Designation: E 2119 – 00

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) Devices[1]

This standard is issued under the fixed designation E 2119; 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.

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

2. Referenced Documents

2.1 *ASTM Standards:*

E 1583 Practice for Evaluating Laboratories Engaged in the Determination of Lead in Paint, Dust, Airborne Particulates, and Soil in Around Buildings and Related Structures[2]

E 1605 Terminology Relating to Abatement of Hazards from Lead-Based Paint in Buildings and Related Structures[3]

E 1613 Test Method for Analysis of Digested Samples for Lead by Inductively Coupled Plasm Atomic Emissions Spectrometry (ICP-AES), Flame Atomic Absorption (FAAS), or Graphite Furnace Atomic Absorption (GFA AS) Techniques[3]

E 1645 Practice for Preparation of Dried Paint Samples for Subsequent Lead Analysis by Atomic Spectrometry[3]

E 1729 Practice for Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques[3]

2.2 *Other Document:*

Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing[4]

3. Terminology

3.1 *Definitions*—For definition of terms not presented below, refer to Terminology E 1605.

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. Examples include doors, walls, baseboard 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/cm^2, which must have a reported uncertainty of the lead level. Calibration test samples may be separate from a substrate or adhered to a substrate. All

[1] This practice is under the jurisdiction of ASTM Committee E-6 on Performance of Buildings and is the direct responsibility of Subcommittee E06.23 on Abatement of Hazards from Lead in Buildings and Related Structures.

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[2] Discontinued 1998. See *1997 Annual Book of ASTM Standards*, Vol 04.11.

[3] *Annual Book of ASTM Standards*, Vol 04.11.

[4] Available from the U.S. Department of Housing and Urban Development, Washington, DC 20410, www.hud.gov/lea.

calibration test samples shall be traceable to the National Institute of Standards and Technology (NIST) standard reference materials and have a known specified uncertainty in the known lead level.

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

3.2.9 *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. Such results commonly are referred to and reported as "inconclusive" results, for example, the XRF measurement that cannot determine whether lead is or is not present at or above an appropriate local, state, or federal action level for lead in coatings.

3.2.10 *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.

3.2.11 *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. A negative-for-lead result does not mean there is no lead present. 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.

3.2.12 *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.

3.2.13 *operating mode, n*—one or more settings that define the operating parameters of an XRF instrument. Some XRF instruments have multiple settings for use under different testing situations, for example, substrates, time or testing objectives.

3.2.14 *power-down, n*—an event where the power to the XRF instrument is turned off. The XRF instrument can not collect and display any XRF measurements after a power-down.

3.2.15 *power-on, n*—an event where the power to the XRF instrument from the battery is turned on. The XRF instrument can collect and display any XRF measurements after a power-on.

3.2.16 *probe, n*—a hand-held device containing a radioactive 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.

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

3.2.18 *read time*—a period of X ray data collection time. It may be controlled manually or automatically depending on the XRF instrument model. It 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.

3.2.19 *sampling site*—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.

3.2.20 *substrate, n*—the building material that lies under the coating.

3.2.21 *substrate bias check (SBC), n*—a procedure that generates a QC measurement using a calibration test sample and a control block to determine the effect of that substrate on the XRF measurement.

3.2.22 *substrate-corrected XRF measurements*—a procedure that corrects an XRF measurement for substrate effects (see the HUD Guidelines for more information on substrate corrections).

3.2.23 *substrate type, n*—the type of building material that lies under the coating. Examples include wood, plaster, gypsum wallboard, metal, brick, and concrete.

3.2.24 *test location, n*—an area on a building component where a lead measurement value is obtained.

3.2.25 *testing period, n*—a block of time that defines the continuous power-on operation of an XRF instrument. Any power-down of an XRF instrument terminates the testing period.

3.2.26 *unit, n*—all or a portion of a structure or facility that is the target of an investigation. Test locations are considered to be within a unit. An example of a unit is a single family dwelling including a detached garage that is part of the property.

