OSAC Research Needs Assessment Form

Title of research need: Comprehensive Feasibility of Organic Gunshot Residue Analysis

Keywords: Organic gunshot residue, data analysis, analytical methods

Submitting subcommittee(s): GSR **Date Approved:** 11/28/16

(If SAC review identifies additional subcommittees, add them to the box above.)

Background information:

1. Description of research need:

Several factors have combined to kindle interest in the organic residues produced as a result of firearms discharge events. Primer formulations are moving away from traditional formulations containing Ba/Pb/Sb and moving toward lead-free mixtures. Additionally, recent advances in mass spectrometry have made detection of OGSR possible at forensically relevant concentrations. What is needed to move this concept toward forensic use is a comprehensive feasibility study that integrates metadata analysis of existing literature, method development, and method validation. Specifically this comprehensive research program should address or consider:

- Stability of OGSR on sampling media
- Sampling compatibility with traditional stubs for SEM/EDX
- Discriminating power of selected OGSR compounds
- Additional OGSR targets (i.e., nitroglycerin and nitrocellulose degradation products
- Persistence and secondary transfer characteristics
- Compatibility with existing forensic laboratory instrumentation
- Population studies and environmental background

2. Key bibliographic references relating to this research need:

[1] R. V. Taudte, C. Roux, L. Blanes, M. Horder, K. P. Kirkbride and A. Beavis. The Development and Comparison of Collection Techniques for Inorganic and Organic Gunshot Residues. *Anal. Bioanal. Chem.* **2016**, *408*, 2567.

[2] B. Yeager, K. Bustin, J. Stewart, R. Dross and S. Bell. Evaluation and Validation of Ion Mobility Spectrometry for Presumptive Testing Targeting the Organic Constituents of Firearms Discharge Residue. *Analytical Methods.* **2015**, *7*, 9683.

[3] R. V. Taudte, C. Roux, D. Bishop, L. Blanes, P. Doble and A. Beavis. Development of a Uhplc Method for the Detection of Organic Gunshot Residues Using Artificial Neural Networks. *Analytical Methods*. **2015**, *7*, 7447.

[4] A. Tarifa and J. R. Almirall. Fast Detection and Characterization of Organic and Inorganic Gunshot Residues on the Hands of Suspects by CMV-GC-MS and Libs. *Science & Justice: Journal of the Forensic Science Society.* **2015**, *55*, 168.

[5] S. Benito, Z. Abrego, A. Sanchez, N. Unceta, M. A. Goicolea and R. J. Barrio. Characterization of Organic Gunshot Residues in Lead-Free Ammunition Using a New Sample Collection Device for Liquid Chromatography-Quadrupole Time-of-Flight Mass Spectrometry. *For. Sci Int.* **2015**, *246*, 79.

[6] R. V. Taudte, A. Beavis, L. Blanes, N. Cole, P. Doble and C. Roux. Detection of Gunshot Residues Using Mass Spectrometry. *Biomed Res. Int.* **2014**, DOI: 10.1155/2014/965403.

[7] Z. Abrego, N. Grijalba, N. Unceta, M. Maguregui, A. Sanchez, A. Fernandez-Isla, M. Aranzazu Goicolea and R. J. Barrio. A Novel Method for the Identification of Inorganic and Organic Gunshot Residue Particles of Lead-Free Ammunitions from the Hands of Shooters Using Scanning Laser Ablation-Icpms and Raman Micro-Spectroscopy. *Analyst.* **2014**, *139*, 6232.

[8] J. L. Thomas, D. Lincoln and B. R. McCord. Separation and Detection of Smokeless Powder Additives by Ultra Performance Liquid Chromatography with Tandem Mass Spectrometry (UPLC/MS/MS). *J. Forensic Sci.* **2013**, *58*, 609.

[9] M. Morelato, A. Beavis, A. Ogle, P. Doble, P. Kirkbride and C. Roux. Screening of Gunshot Residues Using Desorption Electrospray Ionisation-Mass Spectrometry (Desi-Ms). *For. Sci Int.* **2012**, *217*, 101.

[10] J. Arndt, S. Bell, L. Crookshanks, M. Lovejoy, C. Oleska, T. Tulley and D. Wolfe. Preliminary Evaluation of the Persistence of Organic Gunshot Residue. *For. Sci Int.* **2012**, *222*, 137.

[11] D. Laza, B. Nys, J. De Kinder, A. K. D. Mesmaeker and C. Moucheron. Development of a Quantitative Lc-Ms/Ms Method for the Analysis of Common Propellant Powder Stabilizers in Gunshot Residue. *J. Forensic Sci.* **2007**, *52*, 842.

3a. In what ways would the research results improve current laboratory capabilities?

This study would be foundational and essential for developing and integrating organic target compounds into a comprehensive analytical method for detection of firearms discharge residue. The work could also yield options for development of presumptive and screening tests.

3b. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

The research will vital in determining the characteristics of OGSR and evaluating its potential as forensic chemical evidence.

3c. In what ways would the research results improve services to the criminal justice system?

By providing methods and data needed to integrate OGSR into forensic analysis. It is anticipated that organic residues will at the very least provide supplemental information to GSR characterization and add to the weight and value of evidence.

4. Status assessment (I, II, III, or IV): I

	Major gap in current knowledge	**Minor** gap in current knowledge
No or limited current research is being conducted	**I**	**III**
Existing current research is being conducted	**II**	**IV**

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.

Subcommittee Approval date: 11/21/16

(Approval is by majority vote of subcommittee. Once approved, forward to SAC.)

SAC

1. Does the SAC agree with the research need? Yes No ◯

2. Does the SAC agree with the status assessment? Yes No ◯

If no, what is the status assessment of the SAC:

Approval date: 11/28/16

(Approval is by majority vote of SAC. Once approved, forward to NIST for posting.)