D58 Development of Latent Fingerprints on Brass Cartridge Casings: Survival of the Firing Process and Impact of Latent Print Development Using Acidified Hydrogen Peroxide on Forensic Firearms Examinations

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After attending this presentation, attendees will gain a better understanding of how often latent fingerprints deposited on brass cartridges survive the firing process and the extent to which latent print processing using acidified hydrogen peroxide interferes with forensic firearms examination.

This presentation will impact the forensic science community by demonstrating the survivability of latent fingerprints on brass cartridge cases after firing and discussing the extent to which latent print processing using acidified hydrogen peroxide interferes with forensic firearms examination.

Latent fingerprints developed on fired cartridge cases may serve as key pieces of evidence during forensic investigations; however, the success of developing latent fingerprints on fired cartridge cases has been a challenge for investigators due to the nature of the firing process. When fingerprints are placed on cartridge cases prior to or while loading of the weapon, there is a high probability they are destroyed due to the extreme temperatures and abrasive forces caused by the firing process. Despite these odds, other researchers have demonstrated that fingerprints, on occasion, do survive the firing process. Several methods for developing latent fingerprints on brass cartridge cases are available, which include cyanoacrylate ester fuming followed by Rhodamine 6G (CA/R6G) fluorescent dye stain and Acidified Hydrogen Peroxide (AHP).

While the majority of previous research has focused on identifying various techniques to develop latent fingerprints, very little research has evaluated the down-range effects of the development techniques to forensic firearm examinations. This is of particular interest with AHP since it is an irreversible reaction having the potential to corrode the brass and negatively interfere with the various impressions linking that cartridge case back to the weapon from which it was fired. The present study is separated into two phases. Phase I examines the survivability of latent fingerprints through the firing process, evaluates the development technique (CA/R6G, AHP, or CA/R6G-AHP) yielding the highest number of latent fingerprint impressions after firing, and the processing time required to develop fingerprints using AHP. Phase II examines whether and if so, the extent to which AHP may interfere with forensic firearm examinations at various processing durations.

For Phase I, the results indicate latent fingerprints deposited using the latent print matrix standards (both amino and eccrine) did survive the firing process; however, no latent prints deposited using the natural fingerprint matrix obtained from the study participant survived. Second, all three techniques were successful for developing latent fingerprints; however, AHP and CA/R6G-AHP were superior to just CA/R6G alone. Third, a maximum processing duration of 75 seconds should be observed when using AHP.

For Phase II, the results indicate firearms examiners considered all cartridge casings suitable for identification, but were able to differentiate whether a cartridge case had been processed. However, of those cartridge cases which had been processed, there was no statistical relationship between the processing technique nor the duration of processing and the level of degradation observed by the firearms examiners. Additionally, there was no statistical relationship of correlation values obtained using MATLAB of the images of the breach faces for each cartridge case before and after processing. These results warrant further research to better understand how the chemistry of fingerprint matrices, time, and normal environmental degradation of latent print residue will impact latent print development and its survival through the firing process. Additionally, further research is warranted to better understand the extent to which AHP processing may interfere with forensic firearms examinations using other types of ammunition and weapons.

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

Cyanoacrylate-Ester, Hydrogen Peroxide, Fingerprint

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