



Standard Practice for Establishing an Examination Scheme for Explosive Residues¹

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^{ε1} NOTE—Fig. 1 was corrected editorially in October 2022.

1. Scope

1.1 This practice covers the evaluation, selection, and application of techniques to establish an examination scheme for use by forensic explosives examiners to identify residues from low and high explosives. A foundation for the consistent approach to the analysis of visible and non-visible explosive residues from post-blast or other explosive-related scenes is provided. Methods for the development of identifying information that follows an efficient order of testing are described.

1.2 This practice establishes requirements for the use of visual, physical, analytical, and instrumental techniques that provide structural and chemical information for an identification of an explosive residue.

1.3 Techniques used in the examination of explosive residues include visual and microscopical inspection, physical characterization, ignition susceptibility testing, chemical and spot testing, and instrumental methods.

1.4 This standard 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 (refer to the T/SWGFEX Suggested Guide for Explosives Analysis Training).

1.5 *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.*

1.6 *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.*

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).

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2. Referenced Documents

2.1 ASTM Standards:²

E620 Practice for Reporting Opinions of Scientific or Technical Experts

E860 Practice for Examining and Preparing Items That Are or May Become Involved in Criminal or Civil Litigation

E1732 Terminology Relating to Forensic Science

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

E2998 Practice for Identification and Classification of Smokeless Powder

E2999 Test Methods for Analysis of Organic Compounds in Smokeless Powder by Gas Chromatography-Mass Spectrometry and Fourier Transform Infrared Spectroscopy

E3255 Practice for Quality Assurance of Forensic Science Service Providers Performing Forensic Chemical Analysis

E3196 Terminology Relating to the Examination of Explosives

E3253 Practice for Establishing an Examination Scheme for Intact Explosives

2.2 Other Resources:

Technical/Scientific Working Group for Fire and Explosion Analysis (T/SWGFEX) Suggested Guide for Explosive Analysis Training³

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, see Terminology E1732, Practice E3253, and Terminology E3196.

3.2 *Definitions of Terms Specific to This Standard:*

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 National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, https://www.nist.gov/system/files/documents/2018/09/21/twgfex_suggest_guide_for_explosive_analysis_training.pdf.

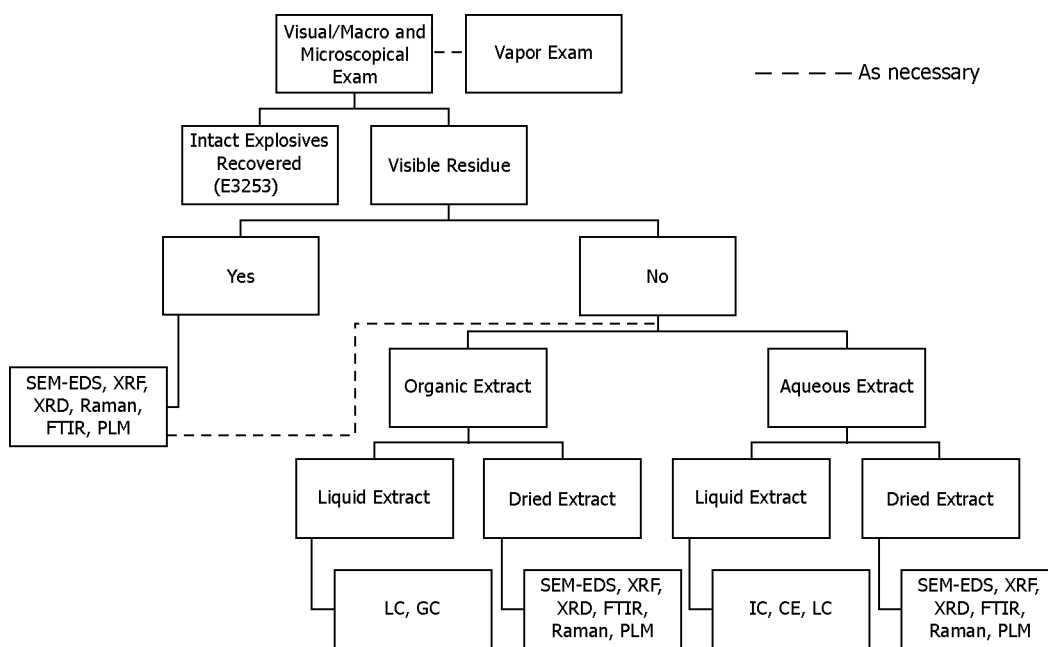


FIG. 1 Scheme for Explosive Residue Examinations

3.2.1 *explosive residue, n*—material remaining from an explosive deflagration or detonation or from direct contact with an explosive. Explosive residue generally does not have a discernible morphology, can be visible or non-visible, and can contain uninitiated and post-combustion components.

3.2.1.1 *Discussion*—Visible explosive residue can be present in large (grams) and small (single particle or single crystal) quantities.

4. Quality Assurance

4.1 The processing of residue evidence samples should be separated in space from other intact explosives to prevent incidental contamination. If space does not allow for this, then process intact explosives and residue evidence separately by time. Ensure appropriate precautions are in place to prevent contamination (1-7).⁴

5. Summary of Practice

5.1 Multiple techniques and methods are used in the identification of explosive residues.

5.2 Examination of suspected explosive residues starts with macroscopical and microscopical observations. The interpretation of these initial tests requires that the examiner has a working knowledge of explosives. While characteristics observed by visual examination results can indicate an explosive residue, it is necessary to use additional analytical techniques to identify suspected explosive residues. Refer to Practice E3253 if suspected intact explosives are recovered.

6. Significance and Use

6.1 This practice is designed to assist the forensic explosives examiner in selecting and organizing an analytical

scheme for identifying explosive residues. The amount and condition of the sample, as well as the availability of instrumental techniques, will determine the selected analytical scheme.

6.2 The forensic explosives examiner considers relevant issues about the case investigation and submitted items, such as sample size, complexity and condition, environmental effects, and collection methods used. Considerations include test methods, sample preparation schemes, test sequences, and acceptable degrees of sample alteration and consumption that will be different for each case submission.

6.3 This practice is used when insufficient material is present to follow Practice E3253.

6.4 This practice is used in conjunction with the referenced documents.

6.5 This practice does not attempt to address all the issues regarding sample analyses. There could be additional tests or analyses performed to provide further discrimination and characterization of samples.

7. Selection of Appropriate Analytical Techniques

7.1 Refer to Practice E3253 for information on the variety of techniques that can be used.

7.1.1 Some of these techniques can irreversibly alter the sample. For example, water extractions can result in ion exchange. A portion of the original sample should be preserved for potential future examination; however, preservation will depend on the submitted sample size, sample preparation, and analytical techniques used.

7.2 A scheme for examining explosive residues is outlined in Fig. 1.

⁴ The boldface numbers in parentheses refer to the list of references at the end of this standard.