Lead Inspector Refresher Handouts Booklet

EEA
ENVIRONMENTAL EDUCATION ASSOCIATES
888 4 ENV EDU *environmentaleducation.com*

LEAD-BASED PAINT HANDOUTS

TABLE OF CONTENTS – Inspector Refresher

§ 745.220 Scope and applicability.

(a) This subpart contains procedures and requirements for the accreditation of training programs for lead-based paint activities and renovations, procedures and requirements for the certification of individuals and firms engaged in lead-based paint activities, and work practice standards for performing such activities. This subpart also requires that, except as discussed below, all lead-based paint activities, as defined in this subpart, be performed by certified individuals and firms.

(b) This subpart applies to all individuals and firms who are engaged in lead-based paint activities as defined in § 745.223, except persons who perform these activities within residential dwellings that they own, unless the residential dwelling is occupied by a person or persons other than the owner or the owner's immediate family while these activities are being performed, or a child residing in the building has been identified as having an elevated blood lead level. This subpart applies only in those States or Indian Country that do not have an authorized State or Tribal program pursuant to § 745.324 of subpart Q.

(c) Each department, agency, and instrumentality of the executive, legislative, and judicial branches of the Federal Government having jurisdiction over any property or facility, or engaged in any activity resulting, or which may result, in a lead-based paint hazard, and each officer, agent, or employee thereof shall be subject to, and comply with, all Federal, State, interstate, and local requirements, both substantive and procedural, including the requirements of this subpart regarding lead-based paint, lead-based paint activities, and lead-based paint hazards.

(d) While this subpart establishes specific requirements for performing lead-based paint activities should they be undertaken, nothing in this subpart requires that the owner or occupant undertake any particular lead-based paint activity.

[61 FR 45813, Aug. 29, 1996, as amended at 73 FR 21766, Apr. 22, 2008]

§ 745.223 Definitions.

The definitions in subpart A apply to this subpart. In addition, the following definitions apply.

Abatement means any measure or set of measures designed to permanently eliminate lead-based paint hazards. Abatement includes, but is not limited to:

(1) The removal of paint and dust, the permanent enclosure or encapsulation of lead-based paint, the replacement of painted surfaces or fixtures, or the removal or permanent covering of soil, when lead-based paint hazards are present in such paint, dust or soil; and

(2) All preparation, cleanup, disposal, and post-abatement clearance testing activities associated with such measures.

(3) Specifically, abatement includes, but is not limited to:

(i) Projects for which there is a written contract or other documentation, which provides that an individual or firm will be conducting activities in or to a residential dwelling or child-occupied facility that:

(A) Shall result in the permanent elimination of lead-based paint hazards; or

(B) Are designed to permanently eliminate lead-based paint hazards and are described in paragraphs (1) and (2) of this definition.

(ii) Projects resulting in the permanent elimination of lead-based paint hazards, conducted by firms or individuals certified in accordance with § 745.226, unless such projects are covered by paragraph (4) of this definition;

(iii) Projects resulting in the permanent elimination of lead-based paint hazards, conducted by firms or individuals who, through their company name or promotional literature, represent, advertise, or hold themselves out to be in the business of performing lead-based paint activities as identified and defined by this section, unless such projects are covered by paragraph (4) of this definition; or

(iv) Projects resulting in the permanent elimination of lead-based paint hazards, that are conducted in response to State or local abatement orders.

(4) Abatement does not include renovation, remodeling, landscaping or other activities, when such activities are not designed to permanently eliminate lead-based paint hazards, but, instead, are designed to repair, restore, or remodel a given structure or dwelling, even though these activities may incidentally result in a reduction or elimination of lead-based paint hazards. Furthermore, abatement does not include interim controls, operations and maintenance activities, or other measures and activities designed to temporarily, but not permanently, reduce lead-based paint hazards.

Accredited training program means a training program that has been accredited by EPA pursuant to § 745.225 to provide training for individuals engaged in lead-based paint activities.

Adequate quality control means a plan or design which ensures the authenticity, integrity, and accuracy of samples, including dust, soil, and paint chip or paint film samples. Adequate quality control also includes provisions for representative sampling.

Business day means Monday through Friday with the exception of Federal holidays.

Certified firm means a company, partnership, corporation, sole proprietorship, association, or other business entity that performs lead-based paint activities to which EPA has issued a certificate of approval pursuant to § 745.226(f).

Certified inspector means an individual who has been trained by an accredited training program, as defined by this section, and certified by EPA pursuant to § 745.226 to conduct inspections. A certified inspector also samples for the presence of lead in dust and soil for the purposes of abatement clearance testing.

Certified abatement worker means an individual who has been trained by an accredited training program, as defined by this section, and certified by EPA pursuant to § 745.226 to perform abatements.

Certified project designer means an individual who has been trained by an accredited training program, as defined by this section, and certified by EPA pursuant to § 745.226 to prepare abatement project designs, occupant protection plans, and abatement reports.

Certified risk assessor means an individual who has been trained by an accredited training program, as defined by this section, and certified by EPA pursuant to § 745.226 to conduct risk assessments. A risk assessor also samples for the presence of lead in dust and soil for the purposes of abatement clearance testing.

Certified supervisor means an individual who has been trained by an accredited training program, as defined by this section, and certified by EPA pursuant to § 745.226 to supervise and conduct abatements, and to prepare occupant protection plans and abatement reports.

Child-occupied facility means a building, or portion of a building, constructed prior to 1978, visited regularly by the same child, 6 years of age or under, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visit lasts at least 6 hours, and the combined annual visits last at least 60 hours. Child-occupied facilities may include, but are not limited to, day-care centers, preschools and kindergarten classrooms.

Clearance levels are values that indicate the maximum amount of lead permitted in dust on a surface following completion of an abatement activity.

Common area means a portion of a building that is generally accessible to all occupants. Such an area may include, but is not limited to, hallways, stairways, laundry and recreational rooms, playgrounds, community centers, garages, and boundary fences.

Component or building component means specific design or structural elements or fixtures of a building, residential dwelling, or child-occupied facility that are distinguished from each other by form, function, and location. These include, but are not limited to, interior components such as: ceilings, crown molding, walls, chair rails, doors, door trim, floors, fireplaces, radiators and other heating units, shelves, shelf supports, stair treads, stair risers, stair stringers, newel posts, railing caps, balustrades, windows and trim (including sashes, window heads, jambs, sills or stools and troughs), built in cabinets, columns, beams, bathroom vanities, counter tops, and air conditioners; and exterior components such as: painted roofing, chimneys, flashing, gutters and downspouts, ceilings, soffits, fascias, rake boards, cornerboards, bulkheads, doors and door trim, fences, floors, joists, lattice work, railings and railing caps, siding, handrails, stair risers and treads, stair stringers, columns, balustrades, window sills or stools and troughs, casings, sashes and wells, and air conditioners.

Containment means a process to protect workers and the environment by controlling exposures to the lead-contaminated dust and debris created during an abatement.

Course agenda means an outline of the key topics to be covered during a training course, including the time allotted to teach each topic.

Course test means an evaluation of the overall effectiveness of the training which shall test the trainees' knowledge and retention of the topics covered during the course.

Course test blue print means written documentation identifying the proportion of course test questions devoted to each major topic in the course curriculum.

Deteriorated paint means paint that is cracking, flaking, chipping, peeling, or otherwise separating from the substrate of a building component.

Discipline means one of the specific types or categories of lead-based paint activities identified in this subpart for which individuals may receive training from accredited programs and become certified by EPA. For example, “abatement worker” is a discipline.

Distinct painting history means the application history, as indicated by its visual appearance or a record of application, over time, of paint or other surface coatings to a component or room.

Documented methodologies are methods or protocols used to sample for the presence of lead in paint, dust, and soil.

Elevated blood lead level (EBL) means an excessive absorption of lead that is a confirmed concentration of lead in whole blood of 20 µg/dl (micrograms of lead per deciliter of whole blood) for a single venous test or of 15-19 µg/dl in two consecutive tests taken 3 to 4 months apart.

Encapsulant means a substance that forms a barrier between lead-based paint and the environment using a liquid-applied coating (with or without reinforcement materials) or an adhesively bonded covering material.

Encapsulation means the application of an encapsulant.

Enclosure means the use of rigid, durable construction materials that are mechanically fastened to the substrate in order to act as a barrier between lead-based paint and the environment.

Guest instructor means an individual designated by the training program manager or principal instructor to provide instruction specific to the lecture, hands-on activities, or work practice components of a course.

Hands-on skills assessment means an evaluation which tests the trainees' ability to satisfactorily perform the work practices and procedures identified in § 745.225(d), as well as any other skill taught in a training course.

Hazardous waste means any waste as defined in 40 CFR 261.3.

Inspection means a surface-by-surface investigation to determine the presence of lead-based paint and the provision of a report explaining the results of the investigation.

Interim certification means the status of an individual who has successfully completed the appropriate training course in a discipline from an accredited training program, as defined by this section, but has not yet received formal certification in that discipline from EPA pursuant to § 745.226. Interim certifications expire 6 months after the completion of the training course, and is equivalent to a certificate for the 6-month period.

Interim controls means a set of measures designed to temporarily reduce human exposure or likely exposure to lead-based paint hazards, including specialized cleaning, repairs, maintenance, painting, temporary containment, ongoing monitoring of lead-based paint hazards or potential hazards, and the establishment and operation of management and resident education programs.

Lead-based paint means paint or other surface coatings that contain lead equal to or in excess of 1.0 milligrams per square centimeter or more than 0.5 percent by weight.

Lead-based paint activities means, in the case of target housing and child-occupied facilities, inspection, risk assessment, and abatement, as defined in this subpart.

Lead-based paint activities courses means initial and refresher training courses (worker, supervisor, inspector, risk assessor, project designer) provided by accredited training programs.

Lead-based paint hazard means any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, or lead-contaminated paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects as identified by the Administrator pursuant to TSCA section 403.

