



OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need:

Keyword(s):

Submitting subcommittee(s): **Date Approved:**

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

Background Information:

1. Description of research need:

Particles emanating from local or individual sources include: fly ash from power stations, aircraft emissions (commonly glass spheres), tire rubber, asphalt, and brake pad abrasion. These particle types occur in forensic soils and urban dusts, but research is needed to better understand their origin, internal variability, distribution, persistence, and weathering.

These point source particles are a useful accessory component in rural/suburban soils, but may have even greater forensic significance in urban locations (due to the general lack of soil). These generally airborne, sub-millimeter fragments and grains may also assist where perpetrator 'clean-up' (washing, fire) has destroyed/removed visible evidence, yet other debris on clothing/footwear/vehicles, remains.

In order for point source material to have high probative value in forensic applications, the material needs to either be rare in the environment or exhibit variable properties. For example, aircraft emissions may be commonly encountered in casework, but if different aircraft produce particles with different trace element signatures, ubiquity plus individual characters would make them useful for forensic applications. If a particular point source material is not ubiquitous/widespread, such particles may be useful for geolocation.

Furthermore, point source particles are often the product of certain industrial processes, types of engines, types of fuel in power stations/smelting works: these change over time, and may allow an age-envelope for the particles to be assigned. An example may be a kind of industrial process, or vehicle manufacture and operation that only occurred from or to a known date, providing a constraint on the age of the deposit.

Understanding of the spatial or temporal variability of these materials may help interpret their significance and utility in forensic applications.

2. Key bibliographic references relating to this research need:

Cui et al. (2013). Evidence of century-scale environmental changes: Trace element in tree-ring from Fuling Mausoleum Shenyang, China. *Dendrochronologia* 31, 1– 8.

MacDonald et al (2011). Dendroanalysis of metal pollution from the Sydney Steel Plant in Sydney, Nova Scotia. *Dendrochronologia*, 29, 9-15.

Millette et al. (2009). Distinguishing coal, coke and other black particles. *The Microscope*, 57, 51-57.

Millette et al. (2012). Characterization of coal ash including fly ash particles. *The Microscope*, 60, 73-84.

Nirei et al. (2011). Classification of man made strata for assessment of geopollution. *Episodes*, 35, 333-336.

Odabasi et al. (2016). Investigation of spatial and historical variations of air pollution around an industrial region using trace and macro elements in tree components. *Science of the Total Environment*, 550, 1010-1021.

Palenik, S. J. (1979). The determination of geographical origin of dust samples. In W. C. McCrone, J. G. Delly & S. J. Palenik (Eds.), *The Particle Atlas, Edition Two* (Vol. 5, pp. 1347-1361). Ann Arbor, MI: Ann Arbor Science Publishers.

Perone et al. (2018). Oak tree-rings record spatial-temporal pollution trends from different sources in Terni (Central Italy). *Environmental Pollution*, 233, 278-289.

Suzuki et al. (2009). Existence state of bromine as an indicator of the source of brominated flame retardants in indoor dust. *Environmental Science and Technology*. 43, 1437-1442.

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

Particles commonly encountered in dust and soil analyses that are not further investigated (ash, glass spheres, rubber), if better understood in terms of their origin, characteristics and distribution, could assume greater forensic significance.

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

1. A component of geological trace evidence analysis will be added to the array of materials that can be analyzed in soils and dusts, improving the quality of the interpretation.
2. Geological methods can be better applied to the high-volume and challenging urban environment.

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

In cases in which point source particulates occur as evidence, the new research will provide insights into the most relevant analyses to conduct and improve the interpretation of their significance in criminal investigations.

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

	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.

Approvals:

Subcommittee	Approval date: <input type="text" value="07/12/2019"/>
<i>(Approval is by majority vote of subcommittee. Once approved, forward to SAC.)</i>	

SAC			
1. Does the SAC agree with the research need?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
2. Does the SAC agree with the status assessment?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
If no, what is the status assessment of the SAC:	<input type="text"/>		
Approval date:	<input type="text"/>		
<i>(Approval is by majority vote of SAC. Once approved, forward to NIST for posting.)</i>			