

Lead Requirements for Contractors Conducting Work at The University of Texas at Austin

I. Purpose

This document provides third party consulting companies with required procedures for performing lead surveys for lead based paint (LBP).

The University of Texas at Austin (UT) has established a maximum concentration of 1.0 mg/cm² in lead painted surfaces for target housing and child occupied facilities.

The permanent UT action level for all non-target housing and child occupied facilities has yet to be determined. The interim UT standard for inhalation has been established at 20 µg/m³. Contact the Environmental, Health & Safety Department (EHS), prior to any lead sampling.

II. Lead Paint Detection Methods

There are two approved methods for testing for the presence of LBP: Portable XRF Detectors and Laboratory Analysis of paint chips. Approved lead testing methods include:

1. XRF using National Institute of Standards and Technology (NIST) reference samples for testing to ensure proper equipment functionality. The NIST Standard Reference Materials (SRM) to be used for XRF calibration are:
 - a) film #2571 which has a 3.58 +/- 0.39 margin of error,
 - b) film #2572 which has a 1.527 +/- 0.091 margin of error,
 - c) film #2573 which has a 1.04 +/- 0.06 margin of error,
 - d) film #2574 which has a 0.714 +/- 0.083 margin of error,
 - e) film #2575 which has a 0.307 +/- 0.021 margin of error, and
 - f) film #2576 which has a 5.59 +/- 0.59 margin of error.
2. Laboratory analysis (by weight) with a method detection limit of less than 50 ppm (mg/kg) (quantitative analysis).

The paint chip shall be a destructive sample collected and submitted to the laboratory to determine lead loading per cc of surface area. A known area for paint chip sampling must be used and identified on the chain of custody document in order that a direct comparison between XRF readings and laboratory analytical results can be made in mg/cm².

Follow ASTM's Standard Practice for Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques (ASTM - E1729).

Depending on the type of paint being sampled and the surface on which it is applied, the quantity of material necessary for an acceptable detection limit is extremely variable. A minimum sample size of about 300 mg is usually required to conduct an analysis, (usually 2-4 square inches in size is typically considered sufficient size). Sufficient sample must be collected so that the method detection limit is less than 50 ppm (mg/kg). Ensure the removal of all layers of paint equally, but none of the substrate.

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Target Housing and Child Occupied Facilities

Only an XRF with an isotope source and a valid performance characteristic sheet (PCS) may be used for lead paint inspections in these facilities. If you use a XRF without a current PCS, or do not follow the requirements of the PCS, the work will be considered invalid, and not an inspection or paint testing, and the work will have to be re-done. X-ray tube type XRF's are not permitted for these types of facilities. Paint chip sampling due to the deteriorated condition of the paint film must not be conducted unless EHS has provided approval.

Non-Child Occupied Facilities

An XRF with an isotope source and a valid PCS or an X-RAY tube that does not have a PCS are acceptable for use at these facilities. All positive XRF results must have the paint film thickness determined by use of an ultrasonic paint density gauge at the location of the XRF sample. This information must be provided in the report and the information used to convert the XRF reading for comparison to an inhalation standard.

III. Other Lead Sampling Protocols

Wipe Samples

Follow the protocol established in ASTM - E1728 – 10, Standard Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination.

Micro-Vacuum Samples

For dust sample collection, use the Standard Practice for Collection of Surface Dust by Micro-vacuum Sampling for Subsequent Metals Determination, ASTM D7144-05a.

Soil Samples

Soil samples must be collected consistent with the EPA Residential Sampling for Lead: Protocols for Dust and Soil Sampling (EPA report number 7474-R-95-001). Soil sampling will not be conducted without prior EHS approval.

Air Samples

Airborne lead requires the use of a 37mm mixed-cellulose ester (MCE with 0.084 micron pore size) cassette.

Drinking Water Samples

The location where water samples are to be collected must be allowed to sit undisturbed for no less than eight (8) hours prior to sampling. No initial flushing of the sample location should be conducted. Two 250 mL samples will be collected from each location: first draw and second draw (after a 30-second flush).

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Chemical Spot Tests

The use of lead chemical test swabs is prohibited without prior approval from EHS.

IV. Equipment Calibration

All equipment that is used for the investigation must be calibrated before use. Documentation of the calibration protocol, sequence, margin of error(s), and readings must be provided in the report

Calibration performance check samples should be analyzed at the beginning of the day and after every 10 different homogeneous sample applications using a NIST standard.

The report must list each key piece of equipment or instrumentation used for the project, state how frequently the equipment is calibrated, and how frequently routine maintenance is performed on it.