Lead-hazard screen is a limited risk assessment activity that involves limited paint and dust sampling as described in § 745.227(c).

Living area means any area of a residential dwelling used by one or more children age 6 and under, including, but not limited to, living rooms, kitchen areas, dens, play rooms, and children's bedrooms.

Local government means a county, city, town, borough, parish, district, association, or other public body (including an agency comprised of two or more of the foregoing entities) created under State law.

Multi-family dwelling means a structure that contains more than one separate residential dwelling unit, which is used or occupied, or intended to be used or occupied, in whole or in part, as the home or residence of one or more persons.

Nonprofit means an entity which has demonstrated to any branch of the Federal Government or to a State, municipal, tribal or territorial government, that no part of its net earnings inure to the benefit of any private shareholder or individual.

Paint in poor condition means more than 10 square feet of deteriorated paint on exterior components with large surface areas; or more than 2 square feet of deteriorated paint on interior components with large surface areas (e.g., walls, ceilings, floors, doors); or more than 10 percent of the total surface area of the component is deteriorated on interior or exterior components with small surface areas (window sills, baseboards, soffits, trim).

Permanently covered soil means soil which has been separated from human contact by the placement of a barrier consisting of solid, relatively impermeable materials, such as pavement or concrete. Grass, mulch, and other landscaping materials are not considered permanent covering.

Person means any natural or judicial person including any individual, corporation, partnership, or association; any Indian Tribe, State, or political subdivision thereof; any interstate body; and any department, agency, or instrumentality of the Federal government.

Principal instructor means the individual who has the primary responsibility for organizing and teaching a particular course.

Recognized laboratory means an environmental laboratory recognized by EPA pursuant to TSCA section 405(b) as being capable of performing an analysis for lead compounds in paint, soil, and dust.

Reduction means measures designed to reduce or eliminate human exposure to lead-based paint hazards through methods including interim controls and abatement.

Residential dwelling means (1) a detached single family dwelling unit, including attached structures such as porches and stoops; or (2) a single family dwelling unit in a structure that contains more than one separate residential dwelling unit, which is used or occupied, or intended to be used or occupied, in whole or in part, as the home or residence of one or more persons.

Risk assessment means (1) an on-site investigation to determine the existence, nature, severity, and location of lead-based paint hazards, and (2) the provision of a report by the individual or the firm conducting the risk assessment, explaining the results of the investigation and options for reducing lead-based paint hazards.

Start date means the first day of any lead-based paint activities training course or lead-based paint abatement activity.

Start date provided to EPA means the start date included in the original notification or the most recent start date provided to EPA in an updated notification.

State means any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, the Canal Zone, American Samoa, the Northern Mariana Islands, or any other territory or possession of the United States.

Target housing means any housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any one or more children age 6 years or under resides or is expected to reside in such housing for the elderly or persons with disabilities) or any 0-bedroom dwelling.

Training curriculum means an established set of course topics for instruction in an accredited training program for a particular discipline designed to provide specialized knowledge and skills.

Training hour means at least 50 minutes of actual learning, including, but not limited to, time devoted to lecture, learning activities, small group activities, demonstrations, evaluations, and/or hands-on experience.

Training manager means the individual responsible for administering a training program and monitoring the performance of principal instructors and guest instructors.

Training provider means any organization or entity accredited under § 745.225 to offer lead-based paint activities courses.

Visual inspection for clearance testing means the visual examination of a residential dwelling or a child-occupied facility following an abatement to determine whether or not the abatement has been successfully completed.

Visual inspection for risk assessment means the visual examination of a residential dwelling or a child-occupied facility to determine the existence of deteriorated lead-based paint or other potential sources of lead-based paint hazards.

[61 FR 45813, Aug. 29, 1996, as amended at 64 FR 31097, June 9, 1999; 66 FR 1239, Jan. 5, 2001; 69 FR 18495, Apr. 8, 2004]

§ 745.225 Accreditation of training programs: target housing and child occupied facilities.

(a) *Scope.* (1) A training program may seek accreditation to offer courses in any of the following disciplines: Inspector, risk assessor, supervisor, project designer, abatement worker, renovator, and dust sampling technician. A training program may also seek accreditation to offer refresher courses for each of the above listed disciplines.

(2) Training programs may first apply to EPA for accreditation of their lead-based paint activities courses or refresher courses pursuant to this section on or after August 31, 1998. Training programs may first apply to EPA for accreditation of their renovator or dust sampling technician courses or refresher courses pursuant to this section on or after April 22, 2009.

(3) A training program must not provide, offer, or claim to provide EPA- accredited lead-based paint activities courses without applying for and receiving accreditation from EPA as required under paragraph (b) of this section on or after March 1, 1999. A training program must not provide, offer, or claim to provide EPA-accredited renovator or dust sampling technician courses without applying for and receiving accreditation from EPA as required under paragraph (b) of this section on or after June 23, 2008.

(b) *Application process.* The following are procedures a training program must follow to receive EPA accreditation to offer lead-based paint activities courses, renovator courses, or dust sampling technician courses:

(1) A training program seeking accreditation shall submit a written application to EPA containing the following information:

(i) The training program's name, address, and telephone number.

(ii) A list of courses for which it is applying for accreditation. For the purposes of this section, courses taught in different languages and electronic learning courses are considered different courses, and each must independently meet the accreditation requirements.

(iii) The name and documentation of the qualifications of the training program manager.

(iv) The name(s) and documentation of qualifications of any principal instructor(s).

(v) A statement signed by the training program manager certifying that the training program meets the requirements established in paragraph (c) of this section. If a training program uses EPA-recommended model training materials, or training materials approved by a State or Indian Tribe that has been authorized by EPA under subpart Q of this part, the training program manager shall include a statement certifying that, as well.

(vi) If a training program does not use EPA-recommended model training materials, its application for accreditation shall also include:

(A) A copy of the student and instructor manuals, or other materials to be used for each course.

(B) A copy of the course agenda for each course.

(C) When applying for accreditation of a course in a language other than English, a signed statement from a qualified, independent translator that they had compared the course to the English language version and found the translation to be accurate.

(vii) All training programs shall include in their application for accreditation the following:

(A) A description of the facilities and equipment to be used for lecture and hands-on training.

(B) A copy of the course test blueprint for each course.

(C) A description of the activities and procedures that will be used for conducting the assessment of hands-on skills for each course.

(D) A copy of the quality control plan as described in paragraph (c)(9) of this section.

(2) If a training program meets the requirements in paragraph (c) of this section, then EPA shall approve the application for accreditation no more than 180 days after receiving a complete application from the training program. In the case of approval, a certificate of accreditation shall be sent to the applicant. In the case of disapproval, a letter describing the reasons for disapproval shall be sent to the applicant. Prior to disapproval, EPA may, at its discretion, work with the applicant to address inadequacies in the application for accreditation. EPA may also request additional materials retained by the training program under paragraph (i) of this section. If a training program's application is disapproved, the program may reapply for accreditation at any time.

(3) A training program may apply for accreditation to offer courses or refresher courses in as many disciplines as it chooses. A training program may seek accreditation for additional courses at any time as long as the program can demonstrate that it meets the requirements of this section.

(4) A training program applying for accreditation must submit the appropriate fees in accordance with § 745.238.

(c) *Requirements for the accreditation of training programs.* For a training program to obtain accreditation from EPA to offer lead-based paint activities courses, renovator courses, or dust sampling technician courses, the program must meet the following requirements:

(1) The training program shall employ a training manager who has:

(i) At least 2 years of experience, education, or training in teaching workers or adults; or

(ii) A bachelor's or graduate degree in building construction technology, engineering, industrial hygiene, safety, public health, education, business administration or program management or a related field; or

(iii) Two years of experience in managing a training program specializing in environmental hazards; and

(iv) Demonstrated experience, education, or training in the construction industry including: Lead or asbestos abatement, painting, carpentry, renovation, remodeling, occupational safety and health, or industrial hygiene.

(2) The training manager shall designate a qualified principal instructor for each course who has:

(i) Demonstrated experience, education, or training in teaching workers or adults; and

(ii) Successfully completed at least 16 hours of any EPA-accredited or EPA-authorized State or Tribal-accredited lead-specific training for instructors of lead-based paint activities courses or 8 hours of any EPA-accredited or EPA-authorized State or Tribal-accredited lead-specific training for instructors of renovator or dust sampling technician courses; and

(iii) Demonstrated experience, education, or training in lead or asbestos abatement, painting, carpentry, renovation, remodeling, occupational safety and health, or industrial hygiene.

(3) The principal instructor shall be responsible for the organization of the course, course delivery, and oversight of the teaching of all course material. The training manager may designate guest instructors as needed for a portion of the course to provide instruction specific to the lecture, hands-on activities, or work practice components of a course. However, the principal instructor is primarily responsible for teaching the course materials and must be present to provide instruction (or oversight of portions of the course taught by guest instructors) for the course for which he has been designated the principal instructor.

(4) The following documents shall be recognized by EPA as evidence that training managers and principal instructors have the education, work experience, training requirements or demonstrated experience, specifically listed in paragraphs (c)(1) and (c)(2) of this section. This documentation must be submitted with the accreditation application and retained by the training program as required by the recordkeeping requirements contained in paragraph (i) of this section. Those documents include the following:

(i) Official academic transcripts or diploma as evidence of meeting the education requirements.

(ii) Resumes, letters of reference, or documentation of work experience, as evidence of meeting the work experience requirements.

(iii) Certificates from train-the-trainer courses and lead-specific training courses, as evidence of meeting the training requirements.

(5) The training program shall ensure the availability of, and provide adequate facilities for, the delivery of the lecture, course test, hands-on training, and assessment activities. This includes providing training equipment that reflects current work practices and maintaining or updating the equipment and facilities as needed.

(6) To become accredited in the following disciplines, the training program shall provide training courses that meet the following training requirements:

(i) The inspector course shall last a minimum of 24 training hours, with a minimum of 8 hours devoted to hands-on training activities. The minimum curriculum requirements for the inspector course are contained in paragraph (d)(1) of this section.

