A133 Vacuum-Based GSR Recovery

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After attending this presentation, attendees will learn about newly available apparta that enhance the collection of GSR from fabric using standard vacuums. Specific attention will be made to the quality control aspects of this evidence collection technique.

This presentation will impact the forensic science community by showing how Vacuum-Based GSR Recovery technique is known to be well-suited in the recovery of GSR from fabric.

Gunshot residue (GSR) is formed from primer detonation. The aerosol produced in the conflagration produces particles, upon condensation, composed of lead, barium, and antimony and the various combinations of those elemental oxides. These particles can deposit on the hands, face, and clothing of the shooter and/or any bystander in close proximity to the event. Current methods of testing surfaces for the presence of GSR include using a stub with double sided carbon tape that is then analyzed using scanning electron microscopy coupled with energy dispersive X-Ray analysis (SEM/EDX).

Testing clothing for GSR presents several unique challenges. These include the GSR particles becoming lodged within the weave of the fabric and the inability of current GSR testing methods to analyze the entire article of clothing for GSR in a non-random fashion. Current methods are inadequate due to the clothing providing such a large testing area and stubs losing stickiness. Vacuuming fabric presents an intuitively obvious solution to collecting residues of any kind. Custom-built devices have been reported in the literature but owing to limited capabilities in most forensic laboratories these may not be an adequate solution. A unit comprised of a nozzle, filter canister and vacuum adapter was recently purchased. The configuration of the device allows for easy cleaning and filter pore-size variablility.

Preliminary particle recovery was performed using barium silicon oxide ($BaO \bullet SiO_2$). $BaO \bullet SiO_2$ is a suitable model for GSR in that it can be applied to a substrate via an atomized spray. Particles are typically less than 10 microns. Additionally, large quantities of particles are deposited using a suspension $BaO \bullet SiO_2$ in water. To ensure that no carryover was present, before testing any clothing with the attachment, the entire set up, complete with a new filter, was tested by pulling room air through the assembly for five minutes. The filter was then analyzed on the SEM. The filter had to produce negative results before being the assembly could used for testing and analysis. Rinsing the assemblies with water proved to be insufficient in removing whereas sonication followed by rinsing eliminated carry-over as measured in these experiments

Testing clothing exposed to GSR was then done. A lab coat and a long sleeve shirt were worn independently by an individual as shots were fires from a handgun. The first test, on the right sleeve of the lab coat from the elbow down to the cuff, illustrated that the vacuum filter did pick up GSR, the stub was able to pick up GSR from the filter, and the SEM was able to analyze the GSR from the stub. This initial test timed-out when the SEM reached 50 particles (a particle density of 0.83 particles/mm).

The left sleeve of the lab coat, from the elbow down to the cuff, was vacuumed using the attachment, and the same area was subsequently stubbed. These two stubs were analyzed on the SEM and the results illustrated that the filter did condense the GSR found on the sleeve. The vacuum filter and subsequent stub for the left sleeve of the lab coat displayed 50 particles (0.80 particles/mm and 22 particles (0.23 particles/mm) respectively.

The right sleeve was tested in the same manner described for the lab coat (from the elbow to the cuff), with the results showing eight particles for the vacuum filter and one particle for the stub. The inside of the front panels of the lab coat were vacuumed and the outside of the panels were subsequently stubbed. The vacuum filter timed out at 50 particles (2.59 particles/mm') and the stub displayed 45 particles (0.48 particles/mm').

It should be noted that the same assembly was used for all of the above measurements. Each cleansing was successful at removing any GSR that may have adhered to the plastic portions of the unit. A new filter was placed in-line for each recovery.

In summary, testing of the vacuum filter attachment produced positive results, illustrating that the filter picked up and condensed GSR particles for a less random, more uniform testing method. Although the filters were disposable, the apparatus and cartridges were re-used, increasing the risk of carryover contamination. Cleansing by sonication followed by rinsing and a quality control system effectively illustrated the vacuum attachment can be used and re-used without contamination.

GSR, Vacuum, Fabric

 ** Presenting Author*