Technical Procedure for the Examination of Primer Gunshot Residue Evidence

1.0 Purpose – This technical procedure shall be followed for the examination of primer gunshot residue evidence.

2.0 Scope – This procedure applies to gunshot residue (GSR) kits, and adhesive lifts collected from inanimate objects.

3.0 Definitions – N/A

4.0 Equipment, Materials, and Reagents

4.1 Equipment

- Scanning Electron Microscope/Energy Dispersive X-Ray Detector (SEM/EDS)

4.2 Materials

- Adhesive lifts

4.3 Reagents

- 10% bleach solution

5.0 Procedure

5.1 Antimony (Sb), barium (Ba), and lead (Pb) are the three most common elements associated with primer gunshot residue.

5.2 Each GSR collection kit shall contain adhesive lifts used to collect evidence from the hands of an individual or inanimate objects (e.g., clothing, vehicles, or other surfaces). Any additional collection materials present (e.g., swabs) will not be examined.

5.3 Analytical Approach for GSR kit examination

5.3.1 Review the request for analysis.

5.3.2 Open kit. Label each piece of evidence within the kit with the item number, date, and the Forensic Scientist's initials.

5.3.3 If kit paperwork (e.g., GSR Analysis Information Form) is present in the kit, label the top of the form with the Laboratory case number, Laboratory item number, Forensic Scientist's initials, and the date.

5.3.4 Scan the labeled paperwork into Forensic Advantage (FA). If this paperwork is not present in the kit, note this in the GSR case record worksheet.

5.3.5 Determine if the GSR kit is suitable for examination. GSR kits from the hands of an individual that meet one or more of the following criteria shall not be examined.

5.3.5.1 The case details revealed that the subject had washed his/her hands prior to GSR kit collection.

5.3.5.2 The case details revealed that a time greater than 4 hours had elapsed between discharge of weapon and collection of GSR kit. This does not apply to GSR kits collected from incapacitated or deceased subjects.

5.3.5.3 The case details revealed that the subject sustained a gunshot wound.

5.3.6 If the GSR kit is suitable for examination, the adhesive lift(s) shall be analyzed using the Trace Evidence Section Technical Procedure for SEM/EDS for GSR Casework.

5.3.7 Report findings.

5.4 Analytical Approach for the Collection of primer GSR on Inanimate objects

5.4.1 Clean examination surface with 10% bleach solution.

5.4.2 Place a new, clean piece of paper over the examination surface.

5.4.3 Open packaging containing the object. Describe and label each object within the packaging.

5.4.3.1 See **Gunshot Residue Examination Criteria** and limitations regarding the collection and analysis of primer GSR on clothing.

5.4.4 Collect from the object using blank adhesive lift(s). Label and collect from each designated area until tackiness is lost.

5.4.5 The adhesive lift(s) shall be analyzed using the Trace Evidence Section Technical Procedure for SEM/EDS for GSR Casework.

5.4.6 Report findings.

5.5 Elemental composition of primer gunshot residue particles using SEM/EDS.

5.5.1 Determine if particles characteristic to primer gunshot residue are present on the corresponding adhesive lifts.

5.5.1.1 Particles characteristic to primer gunshot residue are spheroidal in shape and contain antimony (Sb), barium (Ba), and lead (Pb).

5.5.1.2 Particles characteristic to primer gunshot residue may also contain the following elements: Si, Ca, Al, Cu, Fe, S, P, Zn, Ni, K, Cl, and Sn.

5.5.2 If necessary, elemental composition of particles may be compared to case-specific sources such as spent cartridge casings and the findings reported.

5.6 Guidelines for primer gunshot residue results statements

5.6.1 All results shall be based on the Forensic Scientist's knowledge and experience and the case being examined. The Forensic Scientist has the responsibility to conduct analyses deemed necessary and appropriate and report the results based on his/her findings and experience.

5.6.2 The following is a list of guidelines for reporting results of primer gunshot residue analysis:

5.6.2.1 Examination of the adhesive lift(s) collected from item(s) # _____ revealed the presence of particle(s) characteristic to primer gunshot residue. Characteristic particle(s) on an item could have originated from being in close proximity to a firearm when it was discharged or coming into contact with another item with primer gunshot residue on it.

5.6.2.2 Examination of the adhesive lifts collected from Item(s) # _____ did not identify particles characteristic of primer gunshot residue.

5.6.2.3 Examination of the gunshot residue kit revealed the presence of particle(s) characteristic to primer gunshot residue. Characteristic particle(s) could have originated from the discharge of a firearm, the handling of a discharged firearm, being in close proximity to a firearm when it was discharged or from contacting an object with characteristic primer gunshot residue particles on it.