(ii) The risk assessor course shall last a minimum of 16 training hours, with a minimum of 4 hours devoted to hands-on training activities. The minimum curriculum requirements for the risk assessor course are contained in paragraph (d)(2) of this section.

(iii) The supervisor course shall last a minimum of 32 training hours, with a minimum of 8 hours devoted to hands-on activities. The minimum curriculum requirements for the supervisor course are contained in paragraph (d)(3) of this section.

(iv) The project designer course shall last a minimum of 8 training hours. The minimum curriculum requirements for the project designer course are contained in paragraph (d)(4) of this section.

(v) The abatement worker course shall last a minimum of 16 training hours, with a minimum of 8 hours devoted to hands-on training activities. The minimum curriculum requirements for the abatement worker course are contained in paragraph (d)(5) of this section.

(vi) The renovator course must last a minimum of 8 training hours, with a minimum of 2 hours devoted to hands-on training activities. The minimum curriculum requirements for the renovator course are contained in paragraph (d)(6) of this section.

(vii) The dust sampling technician course must last a minimum of 8 training hours, with a minimum of 2 hours devoted to hands-on training activities. The minimum curriculum requirements for the dust sampling technician course are contained in paragraph (d)(7) of this section.

(viii) Electronic learning and other alternative course delivery methods are permitted for the classroom portion of renovator, dust sampling technician, or lead-based paint activities courses but not the hands-on portion of these courses, or for final course tests or proficiency tests described in paragraph (c)(7) of this section. Electronic learning courses must comply with the following requirements:

(A) A unique identifier must be assigned to each student for them to use to launch and re-launch the course.

(B) The training provider must track each student's course log-ins, launches, progress, and completion, and maintain these records in accordance with paragraph (i) of this section.

(C) The course must include periodic knowledge checks equivalent to the number and content of the knowledge checks contained in EPA's model course, but at least 16 over the entire course. The knowledge checks must be successfully completed before the student can go on to the next module.

(D) There must be a test of at least 20 questions at the end of the electronic learning portion of the course, of which 80% must be answered correctly by the student for successful completion of the electronic learning portion of the course. The test must be designed so that students to do not receive feedback on their test answers until after they have completed and submitted the test.

(E) Each student must be able to save or print a copy of an electronic learning course completion certificate. The electronic certificate must not be susceptible to easy editing.

(7) For each course offered, the training program shall conduct either a course test at the completion of the course, and if applicable, a hands-on skills assessment, or in the alternative, a proficiency test for that discipline. Each student must successfully complete the hands-on skills assessment and receive a passing score on the course test to pass any course, or successfully complete a proficiency test.

(i) The training manager is responsible for maintaining the validity and integrity of the hands-on skills assessment or proficiency test to ensure that it accurately evaluates the trainees' performance of the work practices and procedures associated with the course topics contained in paragraph (d) of this section.

(ii) The training manager is responsible for maintaining the validity and integrity of the course test to ensure that it accurately evaluates the trainees' knowledge and retention of the course topics.

(iii) The course test shall be developed in accordance with the test blueprint submitted with the training accreditation application.

(8) The training program shall issue unique course completion certificates to each individual who passes the training course. The course completion certificate shall include:

(i) The name, a unique identification number, and address of the individual.

(ii) The name of the particular course that the individual completed.

(iii) Dates of course completion/test passage.

(iv) For initial inspector, risk assessor, project designer, supervisor, or abatement worker course completion certificates, the expiration date of interim certification, which is 6 months from the date of course completion.

(v) The name, address, and telephone number of the training program.

(vi) The language in which the course was taught.

(vii) For renovator and dust sampling technician course completion certificates, a photograph of the individual. The photograph must be an accurate and recognizable image of the individual. As reproduced on the certificate, the photograph must not be smaller than 1 square inch.

(9) The training manager shall develop and implement a quality control plan. The plan shall be used to maintain and improve the quality of the training program over time. This plan shall contain at least the following elements:

(i) Procedures for periodic revision of training materials and the course test to reflect innovations in the field.

(ii) Procedures for the training manager's annual review of principal instructor competency.

(10) Courses offered by the training program must teach the work practice standards contained in § 745.85 or § 745.227, as applicable, in such a manner that trainees are provided with the knowledge needed to perform the renovations or lead-based paint activities they will be responsible for conducting.

(11) The training manager shall be responsible for ensuring that the training program complies at all times with all of the requirements in this section.

(12) The training manager shall allow EPA to audit the training program to verify the contents of the application for accreditation as described in paragraph (b) of this section.

(13) The training manager must provide notification of renovator, dust sampling technician, or lead-based paint activities courses offered.

(i) The training manager must provide EPA with notification of all renovator, dust sampling technician, or lead-based paint activities courses offered. The original notification must be received by EPA at least 7 business days prior to the start date of any renovator, dust sampling technician, or lead-based paint activities course.

(ii) The training manager must provide EPA updated notification when renovator, dust sampling technician, or lead-based paint activities courses will begin on a date other than the start date specified in the original notification, as follows:

(A) For renovator, dust sampling technician, or lead-based paint activities courses beginning prior to the start date provided to EPA, an updated notification must be received by EPA at least 7 business days before the new start date.

(B) For renovator, dust sampling technician, or lead-based paint activities courses beginning after the start date provided to EPA, an updated notification must be received by EPA at least 2 business days before the start date provided to EPA.

(iii) The training manager must update EPA of any change in location of renovator, dust sampling technician, or lead-based paint activities courses at least 7 business days prior to the start date provided to EPA.

(iv) The training manager must update EPA regarding any course cancellations, or any other change to the original notification. Updated notifications must be received by EPA at least 2 business days prior to the start date provided to EPA.

(v) Each notification, including updates, must include the following:

(A) Notification type (original, update, cancellation).

(B) Training program name, EPA accreditation number, address, and telephone number.

(C) Course discipline, type (initial/refresher), and the language in which instruction will be given.

(D) Date(s) and time(s) of training.

(E) Training location(s) telephone number, and address.

(F) Principal instructor's name.

(G) Training manager's name and signature.

(vi) Notification must be accomplished using any of the following methods: Written notification, or electronically using the Agency's Central Data Exchange (CDX). Written notification of lead-based paint activities course schedules can be accomplished by using either the sample form titled “Lead-Based Paint Training Notification” or a similar form containing the information required in paragraph (c)(13)(v) of this section. All written notifications must be delivered to EPA by U.S. Postal Service, fax, commercial delivery service, or hand delivery (persons submitting notification by U.S. Postal Service are reminded that they should allow 3 additional business days for delivery in order to ensure that EPA receives the notification by the required date). Instructions and sample forms can be obtained from the NLIC at 1-800-424-LEAD(5323), or on the Internet at *http://www.epa.gov/lead.* Hearing- or speech-impaired persons may reach the above telephone number through TTY by calling the toll-free Federal Relay Service at 1-800-877-8339.

(vii) Renovator, dust sampling technician, or lead-based paint activities courses must not begin on a date, or at a location other than that specified in the original notification unless an updated notification identifying a new start date or location is submitted, in which case the course must begin on the new start date and/or location specified in the updated notification.

(viii) No training program shall provide renovator, dust sampling technician, or lead-based paint activities courses without first notifying EPA of such activities in accordance with the requirements of this paragraph.

(14) The training manager must provide notification following completion of renovator, dust sampling technician, or lead-based paint activities courses.

(i) The training manager must provide EPA notification after the completion of any lead-based paint activities course. This notice must be received by EPA no later than 10 business days following course completion.

(ii) The notification must include the following:

(A) Training program name, EPA accreditation number, address, and telephone number.

(B) Course discipline and type (initial/refresher).

(C) Date(s) of training.

(D) The following information for each student who took the course:

(*1*) Name.

(*2*) Address.

(*3*) Date of birth.

(*4*) Course completion certificate number.

(*5*) Course test score.

(*6*) For renovator or dust sampling technician courses, a digital photograph of the student.

(E) Training manager's name and signature.

(iii) Notification must be accomplished using any of the following methods: Written notification, or electronically using the Agency's Central Data Exchange (CDX). Written notification following renovator, dust sampling technician, or lead-based paint activities training courses can be accomplished by using either the sample form titled “Lead-Based Paint Training Course Follow-up” or a similar form containing the information required in paragraph (c)(14)(ii) of this section. All written notifications must be delivered to EPA by U.S. Postal Service, fax, commercial delivery service, or hand delivery (persons submitting notification by U.S. Postal Service are reminded that they should allow 3 additional business days for delivery in order to ensure that EPA receives the notification by the required date). Instructions and sample forms can be obtained from the NLIC at 1-800-424-LEAD (5323), or on the Internet at *http://www.epa.gov/lead.*

(d) *Minimum training curriculum requirements.* To become accredited to offer lead-based paint courses in the specific disciplines listed in this paragraph, training programs must ensure that their courses of study include, at a minimum, the following course topics.

(1) *Inspector.* Instruction in the topics described in paragraphs (d)(1)(iv), (v), (vi), and (vii) of this section must be included in the hands-on portion of the course.

(i) Role and responsibilities of an inspector.

(ii) Background information on lead and its adverse health effects.

(iii) Background information on Federal, State, and local regulations and guidance that pertains to lead-based paint and lead- based paint activities.

(iv) Lead-based paint inspection methods, including selection of rooms and components for sampling or testing.

(v) Paint, dust, and soil sampling methodologies.

(vi) Clearance standards and testing, including random sampling.

(vii) Preparation of the final inspection report.

(viii) Recordkeeping.

(2) *Risk assessor.* Instruction in the topics described in paragraphs (d)(2)(iv), (vi), and (vii) of this section must be included in the hands-on portion of the course.

(i) Role and responsibilities of a risk assessor.

(ii) Collection of background information to perform a risk assessment.

(iii) Sources of environmental lead contamination such as paint, surface dust and soil, water, air, packaging, and food.

