Designation: ~~E1775 – 16~~ E1775 – 20

Standard Guide for Evaluating Performance of On-Site Extraction and Field-Portable Electrochemical or Spectrophotometric Analysis for Lead[1]

This standard is issued under the fixed designation E1775; 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 provides guidelines for determining the performance of field-portable quantitative lead analysis instruments.

1.2 This guide applies to field-portable electroanalytical and spectrophotometric (including reflectance and colorimetric) analyzers.

1.3 Sample matrices of concern herein include paint, dust, soil, and airborne particles.

1.4 This guide addresses the desired performance characteristics of field-based sample extraction procedures for lead, as well as on-site extraction followed by field-portable analysis.

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~~ safety, health, and ~~health~~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]

D1356 Terminology Relating to Sampling and Analysis of Atmospheres
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
D6966 Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Determination of Metals
D7035 Test Method for Determination of Metals and Metalloids in Airborne Particulate Matter by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)
D7144 Practice for Collection of Surface Dust by Micro-vacuum Sampling for Subsequent Metals Determination

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

Current edition approved ~~March 1, 2016~~Sept. 1, 2020. Published ~~April 2016~~September 2020. Originally approved in 1996. Last previous edition approved in 2016 as ~~E1775 – 07 (2016).~~E1775 – 16. DOI: ~~10.1520/E1775-16.~~10.1520/E1775-20.

[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~~standard's Document Summary page on the ASTM website.

D7439 Test Method for Determination of Elements in Airborne Particulate Matter by Inductively Coupled Plasma–Mass Spectrometry
E1583 Practice for Evaluating Laboratories Engaged in Determination of Lead in Paint, Dust, Airborne Particulates, and Soil Taken From and Around Buildings and Related Structures
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~~
E1644 Practice for Hot Plate Digestion of Dust Wipe Samples for the Determination of Lead
E1645 Practice for Preparation of Dried Paint Samples by Hotplate or Microwave Digestion for Subsequent Lead Analysis
E1726 Practice for Preparation of Soil Samples by Hotplate Digestion for Subsequent Lead Analysis
E1728/E1728M Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination
E1727 Practice for Field Collection of Soil Samples for Subsequent Lead Determination
E1729 Practice for Field Collection of Dried Paint Samples for Subsequent Lead Determination
E1792 Specification for Wipe Sampling Materials for Lead in Surface Dust
E3193 Test Method for Measurement of Lead (Pb) in Dust by Wipe, Paint, and Soil by Flame Atomic Absorption Spectrophotometry (FAAS)
~~E1864~~E3203 ~~Practice for Evaluating Quality Systems of Organizations Conducting Facility and Hazard Assessments for Lead in Paint, Dust, Airborne Particulate, and Soil in and around Buildings and Related Structures~~Test Method for Determination of Lead in Dried Paint, Soil, and Wipe Samples by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) ~~(Withdrawn 2011)~~

2.2 *U.S. EPA Documents:*[3]
EPA 600/R-93/200 Standard Operating Procedure for the Field Analysis of Lead in Paint, Bulk Dust, and Soil by Ultrasonic, Acid Digestion and Colorimetric Measurement (1993)
EPA 747-R-92-001 Laboratory Accreditation Guidelines: Measurement of Lead in Paint, Dust, and Soil (1992)
2.3 *ISO Document:*[4]
ISO Guide 30 Reference materials -- Selected terms and definitions

3. Terminology

3.1 *Definitions*—For definitions of terms not listed here, see ~~Terminology~~Terminologies D1356 and E1605.

~~3.2 *anodic stripping voltammetry*—an electroanalytical technique in which the concentration of analyte metal species dissolved in solution is determined.~~

~~3.2.1 *Discussion*—~~
~~The analyte is first deposited (preconcentrated) electrochemically by reducing the dissolved ion in solution to immobilized metal species at an electrode surface (such as mercury or bismuth). The metal is deposited at an applied potential (voltage) which is negative of the standard oxidation potential for the metal/ion redox couple. After deposition, the preconcentrated metal species is then stripped from the electrode by applying a positive potential sweep, which causes anodic oxidation of the analyte metal species to dissolved ion. The current associated with this reoxidation is measured. The peak current is proportional to the original concentration of dissolved analyte species over a wide range of concentrations.~~

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *anodic stripping voltammetry, n*—an electroanalytical technique in which the concentration of analyte metal species dissolved in solution is determined.

