

# **OSAC 2021-N-0009 Standard Practice for the Collection and Preservation of Organic Gunshot Residue**

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Chemistry: Trace Evidence Scientific Area Committee  
Organization of Scientific Area Committees (OSAC) for Forensic Science*



## **2021-N-0009 OSAC Proposed Standard**

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Prepared by  
Ignitable Liquids, Explosives, and Gunshot Residue Subcommittee  
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## **Standard Practice for the Collection and Preservation of Organic Gunshot Residue**

### **1. Scope**

- 1.1. This practice describes procedures for the sampling and preservation of organic gunshot residues (OGSR) recovered from hands, skin, clothing, and other substrates. This standard practice does not apply to the analysis or interpretation of OGSR, or inorganic gunshot residue (IGSR).
- 1.2. This practice is intended for use by competent forensic science practitioners with the requisite formal education, discipline-specific training (see Practice E2917), and demonstrated proficiency to perform forensic casework.
- 1.3. This practice does not purport to address all of the possible safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory requirements prior to use.

### **2. Referenced Documents**

#### 2.1. ASTM Standards:

- E1492 Standard Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Science Laboratory
- E1588 Standard Practice for Gunshot Residue Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray Spectrometry.
- E1732 Standard Terminology Relating to Forensic Science
- E2917 Standard Practice for Forensic Science Practitioner Training, Continuing Education, and Professional Development Programs.
- E2998 Standard Practice for Characterization and Classification of Smokeless Powders.
- E2999 Standard Test Method for Analysis of Organic Compounds in Smokeless Powder by Gas Chromatography-Mass Spectrometry and Fourier Transform Infrared Spectroscopy
- E3255 Standard Practice for Quality Assurance of Forensic Science Service Providers Performing Forensic Chemical Analysis
- WK56998 Standard Terminology Relating to the Examination of Explosives.
- WK----- Standard Practice for the Collection of Primer Gunshot Residue (pGSR) Particles from Clothing, Vehicles, and Other Objects using Adhesive Lifts.

### **3. Terminology**

- 3.1. Definitions – For definitions of terms that can assist in interpreting this standard, refer to Terminology E1732 and WK 56998.
- 3.2. Definitions of terms specific to this standard

- 3.2.1. *Inorganic GSR (IGSR), n* – Residues from the primer, cartridge case, projectile (e.g., bullet or shot pellets), and/or the firearm that are primarily made of metal, metal oxides, or metal salts.
- 3.2.2. *Organic GSR (OGSR), n* – Residues from the propellant and the priming mixture that are organic compounds.
- 3.2.3. *Primer GSR (pGSR), n* – Residues generating from the priming mixture that could be inorganic or organic in nature.
- 3.2.4. *Stubbing, v* – Act of pressing adhesive tape onto a surface to be sampled using a collection stub; synonymous with dabbing or tape lifting.

#### 4. Significance and Use

- 4.1. The most common reason that gunshot residue (GSR) examination is performed is to determine if an individual was exposed to firearm discharge. Traditional GSR analysis has relied upon the detection of inorganic GSR primarily originating from the ammunition primer (pGSR) as described in Practice E1588; however, OGSR provides information that complements pGSR analysis [1]. This standard practice is of use to forensic laboratories desiring to supplement pGSR analysis with OGSR analysis to identify surfaces exposed to gunshot residue.
- 4.2. OGSR originates from the combustion of the smokeless powder and the priming mixture following their ignition during the firearm discharge process. After a firearm has been discharged, the combined residue can be found on exposed surfaces in the vicinity of the fired weapon (e.g., hands, other exposed skin surfaces, hair, clothing, and other surfaces). OGSR can also be found in the cartridge case after firing and can be recovered to provide information about the constituents of the propellant or the priming mixture, or both.
- 4.3. This practice provides guidance on best practices to be followed in the collection and preservation of OGSR samples intended for forensic analysis.
- 4.4. This practice does not apply to the analysis of intact smokeless powder grains. Refer to Practice E2998 and Test Method E2999 for the characterization of intact smokeless powder grains.

#### 5. Materials

- 5.1. Purity of Reagents – Gas chromatography-mass spectrometry (GC-MS) grade, liquid chromatography-mass spectrometry (LC-MS) grade, or higher-grade chemicals shall be used in the collection of OGSR. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available [1]. Other grades can be used if the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.
- 5.2. Sample Collection Solvents – Acetone, acetonitrile, ethanol, isopropanol, methanol or other appropriate solvents.
- 5.3. Sample Storage Containers – Containers for storing the collection media shall be airtight in order to reduce the loss of sample due to evaporation.

