a specific firearm or ammunition.

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Not all types of ammunition contain compounds of all three of the elements lead, barium, and antimony in their primer formulation. Ammunitions marketed as “Non-toxic” or “Lead-free” may lack one or more of the elements lead, barium, and antimony in their primer. Such ammunitions will produce few, if any, particles identifiable as conventional GSR. In addition, some types of .22-calibre ammunition do not include a compound of antimony in their primer formulation. Primers of this type will likewise generate few, if any, GSR particles containing all three of the elements lead, barium, and antimony.

Particles containing 2 of the 3 elements are reported as well as particles containing all 3 elements listed, however, it should be noted that these 2 component particles may originate from sources other than the discharge of a firearm.

The finding of GSR is not proof that the subject discharged a firearm. The presence of GSR may be the result of activities such as discharging a firearm, being in close proximity to a firearm during discharge, handling a firearm or a fired cartridge case, or coming in contact with a surface bearing GSR.

The absence of GSR particles is not proof that the subject did not discharge a firearm. The absence of GSR may be the result of one or more of the following:

- The subject was not close to a firearm during discharge
- The subject did not contact a surface bearing GSR
- The discharged firearm did not deposit detectable quantities of GSR
- The GSR was lost prior to sampling by physical activity or by any washing, wiping, or cleaning process
- The area sampled did not have GSR on the surface
- The sampling technique was ineffective on the surface sampled

Note: the collection of particles for testing requires direct contact of the adhesive on the stub with the particles. Surfaces heavily contaminated with dirt or debris and some types of textured surfaces, such as fur, velour, velvet, terrycloth, fleece, and other loosely knit fabrics are difficult to sample effectively.

GLOSSARY

Cartridge: A complete unit of unfired ammunition for a firearm consisting of a projectile, propellant (gunpowder), primer, and cartridge case.

Primer: A shock sensitive mixture of chemicals which, when impacted by the firing pin of a firearm, ignites the gunpowder in the cartridge.

SEM/EDS (Scanning Electron Microscopy-Energy Dispersive Spectroscopy):

The SEM produces a magnified image based on the interaction of an electron beam with the sample's surface. The EDS is used to identify the element(s) present based on the x-rays produced through interactions between the sample and the SEM electron beam. This combined technique provides information about both the morphology (shape) of the sample and its elemental composition.