Designation: E3284 – 23

An American National Standard

Standard Practice for Training in the Forensic Examination of Primer Gunshot Residue (pGSR) Using Scanning Electron Microscopy/ Energy Dispersive X-Ray Spectrometry (SEM/EDS)[1]

This standard is issued under the fixed designation E3284; 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 practice describes the minimum requirements of a training program in primer gunshot residue (pGSR) analysis by scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM/EDS). It describes lessons, practical exercises, and progress monitoring and evaluation that should be part of a laboratory's training program.

1.2 The primary purpose of this practice is to facilitate the development and implementation of training programs in crime laboratories or other such analytical entities that participate in the detection, analysis, and classification of pGSR particles.

1.3 *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 limitations prior to use.*

1.4 *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

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

E1732 Terminology Relating to Forensic Science

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

E3309 Guide for Reporting of Forensic Primer Gunshot Residue (pGSR) Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray Spectrometry (SEM/EDS)

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 Refer to Practice E1588, Terminology E1732, and Practice E2917 for terms relative to this practice.

4. Summary of Practice

4.1 This practice provides a summary of the knowledge and skills required to establish competency as an independent pGSR analyst.

4.2 The following topics related to the forensic examination of pGSR using SEM/EDS are included:

4.2.1 Occurrence, transfer, and persistence of pGSR;

4.2.2 Contamination minimization and the prevention of loss of trace evidence;

4.2.3 Other forms of trace evidence [such as deoxyribonucleic acid (DNA) and fibers] that could be associated with persons or exhibits that require sampling for pGSR;

4.2.4 Evidence recovery methods;

4.2.5 Evidence handling procedures;

4.2.6 Evidence packaging and documentation;

4.2.7 Use and maintenance of SEM/EDS and auxiliary equipment;

4.2.8 Quality assurance procedures;

4.2.9 The analysis of pGSR using SEM/EDS and other techniques that have been/can be used to analyze GSR;

4.2.10 The formation of pGSR and other forms of GSR, such as organic GSR;

[1] This practice 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).

Current edition approved Oct. 1, 2023. Published October 2023. DOI: 10.1520/E3284-23.

[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 (SWGGSR), https://www.swggsr.org/.

4.2.11 Identification and classification of pGSR;
4.2.12 The demonstrated ability to differentiate between pGSR and non-firearm, pGSR-like particles;
4.2.13 Interpretation of results of pGSR analysis and limitations of interpretation;
4.2.14 Preparation of scientific reports for potential inclusion as court evidence; and
4.2.15 Presentation of expert opinion evidence pertaining to pGSR in court.

4.3 This practice describes lessons, practical exercises, and methods of progress monitoring and trainee evaluation designed to be incorporated into an individual laboratory's training program. Topics for discussion occur between the trainee and the trainer.

5. Significance and Use

5.1 This practice is intended to be used by subject matter experts in the field of forensic pGSR analysis who have met their laboratory's technical requirements to be assigned to the role of trainer in the category of testing that deals with the detection, analysis, and classification of pGSR particles.

5.2 This practice is intended to be used in conjunction with Practice E2917, as well as the laboratory's existing generalized training protocols, standard operating procedures, and quality practices, to develop a complete training-to-competency program in pGSR analysis by SEM/EDS. This practice provides the required additional, discipline-specific elements for pGSR analysis by SEM/EDS, in accordance with 5.3.2 of Practice E2917; it does not include the core specific elements covered in 5.3.1 of Practice E2917.

5.3 The topics and procedures outlined in this practice are grounded in the body of scientific literature that exists in the field of pGSR examination.
5.3.1 Additional sources of information on pGSR examination, not specifically mentioned in this document, should be considered, added, or substituted. A review of new sources of information on general forensic methods and pGSR examinations should be carried out on a regular basis (e.g. annually or biannually) to incorporate well-established current findings and methods into the training program and to replace any outdated methods.
5.3.2 When possible, make additional training available to the trainee. Such training might include off-site short courses, short internships, and specialized training by experienced examiners.

6. Guidelines

6.1 Training guidelines provide the trainee with the required theoretical knowledge and practical skills in pGSR examination, analysis, and interpretation through a combination of the following training methods:
6.1.1 Reading of relevant literature;
6.1.2 Instruction by and observation of pGSR examiners:
6.1.2.1 and discussions;
6.1.2.2 Demonstration of skills;
6.1.2.3 Observation of case work; and
6.1.2.4 Observation of expert court testimony.
6.1.3 Supervised practice of skills:
6.1.3.1 Practical exercises; and
6.1.3.2 Assisting in and performing supervised casework.
6.1.4 Examinations and tests:
6.1.4.1 Written and oral tests;
6.1.4.2 Practical laboratory tests; and
6.1.4.3 Mock/moot court.

6.2 This is an extensive training program and it is expected that an inexperienced examiner would take approximately six months to one year to complete.
6.2.1 For the purpose of this practice, an inexperienced examiner is an individual who has little knowledge in trace evidence, minimal knowledge of SEM or EDS, or minimal knowledge of pGSR evidence.
6.2.2 Portions of this training program can be substituted or removed based on demonstration of the trainee's previous knowledge and experience of the theory or instrumentation related to this type of analysis.

7. Records of Training

7.1 Document and maintain all training records in accordance with Practice E2917.

8. Responsibilities

8.1 The training coordinator, who has technical competency in all aspects of the forensic discipline of pGSR examination, and supervises the administration of the training program. The training coordinator can also function as a trainer.

8.2 Responsibilities of the trainer(s) include:
8.2.1 Introduction to the relevant scientific literature, laboratory and technical procedures, training material, and appropriate reference collections;
8.2.2 Instruction in the laboratory evidence management systems;
8.2.3 Instruction in the documentation of casework;
8.2.4 Instruction in and discussion of the relevant scientific literature and theory pertaining to SEM/EDS and pGSR;
8.2.5 Instruction, guidance, and supervision of practical skills pertaining to:
8.2.5.1 Contamination minimization and the prevention of loss of trace evidence;
8.2.5.2 Evidence recovery methods;
8.2.5.3 Evidence handling procedures;
8.2.5.4 Evidence packaging and documentation;
8.2.5.5 Use and maintenance of SEM/EDS and auxiliary equipment;
8.2.5.6 Quality assurance procedures;
8.2.5.7 The analysis of pGSR using SEM/EDS and its limitations;
8.2.5.8 Other techniques that have been/can be used to analyze GSR;
8.2.5.9 The formation, identification, and classification of pGSR and other forms of GSR;
8.2.5.10 Interpretation of results, including limitations of the method and limitations of activity-level inferences;
8.2.5.11 Preparation of scientific reports for potential inclusion as court evidence; and