5.6.2.4 Examination of the gunshot residue kit did not identify particles characteristic of primer gunshot residue. There is no indication the subject came into contact with particles characteristic of primer gunshot residue or was in the vicinity of a firearm during discharge. The absence of characteristic particles of primer gunshot residue on hands does not conclude that a subject did not fire a gun. It is possible the subject fired a gun, but the characteristic particles of primer gunshot residue were not deposited, were removed by activity, or were not detected.

5.6.2.5 Examination of the case details revealed that the subject had washed his/her hands prior to the gunshot residue kit being administered. Washing one's hands removes primer gunshot residue. Therefore, the evidence was not examined.

5.6.2.6 Examination of the case details revealed that a time greater than (4) hours had elapsed from the time the weapon was discharged to the time the evidence was collected. The concentration of primer gunshot residue significantly declines after approximately (4) hours. Therefore, the evidence was not examined.

5.6.2.7 This item was not examined due to an improper collection technique. Proper collection for characteristic primer gunshot residue particles requires the use of adhesive lifts.

5.6.2.8 Examination of item(s) # _____ revealed the presence of characteristic particles of primer gunshot residue; therefore, this item was not analyzed.

5.6.2.8.1 This statement shall be used when characteristic particle(s) of primer gunshot residue are identified on an item collected from the same subject or inanimate object.

5.6.2.9 Characteristic particles of primer gunshot residue can be present on a subject that sustained a gunshot wound. Therefore, the GSR kit/clothing was not examined.

5.6.2.10 Spheroidal _____ (indicate elemental composition) particles were found on the adhesive lifts collected from ____ (Item #); therefore the ___ (Item #) was analyzed for comparison. The elemental composition of the particles on the adhesive lifts collected from ___ (Item #) were consistent/not consistent with the elemental composition of the particles from ___ (Item #). These particles, however, could be found in [other] ammunitions or [other] sources.

5.7 Calibrations – No additional calibrations or performance checks are required. See associated technical procedures for instrumental performance checks.

5.8 Maintenance – No additional maintenance is required. See associated technical procedures for instrumental maintenance.

5.9 Sampling

5.9.1 No sampling is performed. When sample selection occurs, it shall be based on the Forensic Scientist's training and experience.

5.10 Gunshot Residue Examination Criteria

5.10.1 Items submitted for primer gunshot residue examination shall be analyzed based on the following criteria:

5.10.1.1 When an agency requests gunshot residue examination for both a gunshot residue kit and clothing from the same subject, the gunshot residue kit shall be examined first.

5.10.1.1.1 If examination of the gunshot residue collection kit reveals particle(s) characteristic of primer gunshot residue, the clothing shall not be examined.

5.10.1.1.2 If examination of the gunshot residue collection kit does not reveal the presence of particle(s) characteristic of primer gunshot residue, the clothing shall be examined.

5.10.1.2 Gunshot residue kits and clothing from a subject that sustained a gunshot wound shall not be examined in the Trace Evidence Section for characteristic particles of primer gunshot residue.

5.10.1.3 Inanimate objects on which primer gunshot residue is expected will not be analyzed. Examples of items that will not be analyzed for gunshot residue include, but are not limited to, firearms and inanimate objects with known bullet holes.

5.11 Calculations – N/A

5.12 Uncertainty of Measurement – N/A

6.0 Limitations

6.1 The presence of characteristic particles of primer gunshot residue on a subject's hands or clothing does not conclude that the subject fired a gun. Characteristic particles could have originated from the discharge of a firearm, the handling of a discharged firearm, being in close proximity to a firearm when it was discharged, or from contacting an object with characteristic primer gunshot residue particles on it.

6.2 The absence of characteristic particles of primer gunshot residue on a subject's hands or clothing does not conclude that a subject did not fire a gun. It is possible the subject fired a gun, but the characteristic particles of primer gunshot residue were not deposited, were removed by activity, or were not detected.

6.3 Inanimate objects packaged together shall be treated as one item. Primer GSR particles can be transferred between objects if packaged together.

7.0 Safety

7.1 Items of clothing or other inanimate objects may have blood or other body fluids present. Use proper protective equipment when dealing with items that may contain biohazard material.

7.2 X-Rays from the EDS detector of the scanning electron microscope are considered to be a minimal health risk. Dosimeter badges are located near the systems to monitor radiation levels.

8.0 References

ASTM Standard E1588, "Standard Practice for Gunshot Residue Analysis by Scanning Electron Microscopy/ Energy—Dispersive X-ray Spectrometry." ASTM International, West Conshohocken, PA, www.astm.org.

ASTM Standard E3309, "Standard Guide for Reporting of Forensic Primer Gunshot Residue (pGSR) Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray Spectrometry (SEM/EDS)." ASTM International, West Conshohocken, PA, www.astm.org.

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9.0 Records – N/A

10.0 Attachments – N/A

Revision History		
Effective Date	Version Number	Reason
07/07/2023	1	Original document created from the Technical Procedure for the Examination of Gunshot Residue Evidence