Performance Characteristic Sheet

EFFECTIVE DATE: **September 25, 1995** **EDITION NO.: 3**

MANUFACTURER AND MODEL:

Make: *Princeton Gamma-Tech, Inc.*
Model: *XK-3*
Source: ^{57}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.

XRF CALIBRATION CHECK LIMITS

0.5 to 2.3 mg/cm^2 (inclusive)

SUBSTRATE CORRECTION:

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

Brick, Concrete, Drywall, Metal, Plaster and Wood.

Substrate correction is <u>not</u> recommended for:

None.

INCONCLUSIVE RANGE OR THRESHOLD

DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm^2)	INCONCLUSIVE RANGE (mg/cm^2)
Readings corrected for substrate bias on all substrates	Brick	None	1.0 to 1.2
	Concrete	None	0.9 to 1.6
	Drywall	1.0	None
	Metal	None	0.4 to 1.7
	Plaster	None	0.8 to 1.3
	Wood	None	1.0 to 1.3

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 approximately 1,200 test locations using three instruments. One instrument had a March 1993 source and the other two instruments had April 1993 sources. All three instruments had sources with 10 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^2 in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 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^2 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^2 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 <u>bare</u> substrate area covered with the NIST SRM paint film nearest 1 mg/cm^2. Repeat this procedure by taking three more readings on a second <u>bare</u> 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.

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

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

- 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^2 lead. There were 143 testing locations with a laboratory reported result equal to or greater than 4.0 mg/cm^2 lead. Of these, 1 had XRF readings less than 1.0 mg/cm^2. 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. Bias and precision ranges are provided whenever significant variability was found between machines of the same model.

MEASURED AT	SUBSTRATE	BIAS (mg/cm^2)	BIAS RANGES (mg/cm^2)	PRECISION* (mg/cm^2)	PRECISION RANGES (mg/cm^2)
0.0 mg/cm^2	Brick	0.9	-	0.6	-
	Concrete	1.3	(0.6, 1.9)	0.6	(0.2, 0.6)
	Drywall	-0.1	(-0.3, 0.2)	0.3	(0.2, 0.3)
	Metal	0.9	(0.5, 1.4)	0.5	(0.4, 0.5)
	Plaster	0.8	(0.4, 1.7)	0.5	(0.4, 0.5)
	Wood	0.2	(-0.1, 1.0)	0.4	(0.3, 0.5)
0.5 mg/cm^2	Brick	0.9	-	0.6	-
	Concrete	1.3	(0.7, 1.9)	0.6	(0.5, 0.7)
	Drywall	0.0	(-0.2, 0.2)	0.4	(0.3, 0.4)
	Metal	1.1	(0.7, 1.6)	0.8	(0.4, 0.9)
	Plaster	0.8	(0.2, 1.6)	0.6	(0.4, 0.6)
	Wood	0.4	(0.1, 1.1)	0.6	(0.3, 0.9)
1.0 mg/cm^2	Brick	0.9	-	0.6	-
	Concrete	1.3	(0.7, 2.0)	0.7	(0.6, 0.8)
	Drywall	0.0	(-0.1, 0.2)	0.4	(0.4, 0.5)
	Metal	1.3	(0.9, 1.7)	1.0	(0.5, 1.1)
	Plaster	0.8	(0.0, 1.6)	0.6	(0.4, 0.7)
	Wood	0.6	(0.3, 1.3)	0.7	(0.3, 1.2)
2.0 mg/cm^2	Brick	0.9	-	0.6	-
	Concrete	1.3	(0.7, 2.0)	0.8	(0.6, 0.9)
	Drywall	0.1	(0.1, 0.2)	0.6	(0.5, 0.6)
	Metal	1.7	(1.4, 2.1)	1.4	(0.6, 1.6)
	Plaster	0.7	(-0.3, 1.6)	0.7	(0.4, 0.8)
	Wood	1.0	(0.8, 1.5)	0.9	(0.3, 1.7)

*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.