



Designation: E2119 – 24

Standard Practice for Quality Systems for Conducting In Situ Measurements of Lead Content in Paint or Other Coatings Using Field- Portable X-Ray Fluorescence (XRF) Devices¹

This standard is issued under the fixed designation E2119; 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 collection and documentation of quality control (QC) measurements for determining acceptable levels of instrumental performance when using field-portable energy-dispersive X-ray fluorescence spectrometry devices (XRFs) for the purposes of generating lead classification results from measurements on paint and other coating films within buildings and related structures.

1.1.1 This practice is not designed to determine the presence of a hazard as defined by authorities having jurisdiction in the United States or other jurisdictions. See Guide [E2115](#) and the HUD Guidelines for more information.

1.2 QC procedures covered in this provisional practice include the performance of calibration checks, substrate bias checks, and specific instructions for documenting the collected data for later use in reporting the results.

1.3 No detailed operating instructions are provided because of differences among the various makes and models of suitable instruments. Instead, the analyst is to follow the instructions provided by the manufacturer of the particular XRF device or other relevant sources of information on XRF operation.

1.4 This practice contains notes which are explanatory and are not part of the mandatory requirements of this provisional practice.

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 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.

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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

[D1356](#) Terminology Relating to Sampling and Analysis of Atmospheres

[E1605](#) Terminology Relating to Lead in Buildings

[E1645](#) Practice for Preparation of Dried Paint Samples by Hotplate or Microwave Digestion for Subsequent Lead Analysis

[E1729](#) Practice for Field Collection of Dried Paint Samples for Subsequent Lead Determination

[E2115](#) Guide for Conducting Lead Hazard Assessments of Dwellings and of Other Child-Occupied Facilities

[E2239](#) Practice for Record Keeping and Record Preservation for Lead Hazard Activities

[E3193](#) Test Method for Measurement of Lead (Pb) by Flame Atomic Absorption Spectrophotometry (FAAS)

[E3203](#) Test Method for Determination of Lead in Dried Paint, Soil, and Wipe Samples by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)

2.2 Other Documents:

[40 CFR 745](#) Lead-Based Paint Poisoning Prevention in Certain Residential Structures³

[HUD Guidelines](#) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, 2nd Edition, July 2012⁴

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

⁴ Available from U.S. Department of Housing and Urban Development, 451 7th Street, SW, Washington, DC 20410, <http://www.hud.gov>.

3. Terminology

3.1 *Definitions*—For definition of terms not presented below, refer to Terminologies [D1356](#) and [E1605](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *building component, n*—part or element of a building that is made of an industry product that is manufactured as an independent unit and is capable of being joined with other elements.

3.2.1.1 *Discussion*—Examples include doors, walls, baseboards, and exterior siding.

3.2.2 *calibration check, n*—a procedure that generates a QC measurement using a calibration test sample with one type of control block (usually wood).

3.2.3 *calibration mode, n*—a selected operating mode that permits adjustment of an instrument's calibration.

3.2.4 *calibration test sample, n*—a test film sample of a known lead level in mg/cm² which has a reported uncertainty of the lead level traceable to the National Institute of Standards and Technology (NIST) Standard Reference Materials (SRMs) or other national or international standard reference materials that have a known specified uncertainty for the known lead level.

3.2.4.1 *Discussion*—For example, use of SRM 2579a, Lead Paint Films for Building Surfaces (SRM 2570 through SRM 2575), is required in the United States when conducting lead-based paint inspections.

3.2.4.2 *Discussion*—Calibration test samples may be separate from a substrate or adhered to a substrate.

3.2.5 *continuing calibration check, n*—a calibration check performed during the testing day after the initial calibration check. A continuing calibration check also can serve as a final calibration check.

3.2.6 *control block, n*—a small block of material of an identifiable substrate type used to simulate a building material during QC measurements.

3.2.7 *display unit, n*—an electronic device that presents the results of an XRF measurement to the user. Other parameters such as total measurement time also may be presented.

3.2.8 *excitation source, n*—a part of an electronic device that emits X-rays or gamma rays, or both, that cause ionization of atoms in the sample, and subsequently a cascade of higher energy electrons into the vacated lower energy shells.

3.2.9 *final calibration check, n*—the last calibration check performed in a testing period.

3.2.10 *inconclusive lead classification result, n*—a lead classification result that reliably cannot be expressed, for example, reported, as either containing lead (positive) or not containing lead (negative) at or above an appropriate local, state, or federal action level for lead in coatings.

3.2.11 *initial calibration check, n*—the first calibration check of the testing period performed after the XRF instrument has been turned on and allowed to warm up.

3.2.12 *lead classification result, n*—an XRF measurement expressed, for example, as either positive-for-lead, or negative-

for-lead, at or above and appropriate local, state, or federal action level for lead in coatings.

3.2.12.1 *Discussion*—A negative-for-lead result does not mean there is no lead present.

3.2.12.2 *Discussion*—For some makes and models of XRF instruments, lead measurement values obtained near an appropriate local, state, or federal action level for lead in coatings may generate inconclusive lead classification results.

3.2.13 *nominal read time, n*—a read time that results when the radioactive source normally provided by the manufacturer for that XRF instrument is at its original source strength.

3.2.14 *operating mode, n*—one or more settings that define the operating parameters of an XRF instrument.

3.2.14.1 *Discussion*—Some XRF instruments have multiple settings for use under different testing situations, for example, substrates, time, or testing objectives.

3.2.15 *performance characteristic sheet (PCS), n*—defines acceptable operating specifications and procedures for a specific XRF lead-based paint analyzer as determined by HUD for use in housing in the United States.

3.2.15.1 *Discussion*—If an XRF analyzer does not have a PCS, or if it is not used, or if the data are not analyzed in accordance with its PCS, the actions and results may not be recognized for hazard determinations in housing in the United States.

3.2.16 *power-down, n*—an event where the power to the XRF instrument is turned off.

3.2.16.1 *Discussion*—The XRF instrument cannot collect and display any XRF measurements after a power-down.

3.2.17 *power-on, n*—an event where the power to the XRF instrument from the battery is turned on.

3.2.17.1 *Discussion*—The XRF instrument can collect and display XRF measurements after a power-on.

3.2.18 *probe, n*—a hand-held device containing an excitation source, X-ray detector and associated mechanical and electronic components that is placed against a test location or calibration test sample to obtain an XRF measurement.

3.2.19 *radioactive source, n*—a radioactive material (for example, ⁵⁷Co or ¹⁰⁹Cd) that emits X-rays or gamma rays, or both, that cause ionization of atoms in the sample, and subsequently a cascade of higher energy electrons into the vacated lower energy shells.

3.2.19.1 *Discussion*—As these electrons fall into the lower energy orbitals, X-rays characteristic of the atomic species, such as lead, are emitted from the test location.

3.2.20 *read time, n*—a period of X-ray data collection time controlled manually or automatically depending on the XRF instrument model.

3.2.20.1 *Discussion*—The read time begins with the opening of the XRF instrument shutter to expose the paint film surface to source gamma rays and X-rays, and ends when the source shutter is closed and the XRF reading is complete.

3.2.21 *sampling site, n*—a local geographical area that contains at least one unit being tested. A sampling site generally is limited to an area that is easily covered by walking.