3.2.27 *x-ray detector, n*—a device that results in an electronic signal as a result of the interception of an x-ray. Examples include gas proportional counters, for example, Xe, solid scintillation counters, for example, CsI, and semiconductor devices of elemental composition, for example, Si or Ge, or compound composition, for example, HgI_2, CdTe, or CdZnTe.

3.2.28 *XRF instrument, n*—a field-portable XRF device or analyzer with associated equipment designed and manufactured for use in measuring lead in paint or other coating films. XRF instruments, at minimum, include an excitation source, such as a radioactive source, x-ray detector, probe, and a display unit.

3.2.29 *XRF measurement, n*—a procedure used to determine the lead content of a coating at a test location using an XRF instrument, or a lead result, expressed as mg of lead per cm^2 of surface, that is, mg/cm^2, obtained from a coating at a test location using an XRF instrument. An XRF measurement may be one reading or the average of one or more XRF readings.

3.2.30 *XRF reading, n*—a response, expressed as mg of lead/cm^2 of surface, that is, mg/cm^2, of an XRF instrument for one read time.

4. Summary of Practice

4.1 This practice covers the quality assurance (QA), quality control (QC) and recording procedures to follow when using field-portable energy-dispersive x-ray fluorescence spectrometry devices (XRFs) to collect measurements of lead in paint or lead in other coating films for the purposes of generating lead classification results. This practice includes start-up procedures, beginning-of-day calibration check QC procedures, during-the-test-day QC check procedures, and end-of-day QC check procedures designed to complement standard operating procedures written by manufacturers for specific models of field-portable XRF instruments.

5. Significance and Use

5.1 This practice provides procedures to generate and document QC data for ensuring that an XRF is operating within acceptable tolerances throughout the testing period when being used to collect lead results during a lead-based pain (LBP) inspection for the purposes of generating lead classification results.

5.2 This practice is intended to supplement XRF instrument manufacturer protocols and Performance Characteristic Sheets (PCSs)[4] through the use of QA and QC procedures to provide uniform lead testing practices among the wide variety of available field-portable XRF instruments.

5.3 While the QC results collected using this practice can provide assurances that an XRF instrument is operating within acceptable tolerances, this practice does not determine an actual level of confidence for a classification result obtained from an XRF measurement.

5.4 This practice does not address selection of test locations or representative sampling for leaded paint. Additional information on conducting measurements of lead in leaded paint or other coatings may be found in the HUD Guidelines, Chapter 7.[4]

5.5 This practice involves the use of field-portable XRF instruments that may contain radioactive materials that emit X rays and gamma rays. These instruments are intended for use only by qualified, trained personnel.

5.6 The use of field-portable XRF instruments for measurement of lead may not accurately reveal low but still potentially hazardous levels of lead.

6. Materials and Equipment

6.1 *(Field-Portable) XRF Instrument*—One of a variety of the commercially available field-portable XRF instruments designed for use in measuring lead in paint and other coatings.

6.2 *Calibration Check Samples*—Calibration test samples that are used to verify XRF instrument calibration.

6.3 *Control Blocks*—A set of substrate materials for use in making QC measurements as defined in Table 1.

6.4 *Substrate Support*—A support material used to hold calibration check samples and control blocks away from any additional underlying material in a manner that will not interfere with the lead measurements on calibration check samples. The support material shall not itself have potentially interfering leaded paint or other material within or on it and shall be one of the following:

TABLE 1 Specifications for Control Blocks[A]

Control Block Substrate Material	Substrate Materials Represented by Control Block	Minimum Thickness of Control Block[B]
Wood, clear pine	All wood and wallboard materials	17 mm
Steel (316 stainless)[C]	All metal materials	6 mm
Brick	All plaster, poured concrete, pressed concrete and brick materials	50 mm

[A]Other materials can be used to supplement this list. However, it is the responsibility of the user to properly characterize other control block materials.
[B]All control blocks are to have minimum length and width dimensions of 60 mm by 60 mm
[C]This grade of steel has been selected because it is readily available and impervious to rusting. Although this steel is not representative of the types of painted or coated metals commonly found in buildings and related structures, it will serve to provide a satisfactory surrogate for quality control measurements.