(iv) Visual inspection for the purposes of identifying potential sources of lead-based paint hazards.

(v) Lead hazard screen protocol.

(vi) Sampling for other sources of lead exposure.

(vii) Interpretation of lead-based paint and other lead sampling results, including all applicable Federal or State guidance or regulations pertaining to lead-based paint hazards.

(viii) Development of hazard control options, the role of interim controls, and operations and maintenance activities to reduce lead-based paint hazards.

(ix) Preparation of a final risk assessment report.

(3) *Supervisor.* Instruction in the topics described in paragraphs (d)(3)(v), (vii), (viii), (ix), and (x) of this section must be included in the hands-on portion of the course.

(i) Role and responsibilities of a supervisor.

(ii) Background information on lead and its adverse health effects.

(iii) Background information on Federal, State, and local regulations and guidance that pertain to lead-based paint abatement.

(iv) Liability and insurance issues relating to lead-based paint abatement.

(v) Risk assessment and inspection report interpretation.

(vi) Development and implementation of an occupant protection plan and abatement report.

(vii) Lead-based paint hazard recognition and control.

(viii) Lead-based paint abatement and lead-based paint hazard reduction methods, including restricted practices.

(ix) Interior dust abatement/cleanup or lead-based paint hazard control and reduction methods.

(x) Soil and exterior dust abatement or lead-based paint hazard control and reduction methods.

(xi) Clearance standards and testing.

(xii) Cleanup and waste disposal.

(xiii) Recordkeeping.

(4) *Project designer.* (i) Role and responsibilities of a project designer.

(ii) Development and implementation of an occupant protection plan for large-scale abatement projects.

(iii) Lead-based paint abatement and lead-based paint hazard reduction methods, including restricted practices for large-scale abatement projects.

(iv) Interior dust abatement/cleanup or lead hazard control and reduction methods for large-scale abatement projects.

(v) Clearance standards and testing for large scale abatement projects.

(vi) Integration of lead-based paint abatement methods with modernization and rehabilitation projects for large scale abatement projects.

(5) *Abatement worker.* Instruction in the topics described in paragraphs (d)(5)(iv), (v), (vi), and (vii) of this section must be included in the hands-on portion of the course.

(i) Role and responsibilities of an abatement worker.

(ii) Background information on lead and its adverse health effects.

(iii) Background information on Federal, State and local regulations and guidance that pertain to lead-based paint abatement.

(iv) Lead-based paint hazard recognition and control.

(v) Lead-based paint abatement and lead-based paint hazard reduction methods, including restricted practices.

(vi) Interior dust abatement methods/cleanup or lead-based paint hazard reduction.

(vii) Soil and exterior dust abatement methods or lead-based paint hazard reduction.

(6) *Renovator.* Instruction in the topics described in paragraphs (d)(6)(iv), (vi), (vii), and (viii) of this section must be included in the hands-on portion of the course.

(i) Role and responsibility of a renovator.

(ii) Background information on lead and its adverse health effects.

(iii) Background information on EPA, HUD, OSHA, and other Federal, State, and local regulations and guidance that pertains to lead-based paint and renovation activities.

(iv) Procedures for using acceptable test kits to determine whether paint is lead-based paint.

(v) Procedures for collecting a paint chip sample and sending it to a laboratory recognized by EPA under section 405(b) of TSCA.

(vi) Renovation methods to minimize the creation of dust and lead-based paint hazards.

(vii) Interior and exterior containment and cleanup methods.

(viii) Methods to ensure that the renovation has been properly completed, including cleaning verification and clearance testing.

(ix) Waste handling and disposal.

(x) Providing on-the-job training to other workers.

(xi) Record preparation.

(7) *Dust sampling technician.* Instruction in the topics described in paragraphs (d)(6)(iv) and (vi) of this section must be included in the hands-on portion of the course.

(i) Role and responsibility of a dust sampling technician.

(ii) Background information on lead and its adverse health effects.

(iii) Background information on Federal, State, and local regulations and guidance that pertains to lead-based paint and renovation activities.

(iv) Dust sampling methodologies.

(v) Clearance standards and testing.

(vi) Report preparation.

(e) *Requirements for the accreditation of refresher training programs.* A training program may seek accreditation to offer refresher training courses in any of the following disciplines: Inspector, risk assessor, supervisor, project designer, abatement worker, renovator, and dust sampling technician. To obtain EPA accreditation to offer refresher training, a training program must meet the following minimum requirements:

(1) Each refresher course shall review the curriculum topics of the full-length courses listed under paragraph (d) of this section, as appropriate. In addition, to become accredited to offer refresher training courses, training programs shall ensure that their courses of study include, at a minimum, the following:

(i) An overview of current safety practices relating to lead-based paint in general, as well as specific information pertaining to the appropriate discipline.

(ii) Current laws and regulations relating to lead-based paint in general, as well as specific information pertaining to the appropriate discipline.

(iii) Current technologies relating to lead-based paint in general, as well as specific information pertaining to the appropriate discipline.

(2) Refresher courses for inspector, risk assessor, supervisor, and abatement worker must last a minimum of 8 training hours. Refresher courses for project designer, renovator, and dust sampling technician must last a minimum of 4 training hours. Refresher courses for all disciplines except project designer must include a hands-on component.

(3) Except for project designer courses, for all other courses offered, the training program shall conduct a hands-on assessment, and at the completion of the course, a course test.

(4) A training program may apply for accreditation of a refresher course concurrently with its application for accreditation of the corresponding training course as described in paragraph (b) of this section. If so, EPA shall use the approval procedure described in paragraph (b) of this section. In addition, the minimum requirements contained in paragraphs (c)(1) through (c)(5) and (c)(7) through (c)(14), and (e)(1),through (e)(3) of this section shall also apply.

(5) A training program seeking accreditation to offer refresher training courses only shall submit a written application to EPA containing the following information:

(i) The refresher training program's name, address, and telephone number.

(ii) A list of courses for which it is applying for accreditation.

(iii) The name and documentation of the qualifications of the training program manager.

(iv) The name(s) and documentation of the qualifications of the principal instructor(s).

(v) A statement signed by the training program manager certifying that the refresher training program meets the minimum requirements established in paragraph (c) of this section, except for the requirements in paragraph (c)(6) of this section. If a training program uses EPA-developed model training materials, or training materials approved by a State or Indian Tribe that has been authorized by EPA under § 745.324 to develop its refresher training course materials, the training manager shall include a statement certifying that, as well.

(vi) If the refresher training course materials are not based on EPA-developed model training materials, the training program's application for accreditation shall include:

(A) A copy of the student and instructor manuals to be used for each course.

(B) A copy of the course agenda for each course.

(vii) All refresher training programs shall include in their application for accreditation the following:

(A) A description of the facilities and equipment to be used for lecture and hands-on training.

(B) A copy of the course test blueprint for each course.

(C) A description of the activities and procedures that will be used for conducting the assessment of hands-on skills for each course (if applicable).

(D) A copy of the quality control plan as described in paragraph (c)(9) of this section.

(viii) The requirements in paragraphs (c)(1) through (c)(5), and (c)(7) through (c)(14) of this section apply to refresher training providers.

(ix) If a refresher training program meets the requirements listed in this paragraph, then EPA shall approve the application for accreditation no more than 180 days after receiving a complete application from the refresher training program. In the case of approval, a certificate of accreditation shall be sent to the applicant. In the case of disapproval, a letter describing the reasons for disapproval shall be sent to the applicant. Prior to disapproval, EPA may, at its discretion, work with the applicant to address inadequacies in the application for accreditation. EPA may also request additional materials retained by the refresher training program under paragraph (i) of this section. If a refresher training program's application is disapproved, the program may reapply for accreditation at any time.

(f) *Re-accreditation of training programs.* (1) Unless re-accredited, a training program's accreditation, including refresher training accreditation, shall expire 4 years after the date of issuance. If a training program meets the requirements of this section, the training program shall be reaccredited.

(2) A training program seeking re-accreditation shall submit an application to EPA no later than 180 days before its accreditation expires. If a training program does not submit its application for re-accreditation by that date, EPA cannot guarantee that the program will be re-accredited before the end of the accreditation period.

(3) The training program's application for re-accreditation shall contain:

(i) The training program's name, address, and telephone number.

(ii) A list of courses for which it is applying for re-accreditation.

(iii) The name and qualifications of the training program manager.

(iv) The name(s) and qualifications of the principal instructor(s).

(v) A description of any changes to the training facility, equipment or course materials since its last application was approved that adversely affects the students' ability to learn.

(vi) A statement signed by the program manager stating:

(A) That the training program complies at all times with all requirements in paragraphs (c) and (e) of this section, as applicable; and

(B) The recordkeeping and reporting requirements of paragraph (i) of this section shall be followed.

(vii) A payment of appropriate fees in accordance with § 745.238.

(4) Upon request, the training program shall allow EPA to audit the training program to verify the contents of the application for re-accreditation as described in paragraph (f)(3) of this section.

(g) *Suspension, revocation, and modification of accredited training programs.* (1) EPA may, after notice and an opportunity for hearing, suspend, revoke, or modify training program accreditation, including refresher training accreditation, if a training program, training manager, or other person with supervisory authority over the training program has:

(i) Misrepresented the contents of a training course to EPA and/or the student population.

(ii) Failed to submit required information or notifications in a timely manner.

(iii) Failed to maintain required records.

(iv) Falsified accreditation records, instructor qualifications, or other accreditation-related information or documentation.

(v) Failed to comply with the training standards and requirements in this section.

(vi) Failed to comply with Federal, State, or local lead-based paint statutes or regulations.

(vii) Made false or misleading statements to EPA in its application for accreditation or re-accreditation which EPA relied upon in approving the application.

(2) In addition to an administrative or judicial finding of violation, execution of a consent agreement in settlement of an enforcement action constitutes, for purposes of this section, evidence of a failure to comply with relevant statutes or regulations.

