OSAC 2023-N-0010
Standard Practice for
The Collection of Primer Gunshot Residue (pGSR) Particles from Clothing, Vehicles, and Other Inanimate Objects using Scanning Electron Microscopy (SEM) Stubs

Ignitable Liquids, Explosives, and Gunshot Residue Subcommittee
Chemistry: Trace Materials Scientific Area Committee
Organization of Scientific Area Committees (OSAC) for Forensic Science

OSAC Proposed Standard

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1 Scope

1.1 This practice describes procedures for collecting samples using adhesive lifts from clothing, vehicles, and other inanimate objects that could have been exposed to primer gunshot residue (pGSR). This practice does not apply to the collection of pGSR from the hands or other body parts of a person.

1.2 This practice should be used by personnel who are responsible for collecting samples intended to be analyzed for the presence of pGSR.

1.3 Units - The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.4 This standard does not purport to address all of the 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:

E1732 Standard Terminology Relating to Forensic Science.

E1188 Standard Practice for Collection and Preservation of Information and Physical Items by a Technical Investigator.

E1459 Standard Guide for Physical Evidence Labeling and Related Documentation.

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.

3 Terminology

3.1 Refer to ASTM E1732 and E1588 for terms relative to this document.

4 Summary of Practice

4.1 pGSR can be deposited on objects as a result of being near the discharge of a firearm or as a result of making physical contact with another surface with pGSR on it.

4.2 SEM stubs are used for collecting pGSR from clothing, vehicles, and other inanimate objects. (1-7)

4.3 Contamination minimization procedures are applied in order to prevent loss and contamination of pGSR. (6)

5 Significance and Use

5.1 pGSR originates from the explosion of the priming mixture following ignition during the firearm discharge process. After a firearm has been discharged, residue can be found on exposed surfaces in the vicinity of the fired weapon. (4, 5)

5.2 The most common reason that pGSR examination is performed is to determine if an inanimate object was exposed to firearm discharge. Recovered pGSR can also provide information about the constituents of the priming mixture. (4, 5)

5.3 This practice is applicable to the recovery of pGSR from objects in a forensic laboratory or in the field.

5.4 This practice provides recommendations to be followed in the collection of pGSR samples intended for forensic analysis.

5.5 This practice is intended to be used in conjunction with E1588, E1188, E1459, and E1492.

6 Materials & Equipment

6.1 Single-use SEM stubs with affixed adhesive tape, individually enclosed in a protective plastic tube container which holds the stub by the pin and protects the surface of the tape from contamination. Double-sided carbon adhesive tape is recommended. (1)

6.2 Clean outerwear (e.g. coveralls or laboratory coat). This can be either a single-use garment or a freshly laundered one.

6.3 Single-use powder-free gloves: nitrile, latex or similar.

6.4 Large format paper, paper roll or other workspace cover.

6.5 Single-use scalpel or blade for opening exhibit packages and removing the protective film from the adhesive lift, if present.

6.6 Laboratory wipes, non-woven, lint-free, or similar.

7 Procedure

7.1 Establish a collection plan based on consultation with other potential examiners.

7.1.1 Collection of pGSR shall typically precede collection of other evidence from the same area, unless more probative evidence is likely and requires prioritized collection. Objects to be sampled for pGSR can be divided into sub-areas for independent sampling.

7.1.2 pGSR is easily lost from hard smooth surfaces such as painted vehicle panels, metal fittings and glass. Samples from these types of surfaces and from surfaces that could be disturbed during evidence processing shall be collected before samples from other surfaces, unless more probative evidence is likely and requires prioritized collection.

7.2 Minimize risk of transfer of pGSR and other forms of trace evidence (6)

7.2.1 Change outerwear between exhibits from different individuals. If the outerwear contacts the exhibit or the exhibit's container, change the outerwear prior to processing the next exhibit.

7.2.2 Change gloves between each exhibit.

7.2.3 For exhibits small enough to examine on a workbench, clean the work surface prior to laying out each exhibit.

7.2.3.1 The exhibit can be placed on top of clean paper in order to collect and preserve other potential evidence.

7.2.3.2 Wipe down the packaging before removing the exhibit or remove the exhibit from the packaging in a location away from the work surface and in a manner where the exhibit does not come into contact with the outside of the package. Change gloves between touching the outside of the package and removing the exhibit from the package.

7.2.4 Store SEM stubs in their protective plastic tube containers.

7.3 Document the exhibits in accordance with Practice E1492.

7.4 Determine the area(s) from which to collect (refer to Appendix A).

7.5 Label each SEM stub container with a unique identifier.

7.6 Collect from each designated area using an SEM stub until tackiness is lost.

8 Environmental Control Samples

8.1 Collect environmental controls as a means of monitoring potential pGSR contamination in the collection process through one or more of the following:

8.1.1 Exposing a collection stub to the room environment for either an established interval or prior to each collection from an object.

8.1.2 Collect directly from workspaces at an established interval or prior to each collection from an object.

8.1.3 Collect directly from the personal protective equipment (PPE) of the collection personnel, prior to each collection from an object.

