A186 Gunpowder Particle and Vaporous Lead Deposit Patterns on Fabric From Hand Gun Discharges III

Kay M. Sweeney, BS, KMS Forensics, Inc., PO Box 8580, Kirkland, WA 98034*

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

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

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 one 9mm semi-automatic pistol using 25 different rounds of 9mm luger ammunition representing fourteen manufacturers or brands.

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.

All 25 different rounds of ammunition were used to fire into white 100% cotton t-shirt type fabric target panels and white 100% nylon rip- stop type jacket fabric panels at a uniform muzzle to target distance of 10 inches. Then, one manufacturer's specific cartridge design was used in the 9mm pistol to fire into white 100% cotton t-shirt type fabric target panels and white 100% nylon rip-stop style jacket fabric at muzzle to target distances of 2," 4," 6," 8," 10," 12," 14," 16," 20," 24," 30," 36,"

42," and 48." Again the same 9mm caliber pistol was used for all test firing exercises. Results relating to firearm discharge into 100% cotton targets were originally reported on in 2007 for a 9mm caliber firearm and in 2008 for a .40 caliber firearm and the current presentation relates to results from 9mm firearm discharge into 100% nylon targets and contrasts those results against the cotton target results.

A template of concentric circles drawn at one inch, two inches, three inches, and four inches from the center point was prepared on clear plastic sheet stock and this was used as an overlay on top of the test fire panels with the center point placed Drug Enforcement Administrationd center on the bullet defect in the panels. The circles were scribed into quarters and during microscopic examination, counts for gunpowder particle deposits in each one quarter of the circle were recorded for each zone, or order, from one inch through four inches out from the bullet defect center point.

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 48 inches.

Gunpowder particle counts for 100% cotton targets were significantly higher than those for the 100% nylon targets in the same order of quarter circle areas. The lowest range of particle counts for the nylon targets is 6% of the cotton target counts using the same ammunition with an identical muzzle to target distance of eight inches (76 particles on the cotton target in the 3rd order quarter circle area and five particles in the same zone for the nylon target) and the highest range for the nylon targets is 28% of the cotton target counts with a common muzzle to target distance of 12 inches (25 particles on the cotton target in the 1st order quarter circle area as opposed to seven particles in the same zone for the nylon target).

Selected test fire panels of both 100% cotton and 100% nylon were subjected to XRF analysis for the presence of vaporous lead deposits and four out of five corresponding panel pairs demonstrated higher levels of

 ** Presenting Author*

lead for the cotton panel over the nylon panel for the same firearm, same ammunition, and same firing distance in the first order quarter circle area. Vaporous lead concentrations were found to drop off dramatically in the 2nd order quarter circle band.

Clothing items with bullet 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).

Gunpowder Pattern, Gunpowder Particles, Vaporous Lead

 ** Presenting Author*