



D46 The Effects of Fabric on Muzzle-to-Target Distance Determinations

Katie M. Carlson, BS, Virginia Commonwealth University, 100 West Cary Street, Richmond, VA 23284; and Ann L. Davis, MS, and John H. Willmer, BS, Virginia Department of Forensic Science, 700 North 5th Street, Richmond, VA 23219*

After attending this presentation, attendees will understand the principles and methodologies for conducting distance determinations, the use of a density model for the dispersion of gunpowder particles and fabric types, if any, which may be problematic for such examinations.

This presentation will impact the forensic community and/or humanity by providing examiners who conduct distance determinations with a documented study validating the use of standard target material for comparison to various fabric types.

Muzzle-to-target distance determinations are often requested of forensic laboratory personnel to assist investigators in their determination of what events took place at a crime scene. Clothing items, such as shirts or pants taken from the victim, are commonly contaminated with blood or other biological materials, making them unsuitable to safely use as a target material. In addition, analysts at many forensic laboratories may not be authorized to alter evidence clothing for distance determination purposes. In order to circumvent these problems, most forensic laboratories use standard testing materials for muzzle-to-target distance determinations. Typical standard testing materials include white twill jean, blue denim and white knit cloth.

The purpose of this research project was to determine whether these standard testing materials provides an accurate muzzle-to-target distance determination, regardless of the type of fabric that was involved in the shooting incident. Patterns resulting from test firing at standard target materials were analyzed and compared to patterns resulting from test firing at various fabric types. The intent was to identify specific fabric types that may not produce valid conclusions when using the standard target material when such examinations are conducted. The methodology used nine by nine (9 x 9) inch fabric targets, a Ruger Model P89 caliber 9mm Luger semiautomatic pistol and Federal brand caliber 9mm Luger cartridges loaded with 147 grain Hydra-Shok jacketed hollow point bullets. This combination was selected because it is commonly encountered in the laboratory and the ammunition provides ample dispersion of gunpowder for comparison out to a muzzle-to-target distance of approximately forty-two (42) inches. Fabrics selected provided a variety of fiber blends, thread counts and weave types that represent clothing types often encountered in the forensic laboratory. Each type of fabric was test fired at approximate muzzle-to-target distances of contact, 1 inch, 6 inches, 12 inches, 18 inches, 24 inches, and 36 inches. Visual and microscopic examinations were conducted to identify any unusual physical properties such as burning, singeing, or melting of the fabric, as well as any gunpowder particles adhering to the cloth. The dispersion of the gunpowder on the targets was rated according to density. This examination was followed by the modified griess test in order to detect a nitrite pattern on the test fired materials. Subsequently, the sodium rhodizonate test was performed to detect a lead residue pattern on the test fired materials. The patterns developed from the various fabric types were analyzed for size and density and compared to the patterns detected on the standard target materials.

Results of the comparative analysis on each of the fabric types and indicate fabrics that might pose a problem when compared to the standard target materials will be presented. The results of these experiments will identify which fabric types, if any, should not be compared to standard target materials for muzzle-to-target distance determinations.

Distance Determination, Fabric, Gunpowder Residue