9 Documentation

9.1 Record the following details, at minimum:

9.1.1 Description of the purpose of the examination and description of the sampling procedure, including any deviation from a typical collection plan and the reason for the deviation.

9.1.2 Details of any other relevant observations made during the examination; e.g., stains, cuts/tears, etc.

9.1.3 Description of the pGSR samples collected and their unique identifier.

9.1.4 Chain-of-custody pertaining to the pGSR samples.

10 Preservation for Re-analysis

10.1 Since pGSR analysis via SEM/EDS is non-destructive, the samples will last indefinitely as long as the stubs are secured in their protective plastic tube containers. The plastic tube containers shall be labeled and either individually sealed, or sealed in a labeled package.

11 References

[1] J.S. Wallace and R.H. Keeley, *"A Method For Preparing Firearms Discharge Residue Samples For Scanning Electron Microscopy"*, Scanning Electron Microscopy, Vol. 11, 1979, pp 179-184.

[2] A. Zeichner and N. Levin, *"Collection Efficiency Of Gunshot Residue [GSR] Particles From Hair And Hands Using Double-Side Adhesive Tape"*, Journal Of Forensic Sciences, Vol. 38, 1993, pp 571-584.

[3] D. DeGaetano and J.A. Siegel, "*A Comparison of Three Techniques Developed for Sampling and Analysis of Gunshot Residue by Scanning Electron Microscopy/Energy-Dispersive X-ray Analysis (SEM-EDX)*" Journal of Forensic Sciences, Vol. 37(1), 1992, pp. 281 -300.

[4] A.J. Schwoeble, and D. Exline, "*Current Methods in Forensic Gunshot Residue Analysis*" CRC Press, 2000, pp. 5-7, 18-19.

[5] J.S. Wallace, "Chemical Analysis of Firearms, Ammunition, and Gunshot Residue", CRC Press, 2008, pp. 234-235, 249-251, 268.

[6] C.C. Quinn, "*Cartridge Residue Discharge Contamination – the Search for the Source*", Science & Justice, 1998, 38(2), pp 81 -84.

[7] D.K. Shaffer and K. Yi, "*A Comparison of Particle Transfer Efficiencies of Two Collection Methods for the identification of Gunshot Residue on Fabric Surfaces by Scanning Electron Microscopy-Energy Spectrometry (SEM/EDX)*", Scanning, Vol. 21, 1999, pp 99-100.

[8] C. Torre, S. Gino, "*Epidermal Cells on Stubs Used for Detection of GSR with SEM/EDX: Analysis of DNA Polymorphisms*", Journal of Forensic Sciences, Vol. 41, 1996, pp. 658-659

[9] D. Hall and M. Fairley, "*A single approach to the recovery of DNA and firearm discharge residue evidence*", Science & Justice, Vol. 44 (1), 2004, pp 15-19.

Appendix A--Example Collection Scheme for Clothing and Vehicles

A1 Collections from clothing.

A1.1 Areas of a garment that may have been in close proximity to the discharge of a firearm or may have come in contact with a firearm while being worn are recommended for collection. The number of SEM stubs collected will be dependent on several factors including, but not limited to, size of the object and tackiness of the SEM stub. More areas can be sampled as the case circumstances dictate. If a garment can easily be worn inside out, samples from exterior areas and additional samples from interior areas can be taken.

A1.2 Common sample areas of long-sleeve shirts, jackets, sweatshirts, hoodies, etc. include:

A1.2.1 Right sleeve from the cuff to the elbow

A1.2.2 Left sleeve from the cuff to the elbow

A1.2.3 Chest

A1.2.4 Back

A1.2.5 Inside shirttail

A1.2.6 Each pocket (if present)

A1.2.7 Hood (if present)

A1.3 Common sample areas of a short-sleeve shirt include:

A1.3.1 Chest

A1.3.2 Back

A1.3.3 Inside shirttail

A1.3.4 Each pocket (if present)

A1.4 Common sample areas of pants and shorts include:

A1.4.1 Front from the waist to the knees

A1.4.2 Back from the waist to the knees

A1.4.3 Inside the waistband

A.1.4.4 Each pocket (if present)

A1.4.5 Belts present through the belt loops

A.2 Collection from surfaces of a vehicle.

A2.1 Areas of a vehicle that may have been in close proximity to the discharge of a firearm or may be recipients of secondary transfer of pGSR particles. The number of SEM stubs collected will be dependent on the tackiness of the SEM stub. Exterior surfaces and visibly soiled interior surfaces of a vehicle are not recommended for sampling because these surfaces tend to be heavily populated with non-pGSR particulate. The areas sampled are dictated by the case circumstances.

A2.1.1 Common sample surfaces include:

A2.1.2 Windowsills

A2.1.3 Headliners

A2.1.4 Front and rear dash

A2.1.5 Center console

A2.1.6 Door handles

A2.1.7 Steering wheel

A2.1.8 Seatbelts (latches and buckles)

A2.1.9 Gear shift

A2.1.10 Seats (headrest, armrest, cushion, and seat back)