## J21 Methods and Materials Used in Steganographic "Invisible Ink" Communications in Prison Facilities

*Michael T. Adkins, MS*, Federal Bureau of Investigation, Washington, DC 20535; Heidi H. Harralson, MA*, Tucson, AZ 85728; Larry S. Miller, PhD, East Tennessee State University, Johnson City, TN 37614*

**Learning Overview:** The goals of this presentation are to: (1) define and describe types of invisible ink steganographic messages both produced and received by prison inmates; (2) aid in establishing patterns of production commonly used by inmates; and (3) provide research information that can assist prison facilities in detecting invisible ink communications more effectively.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by proposing strategies to improve operational effectiveness in prison facilities and forensic laboratories in detecting and deciphering invisible ink communications.

The goals of this study are to: (1) define and describe types of steganographic messages in the form of "invisible ink" both produced and received by prison inmates; (2) aid in establishing patterns of production commonly used by inmates; and (3) provide research information that can assist prison facilities in detecting steganographic "invisible ink" communications more effectively.

This study examined steganographic messages both produced by and received by inmates in prison facilities that use invisible ink formulas to hide messages in ordinary-looking, paper-based documents. Little has been formally published in research about invisible ink or steganography used in prison communications. An earlier study examined the techniques used to develop or render visible a variety of invisible ink formulas commonly used in prison facilities. The present study examined the methods and materials commonly used in creating steganographic messages involving invisible ink. The invisible ink formulas are made of biological materials easily accessible to inmates (i.e., biological and chemical fluids, vegetable and fruit juices). Techniques of developing invisible ink messages received in prison are also accessible to inmates and include heat from a cigarette lighter or iron or the use of a small ultraviolet light.

This study evaluated a collection of steganographic messages received for analysis by a forensic laboratory to establish patterns in the method and materials that inmates use to produce invisible ink messages. The steganographic communications were evaluated on three levels. The first two levels included a materials analysis: (1) ink formulas, including the chemical components used and the method in which the ink is developed or rendered visible; and (2) substrate, including paper types used in the notes and what is accessible or received by inmates. The third level in which the steganographic messages were evaluated involved the method or form of writing or code that was used to transmit the message. For example, the messages can include handwriting, hand printing, or coded writing produced with invisible ink, swabbing parts of an innocuous communication with invisible ink to produce a hidden message, or writing hidden messages or a code in invisible ink in portions of a letter, coloring book page, envelope, postcard, or artwork.

Results of the analysis aids in establishing patterns of production commonly used by inmates, information that can assist prison facilities in detecting invisible ink communications more efficiently.

**Invisible Ink, Steganography, Code Writing**