6.4.1 A polystyrene foam block with minimum thickness of 25 cm,

6.4.2 A table constructed from an empty cardboard box with minimum height of 25 cm, or

6.4.3 Any physical arrangement that holds the calibration check sample so that at least 25 cm of free air space or foam material exists between the XRF instrument-sample-substrate arrangement and any nearby physical objects.

7. Procedure

7.1 Conduct XRF measurements on test locations in accordance with manufacturer protocols (see Note 1). In addition, XRF measurements shall adhere to the items presented in 7.2-7.4.3.

NOTE 1—Exercise care to avoid performing XRF measurements on surfaces, which may generate inaccurate results even under conditions where all measurements are performed within the QC and QA specifications described in this practice. Surfaces that may generate inaccurate results include:

(*1*) Extremely rough, curved or highly ornate surfaces. In general, field-portable XRF instruments are designed to perform XRF measurements on flat surfaces. Any surface condition that does not permit the XRF probe to come into complete contact with the surface may generate inaccurate results.

(*2*) Substrates that have leaded coatings on the side opposite from the surface being measured. The extent of the effect on an XRF measurement depends on the instrument model, the substrate type and thickness, and the lead content of the film on the opposite side. An example would be a recessed portion of a thin panel door where one side contains a leaded coating while the other side does not. In this example, measurements on the side without the leaded coating side may be biased high because of read-through from the lead in the coating on the opposite side.

(*3*) Surfaces that are likely to have objects that may interfere with the XRF measurement, such as pipes or electrical wires, lying immediately under the test location.

7.2 *Warm-Up of XRF Instruments*—All XRF instruments shall be allowed to warm up prior to making any XRF measurements. In absence of specific instructions from the manufacturer, expend a minimum of 5 min between the time an

XRF instrument is turned on to the time that XRF instrument is used to perform XRF measurements.

7.3 *Identification of Test Locations*—Each XRF measurement shall be uniquely identified and recorded. Identification shall be such that a given XRF measurement can be uniquely associated with only one test location or control block measurement. If a measurement is the average of more than one XRF readings, each XRF reading included in the average shall be uniquely identified and recorded. See Section 8 on record keeping.

7.4 *Quality Control (QC) Checks*—Perform QC checks as specified below:

7.4.1 *QC Calibration Checks*—Perform calibration checks as specified in Table 2 for each operating mode used during the testing period (see Note 2). If more than one operating mode is used during a testing period, then replicate QC calibration checks, as specified in Table 2, for each of the different calibration modes using a control block substrate type that is appropriate for the operating mode are required.

NOTE 2—Depending on the make and model of the XRF instrument, different operating modes may be specified by the manufacturer for different substrate types. For example, different modes may exist for wood, metal, and other nonwood or non-metal substrate types.

7.4.1.1 If the error tolerance specifications in Table 2 are not met for any of the QC calibration checks, the XRF instrument is out-of-specification and shall not be used for further testing until it is serviced and able to meet the specifications in Table 2 (see Note 3). If the error tolerance specifications in Table 2 are met for all of the QC calibration checks, the XRF instrument is within specification. All XRF measurements at test locations shall be made between an initial and a final continuing calibration check with an XRF instrument that is within specifications. XRF measurements taken with an XRF instrument, that is out-of-specification are considered invalid. For XRF instruments found to be out-of-specification, the following actions shall be performed:

(*a*) The out-of-specification XRF instrument shall not be used until the problem is identified and solved and the instrument meets specifications in Table 2.

(*b*) Invalid XRF measurements shall be considered unreliable, and shall not be reported. Make entries in the field records indicating which XRF measurements are invalid.