- 5.4. Adhesive Tape Lifts – Suitable adhesive tapes include those used for scanning electron microscope (SEM) sample stubs. Other adhesive tapes can be used at the discretion of the laboratory [2,3].
- 5.5. Swabs – Suitable swabs include cotton, polyester, muslin, and nylon-based substrates [1,4,5].
- 5.6. Vacuums – A suitable vacuum shall be fitted with an inert filter membrane, such as polytetrafluoroethylene (PTFE) and fiberglass filters, with a maximum porosity of 0.5  $\mu\text{m}$  to trap particles, [1,6].

## 6. Procedure

- 6.1. Refer to WK\_\_\_\_\_ for guidelines on minimizing potential contamination of samples during the collection process.
- 6.2. There are three commonly accepted sampling techniques for OGSR: adhesive tape lifting, swabbing, and vacuuming. Each technique differs in its collection efficacy [4]. Consider the surface to be sampled when choosing a sampling technique.
  - 6.2.1. Adhesive tape lifting can be used to sample from many dry surfaces, including skin and clothing.
  - 6.2.2. Swabbing can be used to sample from skin surfaces (e.g., hands, face, neck) or inanimate objects (e.g., tables, vehicles, clothing). This technique is appropriate for either wet or dry surfaces.
  - 6.2.3. Vacuuming can be used to sample textile objects (e.g., clothing, carpeting, etc.).
- 6.3. Use a separate sampling device for each surface (e.g., one for the left hand and a separate device for the right hand) to maximize sample recovery and avoid cross-surface sample commingling, if desired [4,6].
- 6.4. Adhesive tape lifts
  - 6.4.1. Adhesive tape lifts used for SEM sample stubs effectively collect OGSR from many surfaces, including skin, clothing, and objects. Other adhesive tapes can be used at the discretion of the individual laboratory.
  - 6.4.2. Dab the adhesive surface portion of the stub onto the surface to be sampled until tackiness is lost to achieve maximum collection efficiency [7].
- 6.5. Swabbing
  - 6.5.1. Use wet swabs to collect samples from the surface of interest.
    - 6.5.1.1. Suitable solvents can be found in 5.2.
      - Note (1): Ethanol and isopropanol are preferred.
      - Note (2): Acetone and acetonitrile are not recommended for extended contact with skin.
      - Note (3): Certain solvents can dissolve other compounds in the swab material that could interfere with the analysis [4,5,6].
    - 6.5.1.2. Wet substrates should be air-dried prior to sampling with a wet swab.
  - 6.5.2. If a surface is also to be stubbed for recovery of IGSR, perform the adhesive tape stubbing first and then swab the sample to collect OGSR residue [4].
- 6.6. Vacuuming

6.6.1. Prior to vacuuming the textile sample, dab the adhesive on the sample using the procedure in section 6.3.1 to collect IGSR [8].

6.6.2. Vacuum the area of interest thoroughly, to obtain a sample that is as representative as possible, following standard operating procedures of the vacuum.

#### 6.7. Preservation of OGSR Samples

6.7.1. Store sample collection media (e.g., adhesive lifts, swabs, or vacuum filters) in an airtight container immediately to reduce possible loss due to evaporation.

6.7.2. Store samples at 0°C or lower to maximize preservation [4,5].

### 7. Documentation

7.1. Using hardcopies or electronic format, obtain and retain the following for a period of time as determined by laboratory or agency policy, refer to E1492 and E3255:

7.1.1. Field notes from the collection of OGSR, including but not limited to, the materials used for collection, location and type of the surface(s) sampled (e.g., skin, shirt, glass), time elapsed between shooting incident and sample collection, if known, and the storage procedure employed immediately after collection, if known.

7.1.2. Laboratory notes about the handling of the OGSR samples, including but not limited to, how the samples were stored upon arrival at the laboratory, type of sample (e.g., swab, tape lift, vacuum filter), duration of the time the samples were stored prior to analysis.

7.1.2.1. Record any possible contamination (e.g., failure to store in an airtight container) or any other potentially deleterious condition (e.g., failure to store at proper temperature) that might compromise or affect a sample.

7.1.2.2. Record any exceptions to these procedures and reasons or justifications for departures from this Practice.

7.2. The laboratory shall follow other intra-laboratory protocols for documentation as appropriate, including duration of record retention for the field and laboratory notes (7.1.1 – 7.1.2).

### 8. Quality Assurance

8.1. Validate or verify the materials and collection process prior to use, in accordance with Practice E3255.

8.2. Document the validation or verification in accordance with Practice E3255.

### 9. Keywords

9.1. OGSR; Collection; Preservation

### 10. References

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