

# Performance Characteristic Sheet

**EFFECTIVE DATE:** August 24, 1995

**EDITION NO.:** 3

**MANUFACTURER AND MODEL :**

Make: *Scitec Corporation*  
 Model: *MAP-3*  
 Source: *<sup>57</sup>Co*  
 Note: This sheet supersedes all previous sheets for the XRF instrument of the make, model, and source shown above.

## FIELD OPERATION GUIDANCE

**OPERATING PARAMETERS**

Nominal Time Reading is 15 seconds or 60 seconds.

**XRF CALIBRATION CHECK LIMITS**

15-SECOND READINGS	60-SECOND READINGS
0.4 to 1.3 mg/cm <sup>2</sup> (inclusive)	0.6 mg/cm <sup>2</sup> to 1.1 mg/cm <sup>2</sup> (inclusive)

**SUBSTRATE CORRECTION:**

For XRF results below 4.0 mg/cm<sup>2</sup>, substrate is correction recommended for:

Metal and Wood

Substrate correction is not recommended for:

Brick, Concrete, Drywall, and Plaster

**INCONCLUSIVE RANGE OR THRESHOLD**

15-SECOND READING DESCRIPTION	SUBSTRATE	INCONCLUSIVE RANGE (mg/cm <sup>2</sup> )
Results corrected for substrate bias for 15-second readings on metal and wood substrates only	Brick	0.01 to 1.49
	Concrete	0.01 to 1.49
	Drywall	0.91 to 0.99
	Metal	0.91 to 1.29
	Plaster	0.31 to 1.29
	Wood	0.91 to 1.29

60-SECOND READING DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm <sup>2</sup> )	INCONCLUSIVE RANGE (mg/cm <sup>2</sup> )
Readings corrected for substrate bias for 60-second readings on metal and wood substrates only	Brick	None	0.31 to 0.89
	Concrete	None	0.31 to 0.89
	Drywall	None	0.61 to 0.79
	Metal	None	0.91 to 1.19
	Plaster	None	0.21 to 0.91
	Wood	1.0	None

## BACKGROUND INFORMATION

### EVALUATION DATA SOURCE AND DATE

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated from evaluation data collected during the EPA/HUD field evaluation study conducted from March through October 1993. The data were collected from four instruments at approximately 1,200 15-second test locations and 300 60-second test locations. One instrument had a January 1993 source and the other three instruments had July 1993 sources. All four instruments had sources with 40 mCi initial strengths. The results of this study are reported in *A Field Test of Lead-Based Paint Testing Technologies: Technical Report*, EPA 747-R-95-002b, May 1995.

### OPERATING PARAMETERS

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

### XRF CALIBRATION CHECK:

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm<sup>2</sup> in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm<sup>2</sup> film).

If readings are outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instruments into control before XRF testing proceeds

### SUBSTRATE CORRECTION VALUE COMPUTATION

Chapter 7 of the HUD Guidelines provides guidance on correcting XRF results for substrate bias. Supplemental guidance for using the paint film nearest 1.0 mg/cm<sup>2</sup> for substrate correction is provided:

XRF results are corrected for substrate bias by subtracting from each XRF result a correction value determined separately in each house for single-family housing or in each development for multifamily housing, for each substrate. The correction value is an average of XRF readings taken over the NIST SRM paint film nearest to 1.0 mg/cm<sup>2</sup> at test locations that have been scraped bare of their paint covering. Compute the correction values as follows:

- Using the same XRF instrument, take three readings on a bare substrate area covered with the NIST SRM paint film nearest 1 mg/cm<sup>2</sup>. Repeat this procedure by taking three more readings on a second bare substrate area of the same substrate covered with the NIST SRM.
- Compute the correction value for each substrate type where XRF readings indicate substrate correction is needed by computing the average of all six readings as shown below.

For each substrate type (the 1.02 mg/cm<sup>2</sup> NIST SRM is shown in this example; use the actual lead loading of the NIST SRM used for substrate correction):

$$\left. \begin{array}{l} \text{Correction} \\ \text{Value} \end{array} \right\} = \frac{1^{st} + 2^{nd} + 3^{rd} + 4^{th} + 5^{th} + 6^{th} \text{ Reading}}{6} - 1.02 \text{mg/cm}^2$$

- Repeat this procedure for each substrate requiring substrate correction in the house or housing development.

## EVALUATING THE QUALITY OF XRF TESTING

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing. Use either 15-second readings or 60-second readings.

Conduct XRF retesting at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family and multi-family housing, a result is defined as a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF results.

