B18 Supplementary Viewing Techniques of Gunshot Residue (GSR) Utilizing Infrared (IR) and Fluorescence

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Learning Overview: The goal of this presentation is to inform attendees about the use of IR and fluorescent photography as a method for visualizing GSR on dark, patterned, or contaminated clothing.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating techniques capable of visualizing GSR on normally difficult-to-work-with evidence in a rapid and non-destructive manner.

While muzzle-to-target analysis is a crucial component of forensic investigation into firearms-related incidents, a number of obstacles can impede the ability of traditional techniques to observe depositions of GSR at an acceptable level. Microscopic examination for the purpose of documenting GSR deposition patterns is difficult to perform on evidence comprised of darker or patterned fabrics, and environmental contaminants can affect both the microscopic examinations and follow-up chemical testing. For these reasons, development of a supplementary non-destructive technique for GSR visualization is desirable.

Previous studies have demonstrated that GSRs possess both IR and fluorescent properties, allowing for the visualization of deposition patterns on a variety of substrates, though no definitive methodology has currently been established. This study evaluates the ability of the Foster and Freeman Crime-lite® 82S series of light sources, as well as the Foster and Freeman DCS® 5 workstation, for the purpose of visualizing GSRs across a number of variables.

In order to establish that GSR deposition patterns observed utilizing IR mimicked expected results derived from more easily observed lighter fabrics, dark fabrics were shot in triplicate over a selection of fixed distances and calibers. These results were compared to a light fabric control shot with the related caliber at each distance. Testing was then expanded to incorporate a variety of ammunition manufacturers and fabric types to discern the effects, if any, each of these variables had on visualization with IR. Obtained samples were also subjected to fluorescent testing utilizing a green light source (490–560nm) coupled with a deep-red filter (571nm) in order to serve as an additional method for GSR visualization and as a comparison point for obtained IR images. Final testing involved the application of a selection of commonly encountered environmental contaminants to fired targets in order to document their potential interference in the visualization process.

The results of this study indicate that visualization of GSR on dark fabrics utilizing IR in ideal conditions is widely successful across most tested calibers and manufacturers, while fabric composition, weave, and pattern differentially affected IR visualization. Green fluorescent visualization was tested with varying outcomes observed across multiple calibers, manufacturers, and target materials. Contaminants were also demonstrated to have varied effects on visualization as certain environmental contaminants were able to be eliminated nearly completely while others completely obscured GSR patterns. Future avenues for investigation can involve testing the effects of different fluorescent wavelengths and additional contaminants or utilize a more comprehensive list of distinct ammunition types and manufacturers.

Gunshot Residue, Infrared, Fluorescence

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