3.2.1.1 *Discussion*—
The analyte is first deposited (preconcentrated) electrochemically by reducing the dissolved ion in solution to immobilized metal species at an electrode surface (such as mercury or bismuth). The metal is deposited at an applied potential (voltage) which is negative of the standard oxidation potential for the metal/ion redox couple. After deposition, the preconcentrated metal species is then stripped from the electrode by applying a positive potential sweep, which causes anodic oxidation of the analyte metal species to dissolved ion. The current associated with this reoxidation is measured. The peak current is proportional to the original concentration of dissolved analyte species over a wide range of concentrations.

[3] Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, http://www.epa.gov.
[4] Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

3.2.2 *colorimetry, n*—an analytical technique in which ultraviolet-visible light of a single, narrow wavelength range is passed through a sample cell containing dissolved analyte, and the absorption measured.

3.2.3 *reflectance, n*—a measurement technique in which light reflected off of a surface containing the analyte of interest is measured by a detector.

3.2.4 *spectrophotometry, n*—an analytical technique in which a spectrum of a sample containing the analyte of interest is obtained and used to determine the analyte concentration.

3.2.4.1 *Discussion*—
Light is directed onto or through analyte species, and the absorption of this light across a range of wavelengths is measured by a detector. The amount of absorbed light is a function of the concentration of analyte species.

~~3.3 *colorimetry*—an analytical technique in which ultraviolet-visible light of a single, narrow wavelength range is passed through a sample cell containing dissolved analyte, and the absorption measured.~~

~~3.4 *reflectance*—a measurement technique in which light reflected off of a surface containing the analyte of interest is measured by a detector.~~

~~3.5 *spectrophotometry*—an analytical technique in which a spectrum of a sample containing the analyte of interest is obtained and used to determine the analyte concentration.~~
~~3.5.1 *Discussion*—~~
~~Light is directed onto or through analyte species, and the absorption of this light across a range of wavelengths is measured by a detector. The amount of absorbed light is a function of the concentration of analyte species.~~

4. Significance and Use

4.1 This guide is intended for use in evaluating the performance of field-portable electroanalytical or spectrophotometric devices for lead determination, or both.

4.2 Desired performance criteria for field-based extraction procedures are provided.

4.3 Performance parameters of concern may be determined using protocols that are referenced in this guide.

4.4 Example reference materials to be used in assessing the performance of field-portable lead analyzers are listed.

4.5 Exhaustive details regarding quality assurance issues are outside the scope of this guide. Applicable quality assurance aspects are dealt with extensively in references that are cited in this guide.

5. Performance Evaluation Materials

5.1 *Certified Reference Materials (CRMs)*—Reference material accompanied by a certificate, one ~~ore~~or more of whose property values are certified by a procedure which establishes its traceability to an accurate realization of the unit in which the property values are expressed: each certified value is accompanied by an uncertainty at a stated level of confidence (ISO Guide 30).

NOTE 1—These may consist of NIST Standard Reference Materials (SRMs) and are also known as Primary and Secondary Reference Materials:
(1) Paint—Examples are NIST paint SRMs, for example, NIST SRMs 2582, 2583, and numerous other CRMs.
(2) Dust—Examples are NIST 1648a (urban particulate matter), other NIST dust SRMs, and other CRMs.
(3) Soil—Examples are NIST 8704 (river sediment) and NIST soil standards: SRMs 2709a, 2710a, and 2711a and numerous other CRMs.
(4) Airborne Particulate Matter—An example is NIST SRM 2783, which is available for airborne particulate matter collected on filters. Other CRMs are also available.

5.2 *Real-World Materials:*

5.2.1 *Paint,* collected using Practice E1729 (or equivalent). To obtain reference values, determine lead concentration using Test Methods D7439, E3193, and ~~E1613~~E3203 and Practice E1645 (or equivalent).