



Standard Practice for Performance Evaluation of the Portable X-Ray Fluorescence Spectrometer for the Measurement of Lead in Paint Films¹

This standard is issued under the fixed designation E2120; 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 portable X-ray fluorescence (XRF) instruments intended for the measurement of lead in paint. It is intended that manufacturers apply this practice to one unit of a particular model of an instrument when that model is initially available. Replicate tests on additional units of the same model of an instrument are to be performed at the discretion of the manufacturer. This practice also is intended for use by third parties performing independent evaluation of portable X-ray fluorescence instruments.

1.2 All performance evaluation data are to be in SI units.

1.3 Tests of performance are based on replicate measurements of certified reference paint films on a variety of substrate materials. Tests are performed to determine: bias, precision, linearity, limit of detection, interferences, substrate affects, and stability.

1.4 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

D3332 Test Methods for Mechanical-Shock Fragility of Products, Using Shock Machines

E344 Terminology Relating to Thermometry and Hydrometry

E456 Terminology Relating to Quality and Statistics

E1605 Terminology Relating to Lead in Buildings

2.2 ANSI Standards:³

ANSI N538–1979 Classification of Industrial Ionizing Radiation Gauging Devices

ANSI N323–1978 Radiation Protection Instrumentation Test and Calibration

2.3 ISO Standards:³

ISO 2919 Radiation Protection – Sealed Radioactive Sources – General Requirements and Classification

2.4 UL Standards:⁴

UL 544 Safety for Medical and Dental Equipment

UL 3101–1 Chemical Analyzers

3. Terminology

3.1 Definitions:

3.1.1 *accuracy, n*—the theoretical maximum error of a measurement, expressed as the proportion of the amount being measured without regard for the direction of the error, that is achieved with a given probability (typically 0.95) by the method.⁵

3.1.2 *bias, n*—the discrepancy between the mean of the distribution of measurements from a method and the true concentration being measured.

3.1.3 *limit of detection, n*—the smallest (true) signal that will be detected with a probability $1 - \beta$ (β is the probability of an error of the second kind, failing to decide that a substance is present when it is), where the a posteriori decision mechanism has a built-in protection level, α (α is the probability of an error of the first kind, deciding that the substance is present when it is not), against falsely concluding that a blank observation represents a “real” signal. The β and α terms typically are 5 % or 1 %, depending on the requirements of the testing program.⁶

¹ This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.23 on Lead Hazards Associated with Buildings.

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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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from Underwriters Laboratories (UL), 333 Pfingsten Rd., Northbrook, IL 60062-2096, <http://www.ul.com>.

⁵ Kennedy, E.R., T.J. Fischbach, R. Song, P.M. Miller, and S.A. Shulman, *Guidelines for Air Sampling and Analytical Method Development and Evaluation*, DHHS (NIOSH) Publication No. 95–117. National Institute for Occupational Safety and Health, Cincinnati, OH 45226, May 1995.

⁶ Currie, L.A., “Limits for Qualitative Detection and Quantitative Determination,” *Analytical Chemistry*, Vol 40, No. 3, 1968, pp. 586–593.