(*c*) The XRF instrument found to be out-of-specification shall be serviced according to the manufacturer's directions and must successfully meet the manufacturer's QC specifications and the QC specifications herein before the instrument can be returned to service.

NOTE 3—Allowable tolerance specifications should be available from the manufacturer upon request.

7.4.2 *QC Substrate Bias Check (SBC)*—Perform calibration checks as specified in Table 3. SBC measurements are required on all of the control blocks shown in Table 1 even if the substrate material represented by that control block is not tested during the testing period.

7.4.2.1 If the error tolerance specifications in Table 3 are not met for any of the substrate types, then the XRF instrument is out-of-specification and shall not be used for further testing until it is serviced and able to meet the specifications in Table 3 (see Note 3). If the error tolerance specifications in Table 3 are met for all the substrate types, then the XRF instrument is within specification. All XRF measurements at test locations shall be made between an initial and a final SBC with an XRF instrument that is within specification. XRF measurements taken with an XRF instrument that is out-of-specification are

TABLE 2 Specifications for Performing Calibration Checks

Item	Specification
Frequency of QC checks	1. Perform an initial calibration check after power-on allowing for an appropriate warm-up period per the manufacturer instructions. 2. Following the initial calibration check, perform a continuing calibration check every 2 h or less. 3. After making XRF measurements at test locations and prior to power-down of the XRF instrument, perform a final continuing calibration check. All XRF measurements at test locations within the testing period must be bracketed by an initial and a final continuing calibration check. Automatic shut-down of XRF instruments resulting from excessive battery drainage may not be predicted with accuracy. Therefore, replacement of a battery or any brief loss of power during the testing period shall not be considered as a power-down event. However, any battery pack replacement shall be immediately followed by a continuing or final calibration check (see Note). Note—It is recommended that if battery loss can be predicted, that calibration checks should be collected prior to a battery replacement since the degree of power loss required to push an XRF instrument out of tolerance, prior to automatic shutdown the XRF instrument caused by battery loss, is unknown.
Nominal Read Time and/or Operating Mode	The nominal read time and/or operating mode shall be that recommended by the manufacturer for an XRF measurement. The nominal read time or operating mode used for test locations shall be the same as that used for calibration checks.
Number of Replicates	A minimum of one XRF measurements shall be taken on each calibration check sample having a different lead level. Compare this measurement to the error tolerance.
Calibration Test Samples	At a minimum, calibration test samples containing the three lead levels listed below (low, action, and high) shall be measured on each control block. The lead levels to use are based on the value of x, where x is equal to the appropriate local, state or federal action level for lead in coatings. 1. Low. The low lead level shall be less than or equal to 0.5x. 2. Mid. The mid level shall be greater than 0.7x and less than 1.3x. 3. High. The high lead level shall meet the following 3 criteria: a. be greater than or equal to 2x; and, b. be less than or equal to 10x; and c. be less than the maximum displayed value on the XRF instrument.
Substrate Types	Unless otherwise specified by the manufacturer, the wood control block, as defined in Table 1, shall be used.
Substrate Support	A substrate support shall be used to create a non-interfering gap between the control block with check sample and the underlying material.
Error Tolerance	The allowable error tolerance for measurement values, in mg/cm^2, collected during calibration checks shall be within the uncertainty range allowed by the manufacturer. The allowable tolerance specification, which should be available from the manufacturer upon request, shall be appropriate for the nominal read time or operating mode used for test locations.