(h) *Procedures for suspension, revocation or modification of training program accreditation.* (1) Prior to taking action to suspend, revoke, or modify the accreditation of a training program, EPA shall notify the affected entity in writing of the following:

(i) The legal and factual basis for the suspension, revocation, or modification.

(ii) The anticipated commencement date and duration of the suspension, revocation, or modification.

(iii) Actions, if any, which the affected entity may take to avoid suspension, revocation, or modification, or to receive accreditation in the future.

(iv) The opportunity and method for requesting a hearing prior to final EPA action to suspend, revoke or modify accreditation.

(v) Any additional information, as appropriate, which EPA may provide.

(2) If a hearing is requested by the accredited training program, EPA shall:

(i) Provide the affected entity an opportunity to offer written statements in response to EPA's assertions of the legal and factual basis for its proposed action, and any other explanations, comments, and arguments it deems relevant to the proposed action.

(ii) Provide the affected entity such other procedural opportunities as EPA may deem appropriate to ensure a fair and impartial hearing.

(iii) Appoint an official of EPA as Presiding Officer to conduct the hearing. No person shall serve as Presiding Officer if he or she has had any prior connection with the specific matter.

(3) The Presiding Officer appointed pursuant to paragraph (h)(2) of this section shall:

(i) Conduct a fair, orderly, and impartial hearing within 90 days of the request for a hearing.

(ii) Consider all relevant evidence, explanation, comment, and argument submitted.

(iii) Notify the affected entity in writing within 90 days of completion of the hearing of his or her decision and order. Such an order is a final agency action which may be subject to judicial review.

(4) If EPA determines that the public health, interest, or welfare warrants immediate action to suspend the accreditation of any training program prior to the opportunity for a hearing, it shall:

(i) Notify the affected entity of its intent to immediately suspend training program accreditation for the reasons listed in paragraph (g)(1) of this section. If a suspension, revocation, or modification notice has not previously been issued pursuant to paragraph (g)(1) of this section, it shall be issued at the same time the emergency suspension notice is issued.

(ii) Notify the affected entity in writing of the grounds for the immediate suspension and why it is necessary to suspend the entity's accreditation before an opportunity for a suspension, revocation or modification hearing.

(iii) Notify the affected entity of the anticipated commencement date and duration of the immediate suspension.

(iv) Notify the affected entity of its right to request a hearing on the immediate suspension within 15 days of the suspension taking place and the procedures for the conduct of such a hearing.

(5) Any notice, decision, or order issued by EPA under this section, any transcripts or other verbatim record of oral testimony, and any documents filed by an accredited training program in a hearing under this section shall be available to the public, except as otherwise provided by section 14 of TSCA or by 40 CFR part 2. Any such hearing at which oral testimony is presented shall be open to the public, except that the Presiding Officer may exclude the public to the extent necessary to allow presentation of information which may be entitled to confidential treatment under section 14 of TSCA or 40 CFR part 2.

(6) The public shall be notified of the suspension, revocation, modification or reinstatement of a training program's accreditation through appropriate mechanisms.

(7) EPA shall maintain a list of parties whose accreditation has been suspended, revoked, modified or reinstated.

(i) *Training program recordkeeping requirements.* (1) Accredited training programs shall maintain, and make available to EPA, upon request, the following records:

(i) All documents specified in paragraph (c)(4) of this section that demonstrate the qualifications listed in paragraphs (c)(1) and (c)(2) of this section of the training manager and principal instructors.

(ii) Current curriculum/course materials and documents reflecting any changes made to these materials.

(iii) The course test blueprint.

(iv) Information regarding how the hands-on assessment is conducted including, but not limited to:

(A) Who conducts the assessment.

(B) How the skills are graded.

(C) What facilities are used.

(D) The pass/fail rate.

(v) The quality control plan as described in paragraph (c)(9) of this section.

(vi) Results of the students' hands-on skills assessments and course tests, and a record of each student's course completion certificate.

(vii) Any other material not listed in paragraphs (i)(1)(i) through (i)(1)(vi) of this section that was submitted to EPA as part of the program's application for accreditation.

(viii) For renovator refresher and dust sampling technician refresher courses, a copy of each trainee's prior course completion certificate showing that each trainee was eligible to take the refresher course.

(ix) For course modules delivered in an electronic format, a record of each student's log-ins, launches, progress, and completion, and a copy of the electronic learning completion certificate for each student.

(2) The training program must retain records pertaining to renovator, dust sampling technician and lead-based paint activities courses at the address specified on the training program accreditation application (or as modified in accordance with paragraph (i)(3) of this section) for the following minimum periods:

(i) Records pertaining to lead-based paint activities courses must be retained for a minimum of 3 years and 6 months.

(ii) Records pertaining to renovator or dust sampling technician courses offered before April 22, 2010 must be retained until July 1, 2015.

(iii) Records pertaining to renovator or dust sampling technician courses offered on or after April 22, 2010 must be retained for a minimum of 5 years.

(3) The training program shall notify EPA in writing within 30 days of changing the address specified on its training program accreditation application or transferring the records from that address.

(j) *Amendment of accreditation.* (1) A training program must amend its accreditation within 90 days of the date a change occurs to information included in the program's most recent application. If the training program fails to amend its accreditation within 90 days of the date the change occurs, the program may not provide renovator, dust sampling technician, or lead-based paint activities training until its accreditation is amended.

(2) To amend an accreditation, a training program must submit a completed “Accreditation Application for Training Providers,” signed by an authorized agent of the training provider, noting on the form that it is submitted as an amendment and indicating the information that has changed.

(3) *Training managers, principal instructors, permanent training locations.* If the amendment includes a new training program manager, any new or additional principal instructor(s), or any new permanent training location(s), the training provider is not permitted to provide training under the new training manager or offer courses taught by any new principal instructor(s) or at the new training location(s) until EPA either approves the amendment or 30 days have elapsed, whichever occurs earlier. Except:

(i) If the amendment includes a new training program manager or new or additional principal instructor that was identified in a training provider accreditation application that EPA has already approved under this section, the training provider may begin to provide training under the new training manager or offer courses taught by the new principal instructor on an interim basis as soon as the provider submits the amendment to EPA. The training provider may continue to provide training under the new training manager or offer courses taught by the new principal instructor if EPA approves the amendment or if EPA does not disapprove the amendment within 30 days.

(ii) If the amendment includes a new permanent training location, the training provider may begin to provide training at the new permanent training location on an interim basis as soon as the provider submits the amendment to EPA. The training provider may continue to provide training at the new permanent training location if EPA approves the amendment or if EPA does not disapprove the amendment within 30 days.

[76 FR 47939, Aug. 5, 2011]

§ 745.226 Certification of individuals and firms engaged in lead-based paint activities: target housing and child-occupied facilities.

(a) *Certification of individuals.* (1) Individuals seeking certification by EPA to engage in lead-based paint activities must either:

(i) Submit to EPA an application demonstrating that they meet the requirements established in paragraphs (b) or (c) of this section for the particular discipline for which certification is sought; or

(ii) Submit to EPA an application with a copy of a valid lead-based paint activities certification (or equivalent) from a State or Tribal program that has been authorized by EPA pursuant to subpart Q of this part.

(2) Individuals may first apply to EPA for certification to engage in lead-based paint activities pursuant to this section on or after March 1, 1999.

(3) Following the submission of an application demonstrating that all the requirements of this section have been meet, EPA shall certify an applicant as an inspector, risk assessor, supervisor, project designer, or abatement worker, as appropriate.

(4) Upon receiving EPA certification, individuals conducting lead-based paint activities shall comply with the work practice standards for performing the appropriate lead-based paint activities as established in § 745.227.

(5) It shall be a violation of TSCA for an individual to conduct any of the lead-based paint activities described in § 745.227 after March 1, 2000, if that individual has not been certified by EPA pursuant to this section to do so.

(6) Individuals applying for certification must submit the appropriate fees in accordance with § 745.238.

(b) *Inspector, risk assessor or supervisor.* (1) To become certified by EPA as an inspector, risk assessor, or supervisor, pursuant to paragraph (a)(1)(i) of this section, an individual must:

(i) Successfully complete an accredited course in the appropriate discipline and receive a course completion certificate from an accredited training program.

(ii) Pass the certification exam in the appropriate discipline offered by EPA; and,

(iii) Meet or exceed the following experience and/or education requirements:

(A) Inspectors. (*1*) No additional experience and/or education requirements.

(*2*) [Reserved]

(B) Risk assessors. (*1*) Successful completion of an accredited training course for inspectors; and

(*2*) Bachelor's degree and 1 year of experience in a related field (e.g., lead, asbestos, environmental remediation work, or construction), or an Associates degree and 2 years experience in a related field (e.g., lead, asbestos, environmental remediation work, or construction); or

(*3*) Certification as an industrial hygienist, professional engineer, registered architect and/or certification in a related engineering/health/environmental field (e.g., safety professional, environmental scientist); or

(*4*) A high school diploma (or equivalent), and at least 3 years of experience in a related field (e.g., lead, asbestos, environmental remediation work or construction).

(C) Supervisor: (*1*) One year of experience as a certified lead-based paint abatement worker; or

(*2*) At least 2 years of experience in a related field (e.g., lead, asbestos, or environmental remediation work) or in the building trades.

(2) The following documents shall be recognized by EPA as evidence of meeting the requirements listed in (b)(2)(iii) of this paragraph:

(i) Official academic transcripts or diploma, as evidence of meeting the education requirements.

(ii) Resumes, letters of reference, or documentation of work experience, as evidence of meeting the work experience requirements.

(iii) Course completion certificates from lead-specific or other related training courses, issued by accredited training programs, as evidence of meeting the training requirements.

(3) In order to take the certification examination for a particular discipline an individual must:

(i) Successfully complete an accredited course in the appropriate discipline and receive a course completion certificate from an accredited training program.

(ii) Meet or exceed the education and/or experience requirements in paragraph (b)(1)(iii) of this section.

