Designation: E1386 – 23

An American National Standard

# Standard Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Solvent Extraction[1]

This standard is issued under the fixed designation E1386; 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 covers the procedure for removing small quantities of ignitable liquid residue from samples of fire debris using solvent to extract the residue.

1.2 This practice is suitable for extracting ignitable liquid residues over a wide range of concentrations.

1.3 Alternate separation and concentration procedures are listed in the referenced documents (Practices E1388, E1412, E1413, E2154, and E3189).

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

E1388 Practice for Static Headspace Sampling of Vapors from Fire Debris Samples

E1412 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration with Activated Charcoal

E1413 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Dynamic Headspace Concentration onto an Adsorbent Tube

E1459 Guide for Physical Evidence Labeling and Related Documentation

E1492 Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Science Laboratory

E1618 Test Method for Ignitable Liquid Residues in Extracts from Fire Debris Samples by Gas Chromatography-Mass Spectrometry

E1732 Terminology Relating to Forensic Science

E2154 Practice for Separation and Concentration of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration with Solid Phase Microextraction (SPME)

E2451 Practice for Preserving Ignitable Liquids and Ignitable Liquid Residue Extracts from Fire Debris Samples

E3189 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Static Headspace Concentration onto an Adsorbent Tube

E3197 Terminology Relating to Examination of Fire Debris

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

## 3. Terminology

3.1 *Definitions*—For definitions of general terms used in this practice, refer to Terminology E1732 and Terminology E3197.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *process blank, n*—an analytical control that is derived from the labware, reagents, and solvents used in various stages of this procedure to check for interfering or contamination products introduced by labware or solvents.

## 4. Significance and Use

4.1 This practice is useful for preparing extracts from fire debris for subsequent analysis by gas chromatography-mass spectrometry (see Test Method E1618).

4.2 This practice is useful to reduce potential fractionation during separation, such as when attempting to distinguish between various grades of fuel oil.

4.3 This practice is particularly useful for extraction from nonporous surfaces such as glass, or the interior of burned containers. It is also well suited to the extraction of ignitable

[1] This practice is under the jurisdiction of ASTM Committee E30 on Forensic Sciences and is the direct responsibility of E30.01 on Criminalistics.

Current edition approved Aug. 1, 2023. Published August 2023. Originally approved in 1990. Last previous edition approved in 2015 as E1386 – 15. DOI: 10.1520/E1386-23.

[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.

liquid residues from samples that are not amenable to extraction using Practice E1412.

4.4 This practice lacks specificity to separate and isolate ignitable liquids from interfering compounds present in the fire debris.

4.5 This practice is not suitable for the extraction of extremely volatile compounds and ignitable liquids (for example, acetone, butane, ethanol, propane, some cigarette lighter fluids), which could evaporate during the concentration step.

4.6 This is a destructive technique. Whenever possible, this technique should only be used when a representative portion of the sample can be preserved for reanalysis. Those portions of the sample subjected to this procedure could be unsuitable for resampling. If sample spoliation is an issue, a nondestructive extraction technique (for example, Practices E1412, E2154) should be used prior to this technique.

## 5. Reagents and Materials

5.1 *Purity of Reagents*—Reagent grade or better chemicals shall be used in all tests. It is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[3] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

5.2 *Solvent*—A single component solvent (polar or nonpolar), with high volatility to allow concentration by evaporation, such as carbon disulfide, pentane, methylene chloride, or diethyl ether.

NOTE 1—Polar oxygenated solvents (such as alcohols) could be immiscible with non-polar solvents (such as pentane). To analyze for polar oxygenated solvents, an additional non-destructive extraction technique, such as Practice E1388, should be used prior to performing solvent extraction.

5.2.1 *Purity of Solvents*—Reagent grade solvents shall be used. Unless otherwise indicated, it is intended that all solvents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[3] Other grades may be used, provided it is first ascertained that the solvent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

5.2.2 Analyze the solvent using the same conditions as used for questioned samples and in accordance with Test Method E1618.

5.2.3 Read and follow the safety precautions described in the safety data sheet (SDS) of the extraction solvent that is used.

5.3 *Filter paper or filter apparatus,* free of extractable hydrocarbons.

5.4 *Beakers, vials, or other extraction containers,* free of extractable hydrocarbons.

5.5 *Compressed dry nitrogen, filtered air, or inert gas.*

## 6. Quality Assurance

6.1 Before initial use of this technique on questioned samples, verify the solvent extraction technique using Test Method E1618.

6.1.1 Use verification samples which are created to simulate questioned samples, composed of different matrices (for example, glass or concrete) spiked with varying concentrations of a selection of ignitable liquids that together cover the range of compounds to be identified with this practice.

6.1.2 Document the verification in accordance with Practice E3255.

## 7. Quality Control

7.1 Analyze a process blank concurrently with questioned samples using the same conditions.

7.1.1 If an ignitable liquid is present in the process blank, review the results of the questioned samples to determine if and how those results were affected.

7.1.2 Document the results of the process blank.

## 8. Procedure

8.1 Observe the appropriate procedures for handling and documentation of all submitted samples as described in Practice E1492 and Guide E1459.

8.1.1 Open and examine the fire debris sample in order to determine that it is consistent with its description.

8.1.1.1 Document and resolve any discrepancies between the description and observed contents.

8.2 If possible, select a representative portion of the sample to extract, preserving the rest of the sample as original for future re-analysis. If the entire sample is extracted, preserve the extract according to Practice E2451.

8.2.1 Record in the case notes a description of the portion of the sample extracted.

8.3 Select an appropriate size container to hold the representative portion during the extraction

8.4 Add sufficient solvent to thoroughly moisten the sample

8.5 Record the solvent manufacturer, grade, and lot number of each solvent used, either in the case notes, a logbook, a digital or barcode record, or some other written or printed record.

8.6 Mix the solvent and debris.

8.6.1 Rinsing of nonporous surfaces is sufficient for extraction of residues.

8.7 Decant the solvent. Filter the solvent if it is cloudy or particulates are visible.

8.8 Analyze sample extracts by Test Method E1618.

8.9 Sample evaporation or dilution could be needed to adjust concentration.

[3] *ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.