Compute the average of all ten retest XRF results.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

## BIAS AND PRECISION

Do not use these bias and precision data to correct for substrate bias. These bias and precision data were computed without substrate correction from samples with reported laboratory results less than 4.0 mg/cm<sup>2</sup> lead. There were 124 15-second testing locations with a laboratory reported result equal to or greater than 4.0 mg/cm<sup>2</sup> lead. Of these, none had XRF readings less than 1.0 mg/cm<sup>2</sup>. For the 60-second testing locations, 34 had laboratory reported results equal to or greater than 4.0 mg/cm<sup>2</sup> lead, with 2 of those having XRF readings less than 1.0 mg/cm<sup>2</sup>. These data are for illustrative purposes only. Actual bias must be determined on the site. Inconclusive ranges provided above already account for bias and precision.

15-SECOND READING MEASURED AT	SUBSTRATE	BIAS (mg/cm <sup>2</sup> )	PRECISION* (mg/cm <sup>2</sup> )
0.0 mg/cm <sup>2</sup>	Brick	-0.7	0.9
	Concrete	-0.7	0.9
	Drywall	0.0	0.4
	Metal	0.3	0.3
	Plaster	-0.7	0.8
	Wood	-0.1	0.5
0.5 mg/cm <sup>2</sup>	Brick	-0.5	1.0
	Concrete	-0.5	1.0
	Drywall	-0.1	0.4
	Metal	0.4	0.5
	Plaster	-0.6	0.8
	Wood	0.2	0.6
1.0 mg/cm <sup>2</sup>	Brick	-0.4	1.0
	Concrete	-0.4	1.0
	Drywall	-0.1	0.4
	Metal	0.5	0.6
	Plaster	-0.4	0.9
	Wood	0.4	0.7
2.0 mg/cm <sup>2</sup>	Brick	-0.1	1.2
	Concrete	-0.1	1.2
	Drywall	-0.3	0.4
	Metal	0.6	0.7
	Plaster	-0.2	0.9
	Wood	0.8	0.8
*Precision at 1 standard deviation			

60-SECOND READING MEASURED AT	SUBSTRATE	BIAS (mg/cm <sup>2</sup> )	PRECISION* (mg/cm <sup>2</sup> )
0.0 mg/cm <sup>2</sup>	Brick	-0.8	0.7
	Concrete	-0.8	0.7
	Drywall	0.0	0.3
	Metal	0.3	0.2
	Plaster	-0.8	0.5
	Wood	-0.2	0.4
0.5 mg/cm <sup>2</sup>	Brick	-0.7	0.7
	Concrete	-0.7	0.7
	Drywall	-0.2	0.3
	Metal	0.4	0.3
	Plaster	-0.6	0.7
	Wood	0.1	0.4
1.0 mg/cm <sup>2</sup>	Brick	-0.7	0.7
	Concrete	-0.7	0.7
	Drywall	-0.4	0.3
	Metal	0.6	0.4
	Plaster	-0.5	0.8
	Wood	0.3	0.4
2.0 mg/cm <sup>2</sup>	Brick	-0.6	0.7
	Concrete	-0.6	0.7
	Drywall	-0.8	0.3
	Metal	0.9	0.5
	Plaster	-0.1	1.0
	Wood	0.8	0.4
*Precision at 1 standard deviation			

**CLASSIFICATION OF RESULTS**

XRF results are classified as positive if they are greater than the upper boundary of the inconclusive range, and negative if they are less than the lower boundary of the inconclusive range, or inconclusive if in between. The inconclusive range includes both its upper and lower bounds. Earlier editions of this *XRF Performance Characteristics Sheet* did not include both bounds of the inconclusive range as "inconclusive." While this edition of the Performance Characteristics Sheet uses a different system, the specific XRF readings that are considered positive, negative, or inconclusive for a given XRF model and substrate remain unchanged, so previous inspection results are not affected.

**DOCUMENTATION**

A document titled *Methodology for XRF Performance Characteristic Sheets* provides an explanation of the

statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Information Center Clearinghouse at 1-800-424-LEAD.

This XRF Performance Characteristics Sheet is a joint product of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Housing and Urban Development (HUD). The issuance of this sheet does not constitute rulemaking. The information provided here is intended solely as guidance to be used in conjunction with Chapter 7, Lead-Based Paint Inspection, of the *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*. EPA and HUD reserve the right to revise this guidance. Please address questions and comments on this sheet to: Director, Office of Lead Hazard Control (L), U.S. Department of Housing and Urban Development, 451 Seventh St, S.W., Washington, DC 20410.