(4) The course completion certificate shall serve as interim certification for an individual until the next available opportunity to take the certification exam. Such interim certification shall expire 6 months after issuance.

(5) After passing the appropriate certification exam and submitting an application demonstrating that he/she meets the appropriate training, education, and/or experience prerequisites described in paragraph (b)(1) of this section, an individual shall be issued a certificate by EPA. To maintain certification, an individual must be re-certified as described in paragraph (e) of this section.

(6) An individual may take the certification exam no more than three times within 6 months of receiving a course completion certificate.

(7) If an individual does not pass the certification exam and receive a certificate within 6 months of receiving his/her course completion certificate, the individual must retake the appropriate course from an accredited training program before reapplying for certification from EPA.

(c) *Abatement worker and project designer.* (1) To become certified by EPA as an abatement worker or project designer, pursuant to paragraph (a)(1)(i) of this section, an individual must:

(i) Successfully complete an accredited course in the appropriate discipline and receive a course completion certificate from an accredited training program.

(ii) Meet or exceed the following additional experience and/or education requirements:

(A) Abatement workers. (*1*) No additional experience and/or education requirements.

(*2*) [Reserved]

(B) Project designers. (*1*) Successful completion of an accredited training course for supervisors.

(*2*) Bachelor's degree in engineering, architecture, or a related profession, and 1 year of experience in building construction and design or a related field; or

(*3*) Four years of experience in building construction and design or a related field.

(2) The following documents shall be recognized by EPA as evidence of meeting the requirements listed in this paragraph:

(i) Official academic transcripts or diploma, as evidence of meeting the education requirements.

(ii) Resumes, letters of reference, or documentation of work experience, as evidence of meeting the work experience requirements.

(iii) Course completion certificates from lead-specific or other related training courses, issued by accredited training programs, as evidence of meeting the training requirements.

(3) The course completion certificate shall serve as an interim certification until certification from EPA is received, but shall be valid for no more than 6 months from the date of completion.

(4) After successfully completing the appropriate training courses and meeting any other qualifications described in paragraph (c)(1) of this section, an individual shall be issued a certificate from EPA. To maintain certification, an individual must be re-certified as described in paragraph (e) of this section.

(d) *Certification based on prior training.* (1) Any individual who received training in a lead-based paint activity between October 1, 1990, and March 1, 1999 shall be eligible for certification by EPA under the alternative procedures contained in this paragraph. Individuals who have received lead-based paint activities training at an EPA-authorized State or Tribal accredited training program shall also be eligible for certification by EPA under the following alternative procedures:

(i) Applicants for certification as an inspector, risk assessor, or supervisor shall:

(A) Demonstrate that the applicant has successfully completed training or on-the-job training in the conduct of a lead-based paint activity.

(B) Demonstrate that the applicant meets or exceeds the education and/or experience requirements in paragraph (b)(1)(iii) of this section.

(C) Successfully complete an accredited refresher training course for the appropriate discipline.

(D) Pass a certification exam administered by EPA for the appropriate discipline.

(ii) Applicants for certification as an abatement worker or project designer shall:

(A) Demonstrate that the applicant has successfully completed training or on-the-job training in the conduct of a lead-based paint activity.

(B) Demonstrate that the applicant meets the education and/or experience requirements in paragraphs (c)(1) of this section; and

(C) Successfully complete an accredited refresher training course for the appropriate discipline.

(2) Individuals shall have until March 1, 2000, to apply to EPA for certification under the above procedures. After that date, all individuals wishing to obtain certification must do so through the procedures described in paragraph (a), and paragraph (b) or (c) of this section, according to the discipline for which certification is being sought.

(e) *Re-certification.* (1) To maintain certification in a particular discipline, a certified individual shall apply to and be re-certified by EPA in that discipline by EPA either:

(i) Every 3 years if the individual completed a training course with a course test and hands-on assessment; or

(ii) Every 5 years if the individual completed a training course with a proficiency test.

(2) An individual shall be re-certified if the individual successfully completes the appropriate accredited refresher training course and submits a valid copy of the appropriate refresher course completion certificate.

(3) Individuals applying for re-certification must submit the appropriate fees in accordance with § 745.238.

(f) *Certification of firms.* (1) All firms which perform or offer to perform any of the lead-based paint activities described in § 745.227 after March 1, 2000, shall be certified by EPA.

(2) A firm seeking certification shall submit to EPA a letter attesting that the firm shall only employ appropriately certified employees to conduct lead-based paint activities, and that the firm and its employees shall follow the work practice standards in § 745.227 for conducting lead-based paint activities.

(3) From the date of receiving the firm's letter requesting certification, EPA shall have 90 days to approve or disapprove the firm's request for certification. Within that time, EPA shall respond with either a certificate of approval or a letter describing the reasons for a disapproval.

(4) The firm shall maintain all records pursuant to the requirements in § 745.227.

(5) Firms may first apply to EPA for certification to engage in lead-based paint activities pursuant to this section on or after March 1, 1999.

(6) Firms applying for certification must submit the appropriate fees in accordance with § 745.238.

(7) To maintain certification a firm shall submit appropriate fees in accordance with § 745.238 every 3 years.

(g) *Suspension, revocation, and modification of certifications of individuals engaged in lead-based paint activities.* (1) EPA may, after notice and opportunity for hearing, suspend, revoke, or modify an individual's certification if an individual has:

(i) Obtained training documentation through fraudulent means.

(ii) Gained admission to and completed an accredited training program through misrepresentation of admission requirements.

(iii) Obtained certification through misrepresentation of certification requirements or related documents dealing with education, training, professional registration, or experience.

(iv) Performed work requiring certification at a job site without having proof of certification.

(v) Permitted the duplication or use of the individual's own certificate by another.

(vi) Performed work for which certification is required, but for which appropriate certification has not been received.

(vii) Failed to comply with the appropriate work practice standards for lead-based paint activities at § 745.227.

(viii) Failed to comply with Federal, State, or local lead-based paint statutes or regulations.

(2) In addition to an administrative or judicial finding of violation, for purposes of this section only, execution of a consent agreement in settlement of an enforcement action constitutes evidence of a failure to comply with relevant statutes or regulations.

(h) *Suspension, revocation, and modification of certifications of firms engaged in lead-based paint activities.* (1) EPA may, after notice and opportunity for hearing, suspend, revoke, or modify a firm's certification if a firm has:

(i) Performed work requiring certification at a job site with individuals who are not certified.

(ii) Failed to comply with the work practice standards established in § 745.227.

(iii) Misrepresented facts in its letter of application for certification to EPA.

(iv) Failed to maintain required records.

(v) Failed to comply with Federal, State, or local lead-based paint statutes or regulations.

(2) In addition to an administrative or judicial finding of violation, for purposes of this section only, execution of a consent agreement in settlement of an enforcement action constitutes evidence of a failure to comply with relevant statutes or regulations.

(i) *Procedures for suspension, revocation, or modification of the certification of individuals or firms* .

(1) If EPA decides to suspend, revoke, or modify the certification of any individual or firm, it shall notify the affected entity in writing of the following:

(i) The legal and factual basis for the suspension, revocation, or modification.

(ii) The commencement date and duration of the suspension, revocation, or modification.

(iii) Actions, if any, which the affected entity may take to avoid suspension, revocation, or modification or to receive certification in the future.

(iv) The opportunity and method for requesting a hearing prior to final EPA action to suspend, revoke, or modify certification.

(v) Any additional information, as appropriate, which EPA may provide.

(2) If a hearing is requested by the certified individual or firm, EPA shall:

(i) Provide the affected entity an opportunity to offer written statements in response to EPA's assertion of the legal and factual basis and any other explanations, comments, and arguments it deems relevant to the proposed action.

(ii) Provide the affected entity such other procedural opportunities as EPA may deem appropriate to ensure a fair and impartial hearing.

(iii) Appoint an official of EPA as Presiding Officer to conduct the hearing. No person shall serve as Presiding Officer if he or she has had any prior connection with the specific matter.

(3) The Presiding Officer shall:

(i) Conduct a fair, orderly, and impartial hearing within 90 days of the request for a hearing;

(ii) Consider all relevant evidence, explanation, comment, and argument submitted; and

(iii) Notify the affected entity in writing within 90 days of completion of the hearing of his or her decision and order. Such an order is a final EPA action subject to judicial review.

(4) If EPA determines that the public health, interest, or welfare warrants immediate action to suspend the certification of any individual or firm prior to the opportunity for a hearing, it shall:

(i) Notify the affected entity of its intent to immediately suspend certification for the reasons listed in paragraph (h)(1) of this section. If a suspension, revocation, or modification notice has not previously been issued, it shall be issued at the same time the immediate suspension notice is issued.

(ii) Notify the affected entity in writing of the grounds upon which the immediate suspension is based and why it is necessary to suspend the entity's accreditation before an opportunity for a hearing to suspend, revoke, or modify the individual's or firm's certification.

(iii) Notify the affected entity of the commencement date and duration of the immediate suspension.

(iv) Notify the affected entity of its right to request a hearing on the immediate suspension within 15 days of the suspension taking place and the procedures for the conduct of such a hearing.

(5) Any notice, decision, or order issued by EPA under this section, transcript or other verbatim record of oral testimony, and any documents filed by a certified individual or firm in a hearing under this section shall be available to the public, except as otherwise provided by section 14 of TSCA or by part 2 of this title. Any such hearing at which oral testimony is presented shall be open to the public, except that

the Presiding Officer may exclude the public to the extent necessary to allow presentation of information which may be entitled to confidential treatment under section 14 of TSCA or part 2 of this title.

[61 FR 45813, Aug. 29, 1996, as amended at 64 FR 31098, June 9, 1999; 64 FR 42851, Aug. 6, 1999]

§ 745.227 Work practice standards for conducting lead-based paint activities: target housing and child-occupied facilities.

(a) *Effective date, applicability, and terms.* (1) Beginning on March 1, 2000, all lead-based paint activities shall be performed pursuant to the work practice standards contained in this section.

