B120 The Significance of Elemental Analysis of Lead Projectiles

Robert D. Koons, PhD, and JoAnn Buscaglia, PhD, Federal Bureau of Investigation, Counterterrorism and Forensic Science Research Unit, FBI Academy, Quantico, VA*

Attendees of this presentation will learn the significance of the results of comparison of the elemental composition of projectile leads, the discrimination capabilities of ICP-AES for comparison of lead compositions, the strengths and limitations of comparative bullet lead examination, and suggestions for wording the results of examinations.

The concentrations of several select elements have been used as points of comparison of the lead component of projectiles for over 30 years. When bullet lead specimens are found to have indistinguishable compositions, it lends strong support to the idea that they were produced from the same melt of lead at a manufacturing site. However, the mixing of lead sources that occurs in the manufacture and packaging of assembled cartridges make assessing the significance of a finding of bullets with indistinguishable compositions difficult. Multiple distinguishable compositions of bullets often occur in a single box of cartridges, and bullets with indistinguishable compositions are found in many boxes produced in the same or closely related production runs. Statistical approaches to assess significance based on variations in manufactured products over time have proven unsuccessful because of the complexity of the processes leading to the ultimate distribution of lead compositions.

The results of a study that was conducted using the FBI Laboratory's collective lead composition data to assess the frequency of occurrence of given compositional patterns will be presented. From a data collection of the results of analysis of 26,000 projectile leads submitted as evidence, a subset of 1,837 specimens having no known manufacturing relationship was randomly selected. This statistically robust data set was used to assess the frequency of randomly occurring associations between projectile leads from the general evidentiary population. Of more than 1.6 million pairwise comparisons among these leads, only 669 pairs were found to have indistinguishable compositions. These results will be evaluated based on the number of elements present at measurable levels and suggestions will be made concerning appropriate wording of significance statements for several typical evidence scenarios.

Bullet Lead, Elemental Analysis, Statistics

 ** Presenting Author*