B53 Using Rapid DNA Analysis to Obtain DNA Profiles From Improvised Explosive Devices (IEDs)

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After attending this presentation, attendees will better understand the potential for using Rapid DNA analysis to obtain DNA profiles from low-level samples. This presentation compares the performance of traditional versus Rapid DNA analysis on low-level samples. This presentation presents data from both traditional and Rapid DNA methods regarding quantity and quality of DNA recovered from various components of IEDs pre- and post-deflagration.

This presentation will impact the forensic science community by determining whether Rapid DNA analysis can produce detectable DNA profiles from low-level samples and by determining the limitations of Rapid DNA analysis. Using Rapid DNA analysis, it is possible to produce a DNA profile in less than two hours. Therefore, this presentation will assist analysts in determining whether it is appropriate to use Rapid DNA analysis methods on low-level samples when time is of the essence, especially when generating investigative leads.

DNA recovery from IEDs was evaluated using traditional and Rapid DNA analysis to compare the performance of both methods. IEDs were chosen because the DNA recovered is low level by nature (touch), often degraded (heat and pressure), and time may be critical when obtaining a profile due to the potential danger of further detonations. In the first stage of the study, mock IEDs were assembled using previously cleaned materials to assess each method's potential for successfully generating a Short Tandem Repeat (STR) profile. The external surfaces and wire twists of the mock devices were swabbed using a double-swab technique (moistened and dry). In addition, DNA samples from tape were collected using a single swab moistened with QIAGEN® ATL tissue lysis buffer. Duplicate swabs were used and processed using traditional DNA analysis and Rapid DNA analysis methods. All samples were produced at least in triplicate. In the second stage of the study, the first stage was repeated using actual IEDs that were deflagrated by professionals in a controlled setting rather than using assembled mock IEDs.

For traditional DNA analysis, standard methods utilized in forensic laboratories including extraction (QIAamp® DNA Investigator), quantification (Investigator® QuantiPlex™), and amplification (PowerPlex® Fusion) were used. Samples were separated and detected using a 3130*xl* and analyzed using GeneMapper®ID 3.2.1 software. For Rapid DNA analysis, the NetBio DNAscan (BioChipSet™ Cassette) was used. Materials that were cleaned for mock IED assembly were checked for background DNA prior to assembly. Each component swabbed was assessed by the average recovered yield of DNA from the entire surface area of the component. Additionally, sample collection from tape was assessed by the average recovered yield of DNA per cm^2. DNA profiles produced by both methods were then generated and analyzed by comparing sample profiles to reference profiles obtained from the known device assemblers (mock and real) and by comparing sample profiles to each other. Profiles were assessed by examining the total number of alleles out of the possible 45 and the total number of complete loci out of 23. Upon analyzing the data for the samples collected from the mock devices, traditional methods yielded complete and concordant profiles from the tape and the external surfaces. Also, traditional methods yielded either no results or partial concordant profiles from the wires. Rapid DNA analysis yielded either no results or partial profiles from

the components. Initial results with the DNAscan on mock IEDs indicated that samples collected from deflagrated devices may yield reduced information when processed with Rapid technology instruments.

The goal of this research was to determine whether Rapid DNA analysis can be used on time-sensitive evidence that most likely yields low-level DNA rather than using traditional DNA analysis in order to decrease the time it takes to produce a DNA profile and potential investigative lead. Overall, traditional DNA analysis performed better on the low-level samples; however, Rapid DNA analysis did produce partial profiles on some samples.

Rapid DNA, Improvised Explosive Device, Low-Level DNA