The report must state how much the equipment can vary from original baseline readings and what action they will take if the XRF varies more the specified percent.

V. Where To Sample

Paint history is unknown for most buildings. Samples are to be collected of each different substrate and paint color. Composite representation of sample areas/systems is prohibited.

Walls and floors associated with rooms used (or previously used) for radiography are suspect as containing lead paint or sheeting material.

Windows

Sills, frames, sashes, jambs, and grills will be sampled separately.

Doors

Frame, jamb, and mold will be sampled separately.

Walls

Concrete, plaster, drywall, crown molding, and cove base will be sampled separately.

Stairs

Balusters (spindles), newel, tread, riser, stringer, and hand rail will be sampled separately.

Floors

Wood floors will be sampled in areas where there is a finish that has not been worn off. Epoxy and painted floors will be sampled in areas where the surface has not been abraded.

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Artificial Turf Fields

Test only those artificial turf fields that appear worn or weathered (i.e. turf that's broken, faded or abraded, with visible dust).

VI. How to Sample

1) XRF Methodology

A minimum of three readings will be collected from each surface when using an XRF. Significantly damaged paint must be sampled by paint chip methodology. Irregular surfaces must be sample by paint chip methodology if the XRF does not fit flush with the surface area.

All XRF readings that are positive for the presence of lean in paint film must also be measured using an ultrasonic paint density gauge for paint thickness.

2) Paint Chip Sampling Methodology

Blanks must be submitted at a rate of 10% of samples each day for all samples submitted to an analytical laboratory for analysis. Blanks are to consist of non-LBP in the general vicinity of the sampling.

Any paint chip sample submitted with an insufficient sample size (< 100 mg) is not permitted and must be resampled. If analyzed, a sample determined to be an insufficient sample will be indicated on the report.

Laboratory analysis of paint samples are recommended in the following situations:

- 1) For new paint;
- 2) When a high accuracy and/or low limits of detection are needed;
- 3) For small items and inaccessible areas or building components with irregular surfaces that cannot be tested with XRF instrumentation;
- 4) To confirm borderline XRF results.
- 5) If requested by EHS.

Target Housing and Child Occupied Facilities

XFR with an isotope source and a valid PCS are to be used for target housing and child occupied facilities. XFRs with an x-ray tube are not to be used for target housing and child occupied facilities.

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Non-Child Occupied Facilities

If dust sampling is to be conducted, the sampling should always be conducted before paint chip sampling in order to minimize the prospect of cross-sample contamination. If paint chip samples are to be collected an inconspicuous area should be chosen when possible. The room's occupant must be notified that paint chip sampling may be necessary.

Until the permanent UT lead level gets established for non-child occupied facilities the following method must be performed.

An Ultrasonic thickness gauge must be used for all positive LBP readings from an XRF. An ultrasonic thickness gauge is a measuring instrument for the non-destructive investigation of a material's thickness using ultrasonic waves. Ultrasonic gauges are used to measure the thickness of coatings on non-metal substrates (wood, concrete, plastics, composites, etc.) without damaging the coating. See the Section X - Reporting in this document to find the proper use of information provided by this device.

Cleanup and Repair

- 1) All settled dust generated must be cleaned up using wet wipes and/or HEPA vacuum.
- 2) The surface can be resealed with new paint if necessary. Apply spackling and/or new paint to repair the area where paint was removed.

Quality Assurance/Quality Control (QA/QC)

QA/QC samples are required to ensure data integrity. All measurements of field QA/QC samples or calibration check measurements must be recorded as a part of the permanent record. A detailed record must be kept of the time and precision of every calibration. Borderline measurements, meaning readings that are within the device's margin of error, should be confirmed by resampling or laboratory analysis.

VII. Testing Laboratories

The laboratory selected to perform analysis on dust wipe, paint chip, and soil samples shall be recognized by the EPA's National Lead Laboratory Accreditation Program (NLLAP). For drinking water, the analytical laboratory used must be accredited under the National Environmental Laboratory Accreditation Program (NELAP). The laboratories accreditation must include drinking water.

The U.S. Environmental Protection Agency (EPA) has stated that the following values are "positive" for lead:

- 1.0 mg/cm²
- 5,000 µg/g
- 5,000 mg/kg
- 5,000 parts per million (ppm), or

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- 0.5% by weight

The results are usually reported by the laboratory in micrograms per gram ($\mu\text{g/g}$) or milligrams per kilogram (mg/kg). If the area sampled is included, the lab may also report results in milligrams per square centimeter (mg/cm^2).