TABLE 3 Specifications for Performing Substrate Bias Check (SBC)

Item	Specification
Frequency of QC checks	1. After the initial calibration check, perform an initial SBC. 2. After making XRF measurements at test locations and prior to power-down of the XRF instrument, perform a final SBC. All XRF measurements at test locations within the testing period must be bracketed by an initial and a final SBC on a control block representing substrate materials found at the testing locations. All XRF measurements at test locations must be bracketed by an initial and a final continuing calibration check. Automatic shut-down of XRF instruments resulting from excessive battery drainage may not be predicted with much accuracy. Therefore, replacement of a battery or any brief loss of power shall not be considered as a power-down event. However, any battery pack replacement shall be immediately followed by a SBC. It is recommended, but not required, to periodically perform SBCs along with continuing calibration checks as a hedge against data loss resulting from a catastrophic power failure (see Note). Note—It is recommended that, if battery loss can be predicted, calibration checks should be collected prior to a battery replacement.
Nominal Read Time and/or Operating Mode	The nominal read time and/or operating mode shall be that recommended by the manufacturer for an XRF measurement. The nominal read time or operating mode used for test locations shall be the same as that used for the SBCs.
Number of Replicates	A minimum of one XRF measurement shall be taken on each calibration check sample having a different lead level. Compare this measurement to the error tolerance.
Calibration Test Samples	A minimum of one calibration test sample with a lead level within $\pm$ 0.3 mg/cm^2 of the appropriate local, state or federal action levels for lead in coatings shall be used on each control block.
Substrate Types	All three control blocks listed in Table 1 shall be used.
Substrate Support	A substrate support shall be used to create a non-interfering gap between the control block with check sample and the underlying material.
Error Tolerance	The allowable error tolerance for measurement values, in mg/cm^2, collected during SBCs shall be within the uncertainty range allowed by the manufacturer. The allowable tolerance specification, which should be available from the manufacturer upon request, shall be appropriate for the nominal read time or operating mode used for test locations. It is expected that the allowable tolerance range given by the manufacturer will incorporate normal variations resulting from the use of a variety of control block materials that fall within the specifications shown in Table 1.

considered invalid. For XRF instruments found to be out-of-specification, the following actions shall be performed:

(*d*) The out-of-specification XRF instrument shall not be used until the problem is identified and solved and the instrument meets specifications in Table 3.

(*e*) Invalid XRF measurements shall be considered unreliable, and not be reported. Make entries in the field records indicating which XRF measurements are invalid.

(*f*) The XRF instrument found to be out-of-specification shall be serviced according to the manufacturer's directions and must successfully meet the manufacturer's QC specifications and the QC specifications herein before the instrument can be returned to service.

7.4.3 For XRF instruments that require substrate corrected XRF measurements, the control blocks used to make calibration checks and SBCs should not be used for these substrate corrections. Substrate corrections for substrate corrected XRF measurements require the use of substrates that are more representative of the substrates being tested in the unit than those used for making calibration checks and SBCs (refer to the HUD Guidelines for more information on substrate corrections).

8. Record Keeping

8.1 *General Record Keeping*—All field data related to collection of XRF measurements during the testing period must be documented. This documentation can take the form of either manual data recording, electronic data recording, or a combination of manual and electronic data recording. These general record keeping procedures are important to document properly and trace field data.

8.1.1 *Requirements for Manual Record Keeping*—Manual record keeping shall be performed within a bound record keeping book, such as a bound set of data forms or bound field notebook and each bound record keeping book shall be used as follows:

8.1.1.1 Each bound record keeping book shall be uniquely identified.

8.1.1.2 Each page within the bound record keeping book shall be uniquely identified using page numbers.

8.1.1.3 All manual record keeping entries shall be made using indelible ink.

8.1.1.4 Each page shall have a signature and date of entry.

8.1.1.5 Any entry errors must be corrected by using only a single line through the incorrect entry (no scratch outs) accompanied by the initials of the person making the correction and the date of correction.

8.1.2 *Requirements for Electronic Record Keeping*—Electronic record keeping, if used for data recording, shall meet the following minimum requirements:

8.1.2.1 All of the records electronically recorded during the testing period shall be printed in hard copy form and included as recording keeping documentation.

8.1.2.2 Each electronically recorded XRF measurement shall include, within the electronically captured record, a unique identification number, a component identifier, and a location identifier that meets all the requirements listed under 8.3.