(2) When performing any lead-based paint activity described by the certified individual as an inspection, lead-hazard screen, risk assessment or abatement, a certified individual must perform that activity in compliance with the appropriate requirements below.

(3) Documented methodologies that are appropriate for this section are found in the following: The U.S. Department of Housing and Urban Development (HUD) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing; the EPA Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead-Contaminated Soil; the EPA Residential Sampling for Lead: Protocols for Dust and Soil Sampling (EPA report number 7474-R-95-001); Regulations, guidance, methods or protocols issued by States and Indian Tribes that have been authorized by EPA; and other equivalent methods and quidelines.

(4) Clearance levels are appropriate for the purposes of this section may be found in the EPA Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead Contaminiated Soil or other equivalent guidelines.

(b) *Inspection.* (1) An inspection shall be conducted only by a person certified by EPA as an inspector or risk assessor and, if conducted, must be conducted according to the procedures in this paragraph.

(2) When conducting an inspection, the following locations shall be selected according to documented methodologies and tested for the presence of lead-based paint:

(i) In a residential dwelling and child-occupied facility, each component with a distinct painting history and each exterior component with a distinct painting history shall be tested for lead-based paint, except those components that the inspector or risk assessor determines to have been replaced after 1978, or to not contain lead-based paint; and

(ii) In a multi-family dwelling or child-occupied facility, each component with a distinct painting history in every common area, except those components that the inspector or risk assessor determines to have been replaced after 1978, or to not contain lead-based paint.

(3) Paint shall be sampled in the following manner: (i) The analysis of paint to determine the presence of lead shall be conducted using documented methodologies which incorporate adequate quality control procedures; and/or

(ii) All collected paint chip samples shall be analyzed according to paragraph (f) of this section to determine if they contain detectable levels of lead that can be quantified numerically.

(4) The certified inspector or risk assessor shall prepare an inspection report which shall include the following information:

(i) Date of each inspection.

(ii) Address of building.

(iii) Date of construction.

(iv) Apartment numbers (if applicable).

(v) Name, address, and telephone number of the owner or owners of each residential dwelling or child-occupied facility.

(vi) Name, signature, and certification number of each certified inspector and/or risk assessor conducting testing.

(vii) Name, address, and telephone number of the certified firm employing each inspector and/or risk assessor, if applicable.

(viii) Each testing method and device and/or sampling procedure employed for paint analysis, including quality control data and, if used, the serial number of any x-ray fluorescence (XRF) device.

(ix) Specific locations of each painted component tested for the presence of lead-based paint.

(x) The results of the inspection expressed in terms appropriate to the sampling method used.

(c) *Lead hazard screen.* (1) A lead hazard screen shall be conducted only by a person certified by EPA as a risk assessor.

(2) If conducted, a lead hazard screen shall be conducted as follows:

(i) Background information regarding the physical characteristics of the residential dwelling or child-occupied facility and occupant use patterns that may cause lead-based paint exposure to one or more children age 6 years and under shall be collected.

(ii) A visual inspection of the residential dwelling or child-occupied facility shall be conducted to:

(A) Determine if any deteriorated paint is present, and

(B) Locate at least two dust sampling locations.

(iii) If deteriorated paint is present, each surface with deteriorated paint, which is determined, using documented methodologies, to be in poor condition and to have a distinct painting history, shall be tested for the presence of lead.

(iv) In residential dwellings, two composite dust samples shall be collected, one from the floors and the other from the windows, in rooms, hallways or stairwells where one or more children, age 6 and under, are most likely to come in contact with dust.

(v) In multi-family dwellings and child-occupied facilities, in addition to the floor and window samples required in paragraph (c)(1)(iii) of this section, the risk assessor shall also collect composite dust samples from common areas where one or more children, age 6 and under, are most likely to come into contact with dust.

(3) Dust samples shall be collected and analyzed in the following manner:

(i) All dust samples shall be taken using documented methodologies that incorporate adequate quality control procedures.

(ii) All collected dust samples shall be analyzed according to paragraph (f) of this section to determine if they contain detectable levels of lead that can be quantified numerically.

(4) Paint shall be sampled in the following manner: (i) The analysis of paint to determine the presence of lead shall be conducted using documented methodologies which incorporate adequate quality control procedures; and/or

(ii) All collected paint chip samples shall be analyzed according to paragraph (f) of this section to determine if they contain detectable levels of lead that can be quantified numerically.

(5) The risk assessor shall prepare a lead hazard screen report, which shall include the following information:

(i) The information required in a risk assessment report as specified in paragraph (d) of this section, including paragraphs (d)(11)(i) through (d)(11)(xiv), and excluding paragraphs (d)(11)(xv) through (d)(11)(xviii) of this section. Additionally, any background information collected pursuant to paragraph (c)(2)(i) of this section shall be included in the risk assessment report; and

(ii) Recommendations, if warranted, for a follow-up risk assessment, and as appropriate, any further actions.

(d) *Risk assessment.* (1) A risk assessment shall be conducted only by a person certified by EPA as a risk assessor and, if conducted, must be conducted according to the procedures in this paragraph.

(2) A visual inspection for risk assessment of the residential dwelling or child-occupied facility shall be undertaken to locate the existence of deteriorated paint, assess the extent and causes of the deterioration, and other potential lead-based paint hazards.

(3) Background information regarding the physical characteristics of the residential dwelling or child-occupied facility and occupant use patterns that may cause lead-based paint exposure to one or more children age 6 years and under shall be collected.

(4) The following surfaces which are determined, using documented methodologies, to have a distinct painting history, shall be tested for the presence of lead:

(i) Each friction surface or impact surface with visibly deteriorated paint; and

(ii) All other surfaces with visibly deteriorated paint.

(5) In residential dwellings, dust samples (either composite or single-surface samples) from the interior window sill(s) and floor shall be collected and analyzed for lead concentration in all living areas where one or more children, age 6 and under, are most likely to come into contact with dust.

(6) For multi-family dwellings and child-occupied facilities, the samples required in paragraph (d)(4) of this section shall be taken. In addition, interior window sill and floor dust samples (either composite or single-surface samples) shall be collected and analyzed for lead concentration in the following locations:

(i) Common areas adjacent to the sampled residential dwelling or child-occupied facility; and

(ii) Other common areas in the building where the risk assessor determines that one or more children, age 6 and under, are likely to come into contact with dust.

(7) For child-occupied facilities, interior window sill and floor dust samples (either composite or single-surface samples) shall be collected and analyzed for lead concentration in each room, hallway or stairwell utilized by one or more children, age 6 and under, and in other common areas in the child-occupied facility where one or more children, age 6 and under, are likely to come into contact with dust.

(8) Soil samples shall be collected and analyzed for lead concentrations in the following locations:

(i) Exterior play areas where bare soil is present; and

(ii) The rest of the yard (i.e., non-play areas) where bare soil is present.

(iii) Dripline/foundation areas where bare soil is present.

(9) Any paint, dust, or soil sampling or testing shall be conducted using documented methodologies that incorporate adequate quality control procedures.

(10) Any collected paint chip, dust, or soil samples shall be analyzed according to paragraph (f) of this section to determine if they contain detectable levels of lead that can be quantified numerically.

(11) The certified risk assessor shall prepare a risk assessment report which shall include the following information:

(i) Date of assessment.

(ii) Address of each building.

(iii) Date of construction of buildings.

(iv) Apartment number (if applicable).

(v) Name, address, and telephone number of each owner of each building.

(vi) Name, signature, and certification of the certified risk assessor conducting the assessment.

(vii) Name, address, and telephone number of the certified firm employing each certified risk assessor if applicable.

(viii) Name, address, and telephone number of each recognized laboratory conducting analysis of collected samples.

(ix) Results of the visual inspection.

(x) Testing method and sampling procedure for paint analysis employed.

(xi) Specific locations of each painted component tested for the presence of lead.

(xii) All data collected from on-site testing, including quality control data and, if used, the serial number of any XRF device.

(xiii) All results of laboratory analysis on collected paint, soil, and dust samples.

(xiv) Any other sampling results.

(xv) Any background information collected pursuant to paragraph (d)(3) of this section.

(xvi) To the extent that they are used as part of the lead-based paint hazard determination, the results of any previous inspections or analyses for the presence of lead-based paint, or other assessments of lead-based paint-related hazards.

(xvii) A description of the location, type, and severity of identified lead-based paint hazards and any other potential lead hazards.

(xviii) A description of interim controls and/or abatement options for each identified lead-based paint hazard and a suggested prioritization for addressing each hazard. If the use of an encapsulant or enclosure is recommended, the report shall recommend a maintenance and monitoring schedule for the encapsulant or enclosure.

(e) *Abatement.* (1) An abatement shall be conducted only by an individual certified by EPA, and if conducted, shall be conducted according to the procedures in this paragraph.

(2) A certified supervisor is required for each abatement project and shall be onsite during all work site preparation and during the post-abatement cleanup of work areas. At all other times when abatement activities are being conducted, the certified supervisor shall be onsite or available by telephone, pager or answering service, and able to be present at the work site in no more than 2 hours.

(3) The certified supervisor and the certified firm employing that supervisor shall ensure that all abatement activities are conducted according to the requirements of this section and all other Federal, State and local requirements.

(4) A certified firm must notify EPA of lead-based paint abatement activities as follows:

(i) Except as provided in paragraph (e)(4)(ii) of this section, EPA must be notified prior to conducting lead-based paint abatement activities. The original notification must be received by EPA at least 5 business days before the start date of any lead-based paint abatement activities.

(ii) Notification for lead-based paint abatement activities required in response to an elevated blood lead level (EBL) determination, or Federal, State, Tribal, or local emergency abatement order should be received by EPA as early as possible before, but must be received no later than the start date of the lead-based paint abatement activities. Should the start date and/or location provided to EPA change, an updated notification must be received by EPA on or before the start date provided to EPA. Documentation showing evidence of an EBL determination or a copy of the Federal/State/Tribal/local emergency abatement order must be included in the written notification to take advantage of this abbreviated notification period.

