B169 Gunpowder Particle and Vaporous Lead Deposit Patterns on Fabric From Hand Gun Discharges II

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After attending this presentation, attendees will learn about the deposit patterns for gunpowder particles and vaporous lead when selected handguns are fired into clothing fabrics using different ammunition and at different distances.

This presentation will impact the forensic community by demonstrating that the collection/manipulation history of clothing exhibiting gunshot defects seized as evidence during shooting scene investigations is extremely important in determining muzzle to target distances.

Clothing items with bullets holes and gunpowder deposits as recovered from shooting homicide victims can be carefully evaluated for their collection/manipulation history, gunpowder particle deposit patterns and vaporous lead deposits and thereby provide a valuable foundation for muzzle to target distance determinations.

Gunpowder particle deposit patterns on clothing fabrics, particularly in the region of a bullet penetration defect, provide interpretive opportunities for forensic scientists interested in establishing an intervening distance measurement between the discharging firearm and the target clothing fabric. The same can be said for vaporous lead deposit patterns. This presentation reports on the results of testing conducted thus far involving a second 9mm semi-automatic pistol with a 5.25 inch barrel and a selected .40 S&W caliber semi-automatic pistol In order to establish baseline information relating to the source of lead in gunpowder particle deposit patterns on clothing the gunpowder, jacketed bullet and cartridge case of one round representing each of the ten manufacturers were tested using x-ray fluorescence spectrophotometry, (XRF). All gun powders were found to contain lead ranging from 25 ppm to 180 ppm.

Then, one manufacturer's specific cartridge design was used in the 9mm pistol and the .40 S&W caliber pistol to fire into white 100% cotton t-shirt fabric at muzzle to target distances of 4", 6", 8", 10", 12", 14", 16", 20", 24", 30", 36", 42", 48", and 54". A template of concentric circles drawn at one inch, two inches, three inches, and four inches from the center point was prepared on clear Mylar sheet stock and this was used as an overlay on top of the test fire panels with the center point placed dead center on the bullet defect in the panels. The circles were scribed into quarters and during microscopic examination, counts for gunpowder particle deposits were made in one quarter of the circle.

The counts, for purposes of this presentation, are reported in three ways. One unit used is the number of gunpowder particles counted in a particular quarter circle area. The gunpowder particle count for the area ranging from the circle center point out to the quarter arc at one inch from the circle center is recorded as the "First Order Quarter-Circle Gunpowder Particle Count" and the number for the "Second Order Quarter-Circle Gunpowder Particle Count" is the number of gunpowder particles counted in the quarter of circle area ranging from the circle center point out to the quarter arc at two inches from the circle center, and so on. Another unit used is the calculated density of gunpowder particles in a particular designated quarter of a circle area and that figure is recorded using the appropriate quarter-circle reference as "First Order Quarter-Circle Density", "Second Order Quarter-Circle Density" and so on. The third unit is the gunpowder particle count for a particular "Quarter-Arc Band" in which gunpowder particle deposits were found. For instance, the "First Order Quarter-Arc Band" is the same space as that designated by the "First Order Quarter-Circle" area and the "Second Order Quarter-Arc Band" is the area between the quarter circle perimeter at one inch from the bullet penetration center and the quarter circle perimeter at two inches from the bullet penetration center, and so on. Gunpowder particles were found on the test panels out to a muzzle to target firing distance of 54 inches.

Generally, gun powder particle deposit counts for the second 9mm pistol, with the 5.25 inch barrel, were less than for the previously reported counts for the 9mm pistol, with the 4⅞ inch barrel, in the First Order Quarter Circle Band area with considerably lower values at the shorter shooting ranges. The lower values for the shorter distances may be due to muzzle gas turbulence induced by higher interior barrel pressures for the slightly longer barrel length. Another contributing factor is the longer burn time allowed by the longer barrel length and therefore fewer and/or smaller surviving gun powder particles at the time of muzzle exit by the fired bullet.

Finally, using the .40 S&W caliber pistol, one each of the twenty nine rounds representing varying cartridge configurations of the thirteen brands were fired into white, 100% cotton t-shirt fabric from a consistent muzzle to target distance of 10 inches. Gunpowder particle deposit counts were tabulated for the various orders of "Quarter-Circle" and "Quarter-Arc Band" areas.

Clothing items with bullets holes and gunpowder deposits as recovered from shooting homicide victims can be examined and analyzed for their gunpowder particle deposit patterns and vaporous lead deposits for the purpose of muzzle to target distance determinations, however in doing so one must make every effort to establish gun powder particle counts out to at least the 4th order in short distances, (from 2 to 14 inches in muzzle to target distances) and out to at least the 5th order in the longer distance shots.

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Gunpowder Patterns, Vaporous Lead, Primer Smoke

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