OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need: Statistical Framework for Method Optimization and Development of GC-MS and LC-MS Systems

Keyword(s): Ignitable Liquid, Explosives, Organic Gunshot Residue, GC-MS, LC-MS, Method Optimization, Validation

Submitting subcommittee(s): Ignitable Liquids, Explosives, & 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 – addresses the need for guidance on method optimization that precedes method validation efforts which are currently being drafted.

This research need highlights the gap in available guidance for the development of analytical methods for forensic ignitable liquid, organic explosive, or organic gunshot residue analysis. While there are documents, guidelines, and research papers that provide guidance on how to validate analytical methods, little, if any, literature exists to assist in the development of the method. The creation of a framework for method development, backed by statistical rigor, would assist in ensuring reproducible results, easing validation efforts, and improving laboratory to laboratory precision while providing the data to easily defend methods if questioned.

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)?

Yes – ongoing research in this area is currently being conducted at the National Institute of Standards and Technology in collaboration with the Virginia Dept. of Forensic Sciences and the Pinellas County Crime Laboratory. Ongoing efforts are also underway with Dr. Michael Sigman at NCFS.

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)

Analytical tools for the analysis of fire debris. A review: 2008–2015: https://www.sciencedirect.com/science/article/pii/S0003267016305499; Advances In Fire Debris Analysis – STARS: stars.library.ucf.edu/cgi/viewcontent.cgi?article=4412&.; GC-MS Guide to Ignitable Liquids: https://www.routledge.com/GC-MS-Guide-to-Ignitable-Liquids/Newman-Gilbert-Lothridge/p/book/9780849331077

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?

No.

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

The development of a statistical framework for method optimization would allow laboratories to gain insight into method performance prior to validation efforts. A statistical framework would also provide laboratories with tangible, objective data on the performance metrics of a method as well as tailor methods to obtain desired analytical responses (i.e., prioritize resolution or sensitivity). This type of approach would also allow laboratories to better understand differences across instruments or assist in developing methods that will perform similarly on all instruments.

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

This research would provide laboratories with tangible, objective data to support why a particular analytical method was developed. This work would also allow for the implementation of statistical process controls that could be used to more easily identify when changes in the analytical performance of a method occur and what the cause of those changes may be. It will also provide a better scientific understanding of the choices of GC/MS method effects on their analysis and interpretation of ILR in fire debris.

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

This research would provide laboratories with the information to objectively defend the particular analytical methods used in their laboratories.

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.