

OSAC RESEARCH NEEDS ASSESSMENT FORM



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

Keyword(s): Gunshot Residue, GSR, Organic Gunshot Residue, Data Analysis, Analytical Methods

Submitting subcommittee(s): Ignitable Liquids, Explosives, and Gunshot Residue **Date Approved:** 3/02/2021

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

Background Information:

1. Does this research need address a gap(s) in a current or planned standard? (ex.: Field identification system for on scene opioid detection and confirmation)

Yes, GSR analysis and interpretation planned standards.

Several factors have combined to kindle interest in the organic gunshot residues (OGSR) produced as a result of firearms discharge events. When a weapon is fired it generates two types of gunshot residue: inorganic and organic residue. However, when determining if a person has fired a weapon, the common technique focuses on the analysis of inorganic gunshot residue only. However, it has been theorized that a person who has fired a weapon should have both inorganic and organic gunshot residue on their body after firing a weapon. Additionally, some ammunition primer formulations are moving away from traditional formulations containing Ba/Pb/Sb and moving toward lead-free mixtures that generate mostly organic gunshot residues. The detection of residues, via SEM/EDX, formed by the latter primers is more demanding and discrimination of these particles from common environmental particles is difficult.

Therefore, it is necessary to find methods that allow a crime lab to supplement current inorganic gunshot residue analysis with organic gunshot residue analysis to increase the significance of the analytical findings. There is a need in the field to determine how organic gunshot residue can supplement inorganic gunshot residue to provide a more comprehensive manner of determining if a person is a shooter/non-shooter. Recent advances in mass spectrometry have made the detection of organic gunshot residue possible at forensically relevant concentrations. What is needed to transition this technology from the research laboratory to the forensic laboratory 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 the following gaps in the literature on OGSR analysis to develop this comprehensive process:

- Stability of OGSR on sampling media
- Sampling compatibility with established collection methods 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. Are you aware of any ongoing research that may address this research need that has not yet been published (e.g., research presented in conference proceedings, studies that you or a colleague have participated in but have yet to be published)?

There are several projects that have not been published yet that have the goal of addressing aspects of this research need:

- Tatiana Trejos at West Virginia University has a NIJ research grant on analyzing organic gunshot residue

- Candice Bridge at University of Central Florida has an ASTEE research grant to conduct an interlaboratory study on the instrumental parameters necessary to detect organic gunshot residue
- Faculty at the University of Lausanne is conducting research on organic gunshot residue analysis
- Paul Kirkbride at Flinders University is conducting research on the collection of organic gunshot residue and its prevalence in the community
- Members of the OSAC ILEXGSR Subcommittee are conducting research on the analysis of organic gunshot residue by gas chromatography-mass spectrometry and liquid chromatography-mass spectrometry.

3. Key bibliographic references relating to this research need: (ex.: Toll, L., Standifer, K. M., Massotte, D., eds. (2019). Current Topics in Opioid Research. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88963-180-3)

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4. Review the annual operational/research needs published by the National Institute of Justice (NIJ) at <https://nij.ojp.gov/topics/articles/forensic-science-research-and-development-technology-working-group-operational#latest>? Is your research need identified by NIJ?

Yes - Comprehensive evaluation of the detection and utility of organic gunshot residues

5. 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(s) for the detection of firearm discharge residue. The work could also yield options for development of presumptive and appropriate screening tests.

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

The research will provide vital information to determine the characteristics of OGSR and evaluate its potential as forensic chemical evidence.

7. 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 of gunshot residue analysis, it will aid the GSR community by providing a way to narrow down the potential shooter of a firearm. It is anticipated that organic residues will at the very least provide supplemental information to GSR characterization and add to the weight and the value of GSR evidence in cases involving the use of a firearm.

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

II

	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.