B57 Shooting Distance Estimation Using Gunshot Residue (GSR) on Mammalian Pelts

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After attending this presentation, attendees will understand how GSR is used for shooting distance estimation and the complications presented by mammalian fur. The various methods that are used to overcome interferences created by fur will be explained. These methods include some of the traditionally used visual and chemical methods, a few of which have been adapted from their traditional form.

This presentation will impact the forensic science community by providing methods that are useful in the field of veterinary forensic science when animals are subject to crimes involving firearms. This presentation will also provide additional methods of enhancing GSR patterns on surfaces that interfere with the commonly performed GSR tests.

GSR is produced from the discharge of a firearm and, for the purpose of this research, GSR includes any residue originating from the propellant, primer, projectile, cartridge case, residues from previous shots, and cleaning agents or lubricants present in the barrel that travel with the bullet to create a pattern on the target. The patterns, both visible and enhanced, may permit an estimation of muzzle-to-target distance to aid in reconstruction of firearm-related events. In cases involving animals, visualization of GSR is complicated by fur color and length. This requires visual and chemical techniques to be adapted so enough contrast is created to assist with muzzle-to-target distance estimation.

Initial photography of the pattern permits visualization, but the periphery shows little contrast. The use of a high-intensity, tunable-wavelength light source may excite some GSR, resulting in fluorescence, thereby increasing contrast between the fur and GSR. Infrared (IR) light can also be used to enhance GSR patterns using a specialized IR camera or an IR viewer. Radiography can be employed to detect the presence of radiopaque metallic particles surrounding the entrance hole. Once all methods of visual enhancement are complete, the Modified Griess test (MGT) can be used to detect the presence of nitrites.

Cow and rabbit hides were shot from a range of distances from contact to three feet with jacketed and unjacketed ammunition using handguns of various calibers, including a .38 Special, a 9mm, and a .45 Automatic Colt® Pistol (ACP). Visualization with white light and IR light shows patterns increasing in size as muzzle-to-target distance increases. In some instances, the presence of a radiopaque ring, presumably metallic lead, around the entrance hole was detected with radiography. The ability to visualize this ring can be enhanced by adjusting characteristics of the image, allowing the radiopaque ring to be visualized at greater distances. As expected, both observable features begin to fade with increasing muzzle-to-target distance. The MGT was conducted using filter paper rather than photographic paper and applying the heat to cheesecloth on the backside of the filter paper. Results of the MGT are consistent with the visual methods, as the patterns increase in size and become more dispersed with increased firing distance.

Gunshot Residue, Mammalian Pelts, Shooting Reconstruction