E2 The Visualization of 9mm and .40 Caliber Gunshot Residue (GSR) From Various Ranges of Fire With Alternate Light Sources (ALS) and Infrared (IR) Imaging

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Learning Overview: After attending this presentation, attendees will better understand the capabilities of ALS and IR imaging when viewing GSR on dark-colored fabrics.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by promoting a better understanding of the capabilities of, and differences between, ALS and IR in visualizing GSR on dark-colored fabrics.

GSR is composed of smoke resulting from combustion of propellant, metallic fragments from the bullet, unburned and partially burned gunpowder particles, and lubricants. GSR may be deposited on surfaces of objects at a crime scene or on clothing or skin of persons present during the weapon discharge. Visualization of GSR is an important task during preliminary phases of criminal investigations. Early presumptive detection can provide immediate insight for investigators by helping to establish if a bullet defect is an entry site, determining if a person may have handled a weapon or had been in close proximity to the weapon at the time of discharge, and in determining a broad, estimated range of fire.

GSR is easily observed on light-colored surfaces due to its inherent dark color. Dark surfaces, however, often obscure GSR. The two visualization methods chosen for this research include IR and ALS. Both of these methods can be practically employed by investigators during preliminary phases of investigations, including crime scene examinations to detect GSR on dark surfaces.

Magtech® .40 caliber 180 grain Full Metal Jacket (FMJ) and 9mm Luger® 115 grain FMJ ammunition were fired five times each from distances of 3 inches, 9 inches, and 18 inches into black, cotton T-shirt samples. Later observed were the samples using a Sirchie® TMX ALS (450nm) with orange barrier filters. Images were taken using a Nikon® D5200 camera and orange filter. A Fuji® XT1 IR camera with IR 830 and 850 filters was utilized, in conjunction with 100-watt incandescent light sources, to observe and photograph the samples with IR. For control purposes, all samples were viewed with the same ALS and IR equipment prior to shooting. No particles were detected on any of the samples prior to shooting.

GSR was visualized on all samples using both IR and ALS; however, differences were observed. ALS was more effective in identifying scattered particles while IR was more effective in identifying scorching, burning, and bullet wipe. The scorching and burning observed with IR was visible at the 3-inch range of fire for both types of ammunition, but not at 9- or 18-inch ranges. Bullet wipe was visible with IR for both types of ammunition at all ranges of fire. The scattered particles observed with ALS, as expected, formed increasingly tighter patterns as the range of fire decreased. Scorching, burning, and bullet wipe were not able to be detected with ALS.

The GSR observed with IR effectively revealed scorching, blackening, and bullet wipe in proximity to the bullet hole, allowing clear evidence of the bullet entry site, while the particles observed with ALS were scattered and more useful in generating a presumptive range of fire estimate. Any range of fire estimates derived from presumptive visualization, however, should not be considered scientifically reliable or conclusive, but can be helpful to investigators in early stages of shooting incidents.

The GSR identified with IR could be easily interpreted due to its close proximity to the bullet holes. The scattered particles detected with ALS, however, could potentially cause interpretation difficulties when other trace particles are present. Using IR and ALS in conjunction provides maximum benefit by allowing visualization of bullet wipe, burning, and scorching, along with the scattered particles.

Gunshot Residue, Alternate Light Source, Infrared Imaging

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