



Designation: E1979 – 21

Standard Practice for Ultrasonic Extraction of Paint, Dust, Soil, and Air Samples for Subsequent Determination of Lead¹

This standard is issued under the fixed designation E1979; 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 an ultrasonic extraction procedure for the extraction of lead from environmental samples of interest in lead abatement and renovation (or related) work, for analytical purposes.

1.2 Environmental matrices of concern include dry paint films, settled dusts, soils, and air particulates.

1.3 Samples subjected to ultrasonic extraction are prepared for subsequent determination of lead by laboratory analytical methods.

1.4 This practice includes, where applicable, descriptions of procedures for sample homogenization and weighing prior to ultrasonic extraction.

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

1.6 *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.*

1.7 *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

D1193 Specification for Reagent Water

¹ This practice is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.12 on Sampling and Analysis of Lead for Exposure and Risk Assessment.

Current edition approved Nov. 1, 2021. Published January 2023. Formerly PS 87–97. Originally adopted by Committee E06 in 1998. Last previous edition approved in 2017 as E1979 – 17. DOI: 10.1520/E1979-21.

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.

D5438 Practice for Collection of Floor Dust for Chemical Analysis

D6785 Test Method for Determination of Lead in Workplace Air Using Flame or Graphite Furnace Atomic Absorption Spectrometry

D7144 Practice for Collection of Surface Dust by Microvacuum Sampling for Subsequent Determination of Metals and Metalloids

D8358 Guide for Assessment and Inclusion of Wall Deposits in the Analysis of Single-Stage Samplers for Airborne Particulate Matter

E631 Terminology of Building Constructions

E1605 Terminology Relating to Lead in Buildings

E1613 Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques (Withdrawn 2021)³

E1726 Practice for Preparation of Soil Samples by Hotplate Digestion for Subsequent Lead Analysis

E1727 Practice for Field Collection of Soil Samples for Subsequent Lead Determination

E1728 Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination

E1729 Practice for Field Collection of Dried Paint Samples for Subsequent Lead Determination

E1775 Guide for Evaluating Performance of On-Site Extraction and Field-Portable Electrochemical or Spectrophotometric Analysis for Lead

E1792 Specification for Wipe Sampling Materials for Lead in Surface Dust

3. Terminology

3.1 *Definitions*—For definitions of terms relating to this practice that do not appear in this section, refer to Terminologies E631 and E1605.

3.1.1 *extraction, n*—the dissolution of target analytes from a solid matrix into a liquid form.

³ The last approved version of this historical standard is referenced on www.astm.org.

3.1.1.1 *Discussion*—During sample digestion or extraction, target analytes are extracted (solubilized) into solution to enable subsequent determination by analytical techniques (for example, see Test Method **E1613**).

3.1.2 *ultrasonic extraction, n*—the use of ultrasonic energy and acidic or basic solution to extract targeted analytes from samples.

3.1.2.1 *Discussion*—The extract solution is subsequently analyzed for the determination of targeted analytes.

4. Summary of Practice

4.1 Samples of paint, settled dust (wipe or vacuum), soil, or airborne particles, obtained by ASTM sample collection methods (see Practice **E1729**; Practice **E1728**, Practice **D5438** and Practice **D7144**; Practice **E1727**, respectively), are subjected to ultrasonic extraction in dilute nitric acid for a delineated time period.

4.2 Paint samples are ground, homogenized and weighed, if necessary, prior to ultrasonic extraction.

4.3 Soil and bulk dust vacuum samples are sieved, homogenized, and weighed prior to ultrasonic extraction.

4.4 If applicable, airborne particulate and settled dust filter samples are weighed prior to ultrasonic extraction.

4.4.1 Prew weighed filters assembled into closed-face cassettes as in NIOSH methods 0500 or 0600 (**1**) are used to collect airborne particulate according to Test Method **D6785** or to collect settled dust according to Practice **D7144**.

4.4.2 Closed-face cassettes using internal capsules as in NIOSH methods 0501, 5100, or 7306 (**2**) are used to collect airborne particulate according to Test Method **D6785** or to collect settled dust according to Practice **D7144**.

4.5 Sample extracts are diluted with ASTM Type I water (see Specification **D1193**) in preparation for subsequent determination of lead by analytical techniques (for example Test Method **E1613**, Guide **E1775**, and NIOSH methods 7082, 7105, and 7300 (**3**)⁴).

4.6 This practice was developed based on an EPA standard operating procedure (ultrasonic extraction followed by colorimetric lead analysis (**4**)) and published protocols (ultrasonic extraction followed by anodic stripping voltammetric determination of lead) (**5**) (**6**).

5. Significance and Use

5.1 Ultrasonic extraction using dilute nitric acid is a simpler and easier method for extracting lead from environmental samples than are traditional digestion methods that employ hot plate or microwave digestion with concentrated acids (**3**), (**5**), (**7**), (**8**). Hence, ultrasonic extraction may be used in lieu of the more rigorous strong acid/high temperature digestion methods (for example, see Ref (**3**) and Test Method **E1613**), provided that the performance is demonstrated using accepted criteria as delineated in Guide **E1775**.

5.2 In contrast with hot plate or microwave digestion techniques, ultrasonic extraction is field-portable, which allows for on-site sample analysis.

6. Apparatus and Materials

6.1 *Sonicator*, 50 W minimum power; proper operation of the sonicator shall be confirmed prior to initial use and periodically thereafter.

6.2 *Plastic Centrifuge Tubes*, 50 mL, with screw caps.

6.3 *Analytical Balance*, accuracy better than or equal to ± 0.002 g.

6.4 *Mortar and Pestle*, pug mill, or wiggiebug.

6.5 *Dry Ice* (CO₂(s)).

6.6 *Cooler*, for storage of dry ice.

6.7 *Plastic or Glass Rods*, 0.6 to 1.0 cm diameter, 15 to 20 cm length; tapered at one end to conform to the shape of the bottoms of the 50 mL centrifuge tubes.

6.8 *Powderless Plastic Gloves*.

6.9 *Tweezers*.

6.10 *Class A Pipets*, 5 or 10 mL or both, and other volumes as needed.

NOTE 1—Precision digital mechanical pipettors using replaceable tips meet Class A requirements.

6.11 *Laboratory Wipes*, wet or dry, or both.

6.12 *Power Source for Sonicator*.

6.13 *Sieves*, Number 10 (1.9 mm) and 250 μ m.

6.14 *Collection Tray*.

6.15 *Rubber Mallet*.

6.16 *Nylon Brush*.

6.17 *Aluminum Pie Tins*.

6.18 *Dust Mask*.

6.19 *Glass or Plastic Stirring Rods*.

6.20 *Aluminum Foil* (conventional thickness for household use, that is, not heavy duty).

6.21 *Graphite Pencil*.

7. Reagents

7.1 *ASTM Type I Water*, in accordance with Specification **D1193**.

NOTE 2—Commercially available distilled or deionized water meets ASTM Type I water specifications.

7.2 *Extraction Solution*, 10 % or 25 % v/v HNO₃/H₂O; prepared from reagent grade concentrated nitric acid (70 to 71 % HNO₃) and ASTM Type I water.

NOTE 3—Air filter samples require 10 % nitric acid (v/v) for extraction, while all other sample matrices require 25 % v/v HNO₃/H₂O.

8. Procedure

8.1 *Testing of Sonicator*:

8.1.1 Before use, ensure proper operation of the sonicator by employing the following diagnostic test.

⁴ The boldface numbers given in parentheses refer to a list of references at the end of the text.