B96 The Development of Odor Profiling Methods for the Detection of Contraband Firearms

Kirsten R. Nettles, BS, Texas Tech Univeristy-Institute for Forensic Science, Lubbock, TX 79416-2103; Cameron P. Ford, Ford K9 LLC, Henderson, NV 89002; Paola A. Prada-Tiedemann, PhD, Texas Tech University, Lubbock, TX 79416-2103*

Learning Overview: After attending this presentation, attendees will better understand the Volatile Organic Compounds (VOCs) emitted from the actual firearm device in terms of the odor signature of firearm-related particulates for better source identification.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by evaluating volatile odor signatures from firearms to include the full device and other parts, such as magazines, because there is a need within the national security community to formulate an educated approach to understanding and enhancing canine detection of body-worn/carried firearms. This is a direct Organization of Scientific Area Committees (OSAC) need defined by the Dog and Sensors Subcommittee.

Firearms are recurrently the lethal means in forensic casework ranging from homicide and suicide to accidental injuries, indicating an important law enforcement and national security concern. With regard to mass shootings in this country, prevention tactics such as firearm detection canines have been at the front line of security tools for law enforcement personnel. For optimal use and field applications, canines need to be trained with high-quality training aids that are on par with current national security threats. Currently, there is no scientific foundation as to the chemical odor signature of firearms used in canine detection. Although previous studies have been focused toward an understanding of gunshot residue components as it relates to firearm discharge events, this study is focused on using the firearm as a direct source for odor profiling for purposes of body worn/concealed weapon detection. Creating an additional capability for firearm detection and analysis via odor profiles will allow unique odor signatures to be identified for instrumental classification.

This study provides a novel method application to generate an odor profile using Solid Phase Microextraction-Gas Chromatography/Mass Spectrometry (SPME-GC/MS) as a rapid system for the analysis of headspace odor volatiles. Instrumental evaluation utilized Divinylbenzene/ Carbon/Polydimethylsiloxane (DVB/CAR/PDMS) -coated SPME fibers that were injected into a GC/MS system for the identification of extracted volatile odor profiles from magazines (loaded and unloaded) as well as full firearm devices. Eight ammunition samples were collected and analyzed to provide another target analyte for analysis as a control. The magazines and firearms will be utilized from the local law enforcement shooting range. There were at least 30 unloaded and loaded magazine samples and 15 firearm samples. The findings include an assortment of compounds emitted from the magazines and/or firearms exhibiting distinctive odor profiles that have not yet been reported as part of organic gunshot residue constituents or similar discharge components in the literature. There is a dearth of research in terms of firearm odor volatiles, specifically as it relates to associated vapor signatures to enhance detector development in a variety of threats including terrorist attacks and mass shootings. This research responded to that gap by testing the firearm as a target sampling source to investigate the odor bouquets created before it is used in a shooting. The understanding of key odorants above a firearm will have a direct impact to national and international detection industries by providing knowledge that can be used to enhance training regimens, training-aid development to better prepare canine teams for current threats in our communities, and at ports of entry, as seen with the illegal transportation of firearms.

Volatile Organic Compounds, Canine Detection, Contraband Firearms

*Presenting Author