Laboratory Sample Chip, Wipe, Soil Analysis (Lead)

The Contractor shall send all lead samples that require laboratory analysis to an NLLAP recognized laboratory. The Contractor shall verify in the Survey Report that the selected laboratory is accredited by NLLAP for each type of analysis to be performed.

Laboratory Testing for Artificial Turf

Lead Testing of Artificial Turf Fields Analysis: SW846-6010B, ICP – AES (Inductively Coupled Plasma – Atomic Emission Spectroscopy).

Laboratory Air Sample Analysis (Lead)

Analysis shall be performed in accordance with NIOSH 7082 Method.

Laboratory Micro-Vacuum Sample Analysis (Lead)

Analysis shall be performed in accordance with NIOSH 7082 Method.

Laboratory TCLP Sample Analysis (Lead)

Analysis shall be performed in accordance with EPA's TCLP test method 1311 in the most recent version of "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", See EPA Publication SW-846.

VIII. Communicating Information

Information regarding sampling collection, data analysis, and the investigation in general will only be communicated to EHS or the project manager. Building occupants are to be referred to the project manager and not provided any inferences, information, or data.

If EHS specifies that raw data is the deliverable, then only raw data with no interpretation must be provided.

All data tables must include unit of measure if appropriate. The margin of error for all methodologies and devices used must be included in the report, as a foot note under the table unless otherwise specified by EHS.

IX. Chain-of-Custody Documentation

The chain-of-custody (COC) procedure is intended to ensure that the sample is kept secure at all times and will stand up to the documentation requirements that may be associated with legal challenge. The COC document identifies the location, transfer, and security of the samples from collection to disposal and provides documentation that identifies each person having true possession of the sample.

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The COC will be completed in sufficient detail so that individual sample identification can be directly correlated to the corresponding floor plans and the laboratory analytical results. Current room uses, designations, numbering, or colors can change and should not be the only way of identifying the sample.

1) Sample Identification

All samples collected shall have a unique identification number assigned to them so that there are multiple ways to research individual samples. The preferred method is to use the three letter building designation followed by a hyphen and then a catalog number for the sample. This would also apply to UT Systems buildings. For outlying facilities such as MSI, MCB, PRC etc. use the facility designation.

2) Sample Location

The sample location should include room numbers at the time of the survey and be accurately reflected on floor plans. Room numbers change within buildings and the location identified is dependent on whether or not the material is homogeneous throughout the area being inspected. If soil sampling is performed, include locations, depth etc. for the soil sampling. A map must be provided with locations indicated.

All floor plans must be marked to indicate rooms and areas where sampling was conducted. This information must be reflected on the COC.

X. Reporting

All reporting must be inclusive of raw data and laboratory analyses. Recitation of current state and federal rules and statutes within the report is not necessary. Reporting should be provided in tabular format and the information should be cross-referenced with the COC and sample analytical results.

Wall identification conventions used by the inspector for XRF investigations will be described in detail.

Each testing method, device and XRF serial number (if applicable) and sampling procedures employed for paint analysis, including quality control data must be provided.

For final reports, and comparison to laboratory analysis of calibration and confirmation samples, XRF results should typically be rounded to two significant figures.

Target Housing and Child Occupied Facilities

The following information is required when presenting XRF analytical data.

Sample Number	Location	Color	Substrate	Reading Time (in seconds)	Device Paint Depth Index	Results (mg/cm ²)

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Non-Child Occupied Facilities

Two formulas are to be used for the following table. The first provides a projected concentration of lead based on percent. The formula and explanation can be found as Appendix A.

The second formula is the projected concentration of the potential inhalation hazard. To determine the concentration of lead in the air (i.e., employee exposure) multiply the total airborne concentration of dust times the percentage of lead in the paint. For example, if the concentration of total dust is 15 mg/m^3 and the concentration of lead in paint is 0.06%, the airborne lead level will be $(0.06\%) \times (15 \text{ mg/mm}^3) \times (1000 \text{ } \mu\text{g/mg}) \div 100 = 9 \text{ } \mu\text{g/m}^3$. Consequently, the airborne concentration of dust would have to be 50 mg/m^3 before the action level of $30 \text{ } \mu\text{g/m}^3$ would be reached. Arithmetically, this would read, $(50 \text{ mg/m}^3 \text{ airborne paint}) \times (0.06\% \text{ lead}) \times (1000 \text{ } \mu\text{g/mg}) \div 100 = 30 \text{ } \mu\text{g/m}^3 \text{ airborne lead}$.

The permanent UT action level for all non-target housing and child occupied facilities has yet to be determined the interim standard for inhalation has been established at $20 \text{ } \mu\text{g/m}^3$.

