A47 Low-Template DNA Analysis: Applicability and Risk Assessment

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After attending this presentation, attendees will understand the difference between traditional and LCN DNA analysis, and appreciate many issues associated with LCN analysis and its potential applicability to specific human biometrics applications.

This presentation will impact the forensic science community by increasing understanding and awareness of a DNA testing strategy that is gaining in popularity in the U.S. forensic community. Attendees will appreciate that the gain of increased DNA detection sensitivity must be balanced against the potential for loss of fidelity and reproducibility in the analytical process that is incurred by LCN procedures. While LCN analysis warrants further consideration and development, laboratories must be mindful of the additional quality assurance and training requirements that it necessitates.

The fact that human biological material can be transferred onto objects via physical contact presents criminal investigators with a potential means of associating evidentiary items with individuals by way of DNA typing. Traditional analytical conditions are routinely used in DNA testing of touched objects and other items containing low-level DNA. However, over the past decade, forensic scientists have explored the possibility of enhancing existing DNA analysis methodologies to maximize the ability to obtain DNA profiles from low-template samples. Strategies such as increasing the amplification cycle number, modification of capillary electrophoresis conditions, desalting amplified samples, and whole genome amplification have demonstrated increased detection sensitivity down to the single-cell level. Experimental studies conducted at the FBI Laboratory, Nuclear DNA Analysis Unit (NDNAU), have explored the transfer of skin cells onto objects and the ability to obtain DNA typing results that are suitable for matching purposes using traditional and enhanced analysis methods. These studies showed that enhancement strategies can alter the performance characteristics of the PCR and result in demonstrable losses of fidelity and reproducibility in the analytical process. Consideration is given to factors that affect the accuracy of DNA typing results, given the increased risk of allele drop-in and contamination with low copy number analysis. The potential exists for DNA test kits, reagents, and supplies to contain biological contaminants that may be detected together with, or instead of, sample DNA. Studies demonstrated detectable DNA in consumable products and explored the efficiency of decontamination efforts. This presentation aims to explore the applicability of low copy number DNA analysis and increase awareness of issues associated therein. At present, guidelines have not been established in the U.S. for validation or the complex interpretation procedures associated with low copy number analysis. It is essential that, as interest in these strategies increases, the forensic community be mindful of the additional quality assurance and training requirements that would be necessitated with implementation and informed auditing. Deliberation of ways to improve the recovery of DNA from evidentiary items, augment quality control practices, and prevent

DNA typing errors have made low-level DNA analysis a potentially useful tool that warrants further development and consideration for certain human biometrics applications.

DNA, LCN, Interpretation

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