



B121 A Study of the Presence of Gunshot Residue in Pittsburgh Police Stations Using SEM/EDX and LC-MS/MS

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After attending this presentation, attendees will be informed about a novel approach that was used in the investigation of the likelihood of Pittsburgh police vehicles and stations being sources of both inorganic and organic secondary Gunshot Residue (GSR) contamination. Attendees will also better understand how to analyze both inorganic and organic GSR from a carbon-coated adhesive aluminum stub.

This presentation will impact the forensic science community by investigating the presence of both inorganic and organic GSR contamination in police stations and vehicles — something that has yet to be investigated. Several studies have shown that environmental sources such as cars, fireworks, or paints can produce particles that may be misinterpreted as characteristic inorganic GSR. Yet, by testing for both organic and inorganic GSR, this possibility of misinterpretation by environmental sources could potentially be eliminated, which in turn would greatly enhance the significance of the evidence.

A police station or vehicle contaminated with GSR could lead to arrested individuals testing positive for GSR even though they have neither recently fired a gun nor been in the vicinity of a fired gun. This in turn could result in the incrimination of the innocent as well as lessen the legitimacy of a positive GSR result. Due to the risk of secondary transfer of GSR by a police vehicle or station onto the suspect prior to GSR sampling, it is necessary to create a baseline for the amount of GSR present in a police station or police vehicle. The potential of police stations and vehicles being sources of secondary inorganic GSR contamination has been investigated using Scanning Electron Microscopy with Energy-Dispersive X-ray Analysis (SEM/EDX); however, the presence of organic GSR contamination has not been examined.

This research takes a novel approach by investigating the likelihood of Pittsburgh police vehicles and stations being sources of both inorganic and organic secondary GSR contamination. Seventy-three samples were collected from four Pittsburgh police stations and vehicles using carbon-coated adhesive aluminum stubs. The samples were automatically analyzed using the SEM/EDX for the presence of non-crystalline particles containing approximately 10% by weight antimony, barium, and lead. These particles were classified as characteristic inorganic GSR, while non-crystalline particles containing various combinations of lead, antimony, and barium with aluminum, titanium, and zinc were classified as consistent with inorganic GSR. For a sample to be considered positive for GSR, there must have been at least three characteristic inorganic GSR particles present. Only one characteristic inorganic GSR particle was found; no sample was classified as positive for GSR. These results suggest there is a small potential of secondary transfer of inorganic GSR by a police vehicle or station onto a suspect. To test for the presence of organic GSR, these same 73 samples were then extracted with methanol and analyzed using Liquid Chromatography with Tandem Mass Spectrometry (LC-MS/MS). Optimized liquid chromatography parameters and an optimized multiple reactions monitoring scanning method were developed to obtain the greatest sensitivity for the following investigated compounds: akardite II, ethyl entralite, diphenylamine, N-nitrosodiphenylamine, 4-nitrodiphenylamine, and 2-nitrodiphenylamine. The limit of detection for each of the above compounds was found to be 0.53, 0.40, 1.18, 3.78, 2.33, and 2.33 nmol L⁻¹, respectively. Recovery percent from spiked SEM stubs was also investigated.

Gunshot Residue, SEM/EDX, LC-MS/MS