If the concentration of total dust is 20 mg/m^3 and the concentration of lead in paint is 0.06%, the airborne lead level will be $(0.06\%) \times (20 \text{ mg/mm}^3) \times (1000 \text{ } \mu\text{g/mg}) \div 100 = 12 \text{ } \mu\text{g/m}^3$.

The following information is required when presenting XRF analytical data.

Sample Number	Location	Color	Substrate	Reading Time (in seconds)	Device Depth Index	Results (mg/cm ²)	Paint Density Ultrasonic (g/cm ³)	Projected Concentration (%)	Projected Concentration (μg/m ³)

Recommendations will be included in the report, only if EHS has provided prior approval.

XI. References

American Society for Testing and Materials (ASTM)

E1605, Standard Terminology Relating to Abatement of Hazards from Lead-Based Paint in Buildings and Related Structures.

E1727, Standard Practice for Field Collection of Soil Samples for Lead Determination by Atomic Spectrometry Techniques.

E1728 – 10, Standard Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination

E1729, Standard Practice for Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques.

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PS95-98, Standard Provisional 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.

Consumer Products Safety Commission (CPSC)

16 CFR Part 1303 – Ban of Lead-Containing Paint and Certain Consumer Products Bearing Lead-Containing Paint

U.S Environmental Protection Agency (EPA)

40 CFR Part 261, Appendix II - Toxic Characteristic Leaching Procedure (TCLP)

40 CFR Part 745, Chapter 227 - Distinct Painting History

40 CFR Part 745, Subpart L - Requirements for Lead-Based Paint Activities

Pb-Based Paint Laboratory Operations Guidelines: Analysis of Pb in Paint, Dust, and Soil
Revision 1.0, May 1993

Paint Chip Sample Collection Guide – Lead Renovation, Repair and Painting Program -
October 2011

Methodology for XRF Performance Characteristic Sheets, EPA 747-R-95-008, September
1997 (PDF)

Texas Department of State Health Services (DSHS)

Texas Environmental Lead Reduction Rules, February 19, 1996

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Federal Lead Standards

Paint (surface coatings)

1.0 mg/cm² Federal Lead definition for LBP (by XRF)

0.5% Federal Lead definition for LBP (by paint chip sampling, same as 5,000 ppm)

90 ppm 2009 CPSC LBP limit for paints/coatings in homes and schools & children's products (same as 0.009%)

Hazardous Waste

5 ppm EPA/RCRA TCLP Limit (Toxicity Characteristic Leaching Procedure)

Note; This most often applies to non-housing waste; commercial/industrial

EPA Drinking Water Standard

15 ppb EPA SDWA action level for drinking water (Safe Drinking Water Act)

APPENDIX A

**A METHOD TO DETERMINE APPROXIMATE
PERCENT WEIGHT LEAD USING XRF**

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A Method to Determine Approximate Percent Weight Lead Using XRF

The method is based on the following formula, which relates the mg/cm^2 of lead to the percent weight of lead. The results are in percent, not weight fraction, for example, 0.5%, not 0.005:

$$w_{\text{lead}} = 100 M_{\text{lead}} / (2.54 \rho t) \quad (1)$$

- w_{lead} is the percent weight lead.
- M_{lead} is the amount of lead in mg/cm^2 measured by the XRF
- ρ is the paint density in g/cm^3 .
- t is the paint thickness in mils, measured with a coatings thickness gauge.

The method requires an XRF measurement for M_{lead} , a non-destructive paint thickness measurement for t , and the input of the paint density. A reasonable estimate must be made for the paint density. Most users will either know this value, or they will measure it on a few representative surfaces. In general paint density is between 1.0 and 2.0, thus an estimate of 1.5 should be satisfactory for this approximate method.

The proposed method will yield percent weight lead from XRF measurements. Small scale field testing performed by NITON with Mobil Oil Company has shown that the method has a precision of $\pm 40\%$ (95% confidence level) and a limit of detection between 0.1 and 0.1 % lead. Fluctuations in paint density are the primary contribution to the precision. It is important to note that this is a new and experimental method. There is no supporting data other than the small-scale field study conducted by NITON Corporation. However, we hope to encourage the use and publication of this method because it provides a technique for a rapid, thorough and non-destructive evaluation of percent weight lead on painted surfaces.

Steps to Perform to Determine Approximate Percent Weight Lead:

1. Perform XRF measurements for lead.
 2. Measure the paint thickness using the coatings thickness gauge.
 3. Using a paint density (either determined by the user, or estimated at $1.5 \text{ g}/\text{cm}^3$), use the above formula to calculate percent weight lead.
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