D59 Evaluation and Validation of the SABRE Hand-Held Device for Pre- and Post-Blast Explosive Detection

William Langston*, Univ of Mary Washington, 1301 College Ave, Fredericksburg, VA 22401; Roman Aranda, PhD, FBI, 2501 Investigation Pkwy, Quantico, VA 22135; Kimberly A. Perusse, MS, 880 Glenwood Ave, Unit 3570, Atlanta, GA 30316; and James J. Harrell, BS, Lawrence A. Presley, MS, and Candice Bridge, PhD, USACIL, 4930 N. 31st St, Forest Park, GA 30297

After attending the presentation, attendees will have an understanding for the use of an ion-mobility instrument in the detection of explosives and non-explosives.

The presentation will impact the forensic science community by providing a quick and easy technique for the detection and differentiation of explosives and possible false positive triggers.

Rapid detection of explosives is needed to provide real-time analysis of residues on suspected terrorists, explosive devices, and criminal offenders in military and domestic forensic settings. Instrumentation such as hand-held portable devices exists in the public market which identifies explosives with varying success. With an instrument capable of operating at a high level of accuracy and specification, personnel in theatre or security check points are capable of making informed decisions with minimal time delay. In addition, the device must be ruggedized for many different environmental conditions. The purpose of this study is to evaluate a portable hand-held device, the SABRE 5000, in the rapid identification of pre- and post-blast explosives for the defense and forensic communities. The SABRE 5000 is a recent update of its predecessor, the SABRE 4000, and utilizes Ion Mobility Spectrometry to identify the presence of explosives.

To evaluate the SABRE 5000 was conducted for pre- and post-blast explosives. For pre-blast explosives, 1,3,5-trinitroperhydro-1,3,5-triazine (RDX), Trinitrotoluene (TNT), Pentaerythritol Tetranitrate (PETN), Ammonium Nitrate (AN), and Potassium Nitrate (PN), samples were created in methanol at several concentrations from 1 ppb – 1000 ppm. Each sample at each concentration was analyzed in triplicate on the SABRE 5000 to determine its limit of detection for each explosive. Type I (false positive) and Type II (false negative) errors were calculated for each explosive as well as the sensitivity and specificity for the instrument.

In order to test for post-blast explosive samples, a test explosive consisting of an 8 gram mixture of a 60:40 TNT:PETN booster was carried out in two 55 gallon steel drums filled with saltwater. The detonations were carried out at the surface level of the saltwater and submerged half-way below the surface. Various types of witness plates (i.e., metal plates, cardboard, aluminum foil, etc.) were included to simulate a water vessel that was attacked in a saltwater area. This would allow for analysis of PETN and TNT in this sort of environment. Samples were collected from the water surface, the water at the bottom of the water cavity, and various witness plates.

The instrument's effectiveness as a real-time analyzer was assessed using a Receiver Operating Characteristic (ROC) analysis, the area under the ROC curve, and the likelihood ratio based on the slope of the curve produced. The analysis provides a set of thresholds for a variety of explosives, such as TNT, PETN, RDX, and other nitrate salt-based explosives, thereby allowing a confidence level to be set for each explosive. The ease of use, portability, effectiveness, and durability of the IMS was assessed in this project. Explosive samples, particularly the post-blast samples, analyzed by the SABRE 5000 were verified using a gas chromatograph-mass spectrometer (GC/MS) to ensure accuracy of results. This validation study will attempt to show whether the SABRE 5000 is ready to be employed for use at airports, border patrol, as well as in theatres.

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

IMS, Post-Blast Analysis, Explosives