8.2 *Specific Record Keeping for Each Unit*—At a minimum, the following information must be documented for each unit tested:

8.2.1 Project or client name, or both, address and city/state location,

8.2.2 General sampling site description and unit designation.

8.2.3 XRF instrument manufacturer, model number, probe serial number, radiation source type, radiation source age, or date of manufacture, and if appropriate, display unit serial number and software version number.

8.2.4 Name of person operating the XRF instrument, a contact address for this person, and a telephone number where this person can be reached.

8.2.5 A statement describing the testing protocols used to collect the data.

8.2.6 The local, state, or federal action level for lead in coatings that is used to convert XRF measurements into lead classification results.

8.2.7 The listing of all laboratory confirmatory samples collected in the unit.

8.2.8 A listing of error tolerances used to assess the XRF measurement values obtained from calibration checks, SBC, and checks recommended by the manufacturer of the XRF instrument.

8.2.9 A list of defined technical terms (glossary) used to report the results. At a minimum, the glossary shall contain definitions for building component names and codes, such as wall orientation codes, used in reporting lead measurement results.

8.2.10 Any relevant notes regarding the testing in a unit including, but not limited to, the nominal read time or the operating mode utilized during testing (see Note 4), miscellaneous diagrams, photos or videos.

NOTE 4—Read time and operating mode may be general for a unit or vary among test locations. Describe fully operational or testing problems or unusual occurrences.

8.3 *Specific Record Keeping for XRF Measurements at Each Test Location*—At a minimum, the following information must be documented for XRF measurements collected at each test location within a unit.

8.3.1 A unique sample identifier.

8.3.2 Descriptive information on the location of the XRF measurement. At a minimum, the location description shall be sufficient to determine which building component was tested within the unit and where within that component the measurement is taken. This description shall be sufficient to distinguish between like building components that may have different painting histories present within the same room. An example is an interior window sill on wall B (west wall) in the dining room.

8.3.3 Substrate types, if known.

8.3.4 All XRF measurement values with units of measure, for example, mg/cm^2. If an XRF measurement is the average of more than one XRF reading, each XRF reading value included in the average shall also be recorded.

8.3.5 For each XRF measurement value, determine and record a lead classification result with respect to appropriate local, state or federal action levels for lead in leaded paint or other coatings (see Note 5). Lead classification results shall be determined as per guidance provided in the performance characteristic sheets (PCSs) referenced from Chapter 7 of the HUD Guidelines or other appropriate guidance from the manufacturer of the XRF instrument used to collect the XRF measurements.

NOTE 5—If an inconclusive lead classification result is generated from an XRF measurement, one of two options is suggested as a means to generate more definitive lead classification result; collect a paint sample at the test location where the XRF measurement was taken using Practice E 1729 and submit for laboratory confirmation analysis by Practice E 1613, using Practice E 1645 and Practice E 1583, or equivalent standards; or, assume the result is classified as positive-for-lead.

8.3.6 Date and approximate clock time of the XRF measurements.

8.3.7 Any relevant notes regarding the testing at a testing location such as nominal read time or the operating mode (see Note 4), or both.

8.4 *Specific Record Keeping for Quality Control Checks*—At a minimum, the following information must be documented for each calibration check, SBC, and checks recommended by the manufacturer of the XRF instrument:

8.4.1 A unique identifier for each XRF measurement;

8.4.2 A description of each control block and substrate support.

8.4.3 A description of each calibration check test sample.

8.4.4 All XRF measurements with units of measure, for example, mg/cm^2. If an XRF measurement is the average of more than one XRF reading, each XRF reading value included in the average shall be recorded.

8.4.5 Date and approximate clock time of the XRF readings and measurements.

8.4.6 Any relevant notes regarding the testing including, but not limited to, the nominal read time or the operating mode utilized during testing.

9. Keywords

9.1 analysis; building; coatings; field testing; lead; paint; testing; XRF