This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

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An American National Standard

Standard Guide for Reporting of Forensic Primer Gunshot Residue (pGSR) Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray Spectrometry (SEM/EDS)[1]

This standard is issued under the fixed designation E3309; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide describes the contents of a formal, written technical report expressing the results and interpretation of pGSR particle analysis by SEM/EDS by forensic service providers.

1.2 This guide is intended for use by competent forensic science practitioners with the requisite formal education, discipline-specific training (see Practices E2917), and demonstrated proficiency to perform forensic casework.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E620 Practice for Reporting Opinions of Scientific or Technical Experts

E1732 Terminology Relating to Forensic Science

E1588 Test Method for Primer Gunshot Residue Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray Spectrometry

E2917 Practice for Forensic Science Practitioner Training, Continuing Education, and Professional Development Programs

2.2 *Other Documents:*

SWGGSR Guide for Primer Gunshot Residue Analysis by Scanning Electron Microscopy/Energy Dispersive X-ray Spectrometry[3]

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms that can assist in interpreting this standard, refer to Terminology E1732.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *background sample, n*—a recovered sample from a source believed not to have been exposed to pGSR.

3.2.1.1 *Discussion*—Background samples can be used to establish a threshold value.

3.2.2 *candidate particles, n*—particle(s) classified by the instrument software based on detection of appropriate (as specified in Practice E1588) constituent elements as potential pGSR.

3.2.3 *confirmed particles, n*—particle(s) relocated, analyzed, and classified by the analyst as pGSR based on appropriate (as specified in Practice E1588) constituent elements and morphology.

3.2.4 *threshold, n*—a value, based on a background sample study, below which the number of pGSR particles identified cannot be distinguished from background levels and thus cannot be reliably interpreted as associated with the discharge of a firearm or contact with a source of pGSR.

4. Significance and Use

4.1 This guide is designed to be used by forensic service providers when issuing final reports on pGSR analyses by SEM/EDS.

[1] This guide is under the jurisdiction of ASTM Committee E30 on Forensic Sciences and is the direct responsibility of Subcommittee E30.13 on Ignitable Liquids, Explosives, and Gunshot Residue (ILEGSR).

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Scientific Working Group for Gunshot Residue, https://www.swggsr.org.

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4.2 This guide is intended to be used in conjunction with Practice E1588, Practice E620, and the SWGGSR Guide.

5. Report

5.1 The report reflects interpretations based on the classification of particle data from the results of instrumental analysis, and on associated definitions in Practice E1588, the SWGGSR Guide, and the scientific literature.

5.2 *Pertinent Information*—Satisfy the requirements of Practice E620, Section 4.7, by listing:

5.2.1 The general examinations conducted, including the generic class and type of instrumentation used and the discipline specific technique, methodology, or procedure performed.

5.2.1.1 *Example Wording*—Exhibit 1 was examined by SEM/EDS for the presence of pGSR particles based on elemental constituents and morphology.

5.2.2 Best practice is to report the quantity of the confirmed pGSR-related particles.

5.2.3 Report the type of particle found using the terms *characteristic*, *consistent*, and *commonly associated* with pGSR. Provide definitions of these terms in the report or in an appendix.

5.2.3.1 The elemental constituents for each particle or particle class can also be included in the report.

5.2.4 If a threshold value is used, state the value in the report.

5.3 *Descriptive Information*—Meet the requirements of Practice E620, Section 4.7, and:

5.3.1 If errors are detected in a report, issue an amended report that contains the reasons for the amendments. Clearly indicate that it is an amended report and include the date of the original report.

5.3.2 If additional work is performed after the original report is issued, issue a supplemental report. Clearly indicate on the supplemental report that it is supplemental and include the date of the original report.

5.3.3 Distribute amended and supplemental reports to all recipients of the original report.

5.4 *Results*—Meet the requirements of Practice E620, Sections 4.8 and 4.9. The example wordings provided below do not purport to show all possible reporting styles and can be subject to style modifications.

5.4.1 Example wordings based on confirmed particles detected on the recovered sample, either consistent with, or characteristic of pGSR.

5.4.1.1 (Numerical Value) particles characteristic of pGSR and (numerical value) particles consistent with pGSR were confirmed on the (sample source).

5.4.1.2 (Numerical Value) particles containing lead, barium, and antimony (characteristic) were confirmed on the (sample source).

5.4.1.3 At least (threshold value) particles characteristic of pGSR were confirmed on the (sample source).[4]

5.4.1.4 (Numerical value) particles containing (elemental constituents) were confirmed on the (sample source).

5.4.2 Example wordings based on the absence of confirmed particles detected on the recovered sample, either consistent with, or characteristic of pGSR.

5.4.2.1 No (zero) characteristic pGSR particles were detected on the (sample source).

5.4.2.2 No (zero) particles confirmed as either characteristic of or consistent with pGSR were detected on the (sample source).

5.4.2.3 (Numerical value) particles characteristic of pGSR were confirmed but were below the established threshold level to be considered distinguishable from background levels based upon previously conducted background studies.[4]

5.4.2.4 (Sample source) contained only particles that one might expect to see in typical background samples.

5.4.3 Example wordings for inconclusive or indeterminate results. For inconclusive or indeterminate results, use wording that clearly indicates to the reader that the analytical data cannot be interpreted unambiguously. This result could be due to factors such as contamination, unusual particle populations, or unusual elements present in particles. Further testing could be warranted (**1**).[5]

5.4.3.1 The particles on the (sample source) cannot be unambiguously interpreted as pGSR due to _____.

5.4.3.2 The presence of [atypical element(s)] in combination with lead, barium, and antimony is uncommon in characteristic pGSR. Therefore, these particles cannot be unambiguously distinguished as either routine background or pGSR. Submission of additional reference materials (spent cartridge case, weapon, clothing, etc.) for additional testing could result in a more conclusive interpretation.

5.4.3.3 Characteristic pGSR particles were detected on the negative control. This suggests that any pGSR particles found on the sample could have resulted from contamination and therefore no unambiguous interpretation can be made.

5.5 *Interpretations and Limitations*—Meet the requirements of Practice E620, Section 4.8 and 4.9. The examples listed below do not purport to show all possible reporting styles and can be subject to style modifications.

5.5.1 Interpretations can be drawn from the identification of characteristic pGSR particles on a recovered sample from a person. Include wording stating that the identification of characteristic pGSR particles is consistent with the following interpretations: (*1*) the person discharged a firearm; (*2*) the person was in the vicinity of a firearm discharge; or (*3*) the

[4] For use by laboratories with an established threshold value. Laboratories must be able to provide the supporting background sample study and data interpretation which the threshold value is based on, if requested. An Appendix to the report can be used to detail the specific number and classification of particles detected.

[5] The boldface numbers in parentheses refer to a list of references at the end of this standard.