C19 The Effect of PCR Additives and Enhancement Techniques on DNA Recovery From Fired Cartridge Cases and Compromised Samples

David A. Diekema, BS, 2900 Kensington Avenue, Apartment 212, Richmond, VA 23221; Yvette Orihuela, MS, 2004 Idlewood Avenue, Apartment D, Richmond, VA 23220; Stephanie Karczynski, MS, Washington State Patrol, 2203 Airport Way South, Suite 250, Seattle, WA 98134; Katie M. Horsman-Hall, PhD, Susan Greenspoon, PhD, and Ann L. Davis, MS, Virginia Department of Forensic Science, 700 North 5th Street, Richmond, VA 23219; Jeffrey D. Ban, BS, 1501 East Franklin Street, Richmond, VA 23219; Brad Jenkins, MS, Virginia Department of Forensic Science, 700 North 5th Street, Richmond, VA 23219*

During this presentation, attendees will be made aware of the effectiveness of PCR additives and enhancement techniques on the typing success of artificially-compromised DNA and DNA recovered from fired cartridge cases. These PCR enhancement techniques were implemented during PowerPlex® 16 amplification and STR analysis in attempt to increase the success of developing genetic profiles from touch DNA recovered on fired cartridge cases and other compromised samples.

This presentation will impact the forensic community by determining the value of new methods for developing DNA profiles from fired cartridge cases that can be implemented with currently accepted amplification and typing techniques with minor modifications.

Cartridge cases are often handled by the person responsible for discharging a firearm and recovered at crime scenes. However, the touch DNA that may be present is often thought to be of insufficient quantity or too highly degraded for STR amplification. Prior research at the Virginia Department of Forensic Science (VDFS)[(1)] has shown that sufficient DNA may be recoverable from handled cartridge cases for STR profiling but its success is limited by the molecular integrity and polymerase inhibition encountered with these samples as a result of the firing process. Partial profiles have repeatedly been generated from fired cartridge cases in the research setting under "realistic" conditions, implicating that optimized PCR amplification and DNA repair techniques may generate profiles with more discriminatory results. Understanding the degree of compromise and the resulting quality of DNA may enable DNA repair or stabilization techniques to be utilized in the preparation and amplification of DNA for STR typing, thereby allowing for increased typing success of such samples.

In this study, DNA was collected from fired cartridge cases handled by a DNA shedder. The quality of DNA recovered from fired cartridge cases was analyzed using Plexor HY™, a quantitative PCR technique.[(2)] PCR additives including Tween® 20, betaine, dimethyl sulfoxide (DMSO), formamide, and PCRboost™ were evaluated along with the commercial PreCR™ Repair mix, and MinElute® PCR purification kit using artificially-compromised samples including fired cartridge cases. The use of the PreCR™ Repair mix failed to identify a specific form of damage present in fired cartridge case samples. None of the PCR- enhancement additives significantly improved the STR typing results obtained.

Therefore, the results of this study do not support the routine analysis of cartridge case samples with the enhancement techniques evaluated. The studies suggest a large variation in DNA yield and STR typing results with fired cartridge case samples. Further studies are warranted to test non-probative casework samples.

References:

1 Horsman-Hall KM, Karczynski SL, Orihuela Y, Davis AL, Greenspoon SA, and Ban JD. Developing STR Profiles from Fired Cartridge Cases Using the AmpFℓSTR® Minifiler™ PCR Amplification Kit. Virginia Department of Forensic Science. Applied Biosystems Forensic News, February 2008.

2 Greenspoon SA, Bohr RC, Pittock A, Grubb J, Horsman KM, and Ban JD. Predicting the success of STR typing using the Plexor® HY System and extraction of mock cases using the Differex™ System. Promega Genetic Identity Conference Proceedings - 18th International Symposium on Human Identification, 2007.

PCR Additives, Damaged DNA, Cartridge Cases

 ** Presenting Author*