



Designation: E3203 – 21

Standard Test Method for Determination of Lead in Dried Paint, Soil, and Wipe Samples by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)¹

This standard is issued under the fixed designation E3203; 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 test method specifies a procedure for analysis of dried paint, soil, and dust wipe samples collected in and around buildings and related structures for lead content using inductively coupled plasma-optical emission spectroscopy (ICP-OES).

1.2 This test method should be used by analysts experienced in the use of ICP-OES, the interpretation of spectral and matrix interferences, and procedures for their correction. For determination of lead (Pb) and other metals in air by ICP-OES, see Test Method [D7035](#).

1.3 This test method cites specific methods for preparing test solutions of dried paint, soil, and wipe samples for analysis.

1.4 It is the user's responsibility to ensure the validity of this test method for sampling materials of untested matrices.

1.5 No detailed operating instructions are provided because of differences among various makes and models of suitable ICP-OES instruments. Instead, the analyst shall follow the instructions provided by the manufacturer of the particular instrument. This test method does not address comparative accuracy of different devices or the precision between instruments of the same make and model.

1.6 This test method contains notes that are explanatory and are not part of the mandatory requirements of this test method.

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

1.7.1 *Exception*—The inch-pound and SI units shown for wipe sampling data are to be individually regarded as standard for wipe sampling data.

1.8 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.

1.9 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
- [D1356](#) Terminology Relating to Sampling and Analysis of Atmospheres
- [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)
- [D7440](#) Practice for Characterizing Uncertainty in Air Quality Measurements
- [E631](#) Terminology of Building Constructions
- [E882](#) Guide for Accountability and Quality Control in the Chemical Analysis Laboratory
- [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

¹ This test method 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.

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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.

- 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
- 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
- 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
- E1792** Specification for Wipe Sampling Materials for Lead in Surface Dust
- E1908** Practice for Sample Selection of Debris Waste from a Building Renovation or Lead Abatement Project for Toxicity Characteristic Leaching Procedure (TCLP) Testing for Leachable Lead (Pb)
- E1979** Practice for Ultrasonic Extraction of Paint, Dust, Soil, and Air Samples for Subsequent Determination of Lead
- E2115** Guide for Conducting Lead Hazard Assessments of Dwellings and of Other Child-Occupied Facilities
- E2271/E2271M** Practice for Clearance Examinations Following Lead Hazard Reduction Activities in Multifamily Dwellings
- E2913/E2913M** Practice for Hotplate Digestion of Lead from Composited Wipe Samples
- E2914/E2914M** Practice for Ultrasonic Extraction of Lead from Composited Wipe Samples
- E3074/E3074M** Practice for Clearance Examinations Following Lead Hazard Reduction Activities in Single Family Dwellings, in Individual Units of Multifamily Dwellings, and in Other Child-Occupied Facilities
- 2.2 ISO and European Standards:**⁴
- ISO 1042** Laboratory glassware – One-mark volumetric flasks
- ISO 3585** Borosilicate glass 3.3 – Properties
- ISO 8655** Piston-operated volumetric apparatus (6 Parts)
- ISO 15202** Workplace air – Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma atomic emission spectrometry (3 Parts)
- ISO/IEC 17025** General requirements for the competence of testing and calibration laboratories

2.3 Other Standards:

- EPA SW-846 Test Method 311** Toxicity Characteristic Leaching Procedure⁵
- JCGM 100** Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement⁶

3. Terminology

3.1 For definitions of pertinent terms not listed here, see Terminologies **D1356**, **E631**, and **E1605**.

3.2 Definitions:

3.2.1 *atomic emission, n*—characteristic radiation emitted by an electronically excited atomic species.

3.2.1.1 *Discussion*—In atomic (or optical) emission spectrometry, a very high-temperature environment, such as a plasma, is used to create excited state atoms. For analytical purposes, characteristic emission signals from elements in their excited states are then measured at specific wavelengths.

3.2.2 *axial plasma, n*—a horizontal inductively coupled plasma that is viewed end-on (versus radially; see 3.2.27).

3.2.3 *background correction, n*—the process of correcting the intensity at an analytical wavelength for the intensity due to the underlying spectral background of a blank. **ISO 15202**

3.2.4 *background equivalent concentration, n*—the concentration of a solution that results in an emission signal of equivalent intensity to the background emission signal at the analytical wavelength. **ISO 15202**

3.2.5 *batch, n*—a group of field or quality control (QC) samples that are collected or processed together at the same time using the same reagents and equipment. **E1613**

3.2.6 *blank solution, n*—solution prepared by taking a reagent blank or field blank through the same procedure used for sample dissolution.

3.2.7 *calibration blank solution, n*—calibration solution prepared without the addition of any stock standard solution or working standard solution. **ISO 15202**

3.2.7.1 *Discussion*—The concentration of the analyte(s) of interest in the calibration blank solution is taken to be zero.

3.2.8 *calibration solution, n*—solution prepared by dilution of the stock standard solution(s) or working standard solution(s), containing the analyte(s) of interest at the concentration(s) suitable for use in calibration of the analytical instrument. **ISO 15202**

3.2.8.1 *Discussion*—The technique of matrix matching is normally used when preparing calibration solutions.

3.2.9 *continuing calibration blank (CCB), n*—a solution containing no analyte added, that is used to verify blank response and freedom from carryover. **E1613**

3.2.9.1 *Discussion*—The absolute value of the measured concentration of the CCB is to be not more than 50 % of the lowest regulatory limit for the sample matrix analyzed or minimum level of concern.

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

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, <http://www.epa.gov>.

⁶ Available from Bureau International des Poids et Mesures (BIPM), Pavillon de Breteuil F-92312, Sèvres Cedex, France, <http://www.bipm.org>.