(iii) Except as provided in paragraph (e)(4)(ii) of this section, updated notification must be provided to EPA for lead-based paint abatement activities that will begin on a date other than the start date specified in the original notification, as follows:

(A) For lead-based paint abatement activities beginning prior to the start date provided to EPA an updated notification must be received by EPA at least 5 business days before the new start date included in the notification.

(B) For lead-based paint abatement activities beginning after the start date provided to EPA an updated notification must be received by EPA on or before the start date provided to EPA.

(iv) Except as provided in paragraph (e)(4)(ii) of this section, updated notification must be provided to EPA for any change in location of lead-based paint abatement activities at least 5 business days prior to the start date provided to EPA.

(v) Updated notification must be provided to EPA when lead-based paint abatement activities are canceled, or when there are other significant changes including, but not limited to, when the square footage or acreage to be abated changes by more than 20%. This updated notification must be received by EPA on or before the start date provided to EPA, or if work has already begun, within 24 hours of the change.

(vi) The following must be included in each notification:

(A) Notification type (original, updated, cancellation).

(B) Date when lead-based paint abatement activities will start.

(C) Date when lead-based paint abatement activities will end (approximation using best professional judgement).

(D) Firm's name, EPA certification number, address, telephone number.

(E) Type of building (e.g., single family dwelling, multi-family dwelling, child-occupied facilities) on/in which abatement work will be performed.

(F) Property name (if applicable).

(G) Property address including apartment or unit number(s) (if applicable) for abatement work.

(H) Documentation showing evidence of an EBL determination or a copy of the Federal/State/Tribal/local emergency abatement order, if using the abbreviated time period as described in paragraph (e)(4)(ii) of this section.

(I) Name and EPA certification number of the project supervisor.

(J) Approximate square footage/acreage to be abated.

(K) Brief description of abatement activities to be performed.

(L) Name, title, and signature of the representative of the certified firm who prepared the notification.

(vii) Notification must be accomplished using any of the following methods: Written notification, or electronically using the Agency's Central Data Exchange (CDX). Written notification can be accomplished using either the sample form titled “Notification of Lead-Based Paint Abatement Activities” or similar form containing the information required in paragraph (e)(4)(vi) of this section. All written notifications must be delivered by U.S. Postal Service, fax, commercial delivery service, or hand delivery (persons submitting

notification by U.S. Postal Service are reminded that they should allow 3 additional business days for delivery in order to ensure that EPA receives the notification by the required date). Instructions and sample forms can be obtained from the NLIC at 1-800-424-LEAD(5323), or on the Internet at *http://www.epa.gov/lead* .

(viii) Lead-based paint abatement activities shall not begin on a date, or at a location other than that specified in either an original or updated notification, in the event of changes to the original notification.

(ix) No firm or individual shall engage in lead-based paint abatement activities, as defined in § 745.223, prior to notifying EPA of such activities according to the requirements of this paragraph.

(5) A written occupant protection plan shall be developed for all abatement projects and shall be prepared according to the following procedures:

(i) The occupant protection plan shall be unique to each residential dwelling or child-occupied facility and be developed prior to the abatement. The occupant protection plan shall describe the measures and management procedures that will be taken during the abatement to protect the building occupants from exposure to any lead-based paint hazards.

(ii) A certified supervisor or project designer shall prepare the occupant protection plan.

(6) The work practices listed below shall be restricted during an abatement as follows:

(i) Open-flame burning or torching of lead-based paint is prohibited;

(ii) Machine sanding or grinding or abrasive blasting or sandblasting of lead-based paint is prohibited unless used with High Efficiency Particulate Air (HEPA) exhaust control which removes particles of 0.3 microns or larger from the air at 99.97 percent or greater efficiency;

(iii) Dry scraping of lead-based paint is permitted only in conjunction with heat guns or around electrical outlets or when treating defective paint spots totaling no more than 2 square feet in any one room, hallway or stairwell or totaling no more than 20 square feet on exterior surfaces; and

(iv) Operating a heat gun on lead-based paint is permitted only at temperatures below 1100 degrees Fahrenheit.

(7) If conducted, soil abatement shall be conducted in one of the following ways:

(i) If the soil is removed:

(A) The soil shall be replaced by soil with a lead concentration as close to local background as practicable, but no greater than 400 ppm.

(B) The soil that is removed shall not be used as top soil at another residential property or child-occupied facility.

(ii) If soil is not removed, the soil shall be permanently covered, as defined in § 745.223.

(8) The following post-abatement clearance procedures shall be performed only by a certified inspector or risk assessor:

(i) Following an abatement, a visual inspection shall be performed to determine if deteriorated painted surfaces and/or visible amounts of dust, debris or residue are still present. If deteriorated painted surfaces or visible amounts of dust, debris or residue are present, these conditions must be eliminated prior to the continuation of the clearance procedures.

(ii) Following the visual inspection and any post-abatement cleanup required by paragraph (e)(8)(i) of this section, clearance sampling for lead in dust shall be conducted. Clearance sampling may be conducted by employing single-surface sampling or composite sampling techniques.

(iii) Dust samples for clearance purposes shall be taken using documented methodologies that incorporate adequate quality control procedures.

(iv) Dust samples for clearance purposes shall be taken a minimum of 1 hour after completion of final post-abatement cleanup activities.

(v) The following post-abatement clearance activities shall be conducted as appropriate based upon the extent or manner of abatement activities conducted in or to the residential dwelling or child-occupied facility:

(A) After conducting an abatement with containment between abated and unabated areas, one dust sample shall be taken from one interior window sill and from one window trough (if present) and one dust sample shall be taken from the floors of each of no less than four rooms, hallways or stairwells within the containment area. In addition, one dust sample shall be taken from the floor outside the containment area. If there are less than four rooms, hallways or stairwells within the containment area, then all rooms, hallways or stairwells shall be sampled.

(B) After conducting an abatement with no containment, two dust samples shall be taken from each of no less than four rooms, hallways or stairwells in the residential dwelling or child-occupied facility. One dust sample shall be taken from one interior window sill and window trough (if present) and one dust sample shall be taken from the floor of each room, hallway or stairwell selected. If there are less than four rooms, hallways or stairwells within the residential dwelling or child-occupied facility then all rooms, hallways or stairwells shall be sampled.

(C) Following an exterior paint abatement, a visible inspection shall be conducted. All horizontal surfaces in the outdoor living area closest to the abated surface shall be found to be cleaned of visible dust and debris. In addition, a visual inspection shall be conducted to determine the presence of paint chips on the dripline or next to the foundation below any exterior surface abated. If paint chips are present, they must be removed from the site and properly disposed of, according to all applicable Federal, State and local requirements.

(vi) The rooms, hallways or stairwells selected for sampling shall be selected according to documented methodologies.

(vii) The certified inspector or risk assessor shall compare the residual lead level (as determined by the laboratory analysis) from each single surface dust sample with clearance levels in paragraph (e)(8)(viii) of this section for lead in dust on floors, interior window sills, and window troughs or from each composite dust sample with the applicable clearance levels for lead in dust on floors, interior window sills, and window troughs divided by half the number of subsamples in the composite sample. If the residual lead level in a single surface dust sample equals or exceeds the applicable clearance level or if the residual lead level in a composite dust sample equals or exceeds the applicable clearance level divided by half the number of subsamples in the composite sample, the components represented by the failed sample shall be recleaned and retested.

(viii) The clearance levels for lead in dust are 40 μg/ft^2 for floors, 250 μg/ft^2 for interior window sills, and 400 μg/ft^2 for window troughs.

(9) In a multi-family dwelling with similarly constructed and maintained residential dwellings, random sampling for the purposes of clearance may be conducted provided:

(i) The certified individuals who abate or clean the residential dwellings do not know which residential dwelling will be selected for the random sample.

(ii) A sufficient number of residential dwellings are selected for dust sampling to provide a 95 percent level of confidence that no more than 5 percent or 50 of the residential dwellings (whichever is smaller) in the randomly sampled population exceed the appropriate clearance levels.

(iii) The randomly selected residential dwellings shall be sampled and evaluated for clearance according to the procedures found in paragraph (e)(8) of this section.

(10) An abatement report shall be prepared by a certified supervisor or project designer. The abatement report shall include the following information:

(i) Start and completion dates of abatement.

(ii) The name and address of each certified firm conducting the abatement and the name of each supervisor assigned to the abatement project.

(iii) The occupant protection plan prepared pursuant to paragraph (e)(5) of this section.

(iv) The name, address, and signature of each certified risk assessor or inspector conducting clearance sampling and the date of clearance testing.

(v) The results of clearance testing and all soil analyses (if applicable) and the name of each recognized laboratory that conducted the analyses.

(vi) A detailed written description of the abatement, including abatement methods used, locations of rooms and/or components where abatement occurred, reason for selecting particular abatement methods for each component, and any suggested monitoring of encapsulants or enclosures.

(f) *Collection and laboratory analysis of samples.* Any paint chip, dust, or soil samples collected pursuant to the work practice standards contained in this section shall be:

(1) Collected by persons certified by EPA as an inspector or risk assessor; and

(2) Analyzed by a laboratory recognized by EPA pursuant to section 405(b) of TSCA as being capable of performing analyses for lead compounds in paint chip, dust, and soil samples.

(g) *Composite dust sampling.* Composite dust sampling may only be conducted in the situations specified in paragraphs (c) through (e) of this section. If such sampling is conducted, the following conditions shall apply:

(1) Composite dust samples shall consist of at least two subsamples;

(2) Every component that is being tested shall be included in the sampling; and

(3) Composite dust samples shall not consist of subsamples from more than one type of component.

(h) *Determinations.* (1) Lead-based paint is present:

(i) On any surface that is tested and found to contain lead equal to or in excess of 1.0 milligrams per square centimeter or equal to or in excess of 0.5% by weight; and

(ii) On any surface like a surface tested in the same room equivalent that has a similar painting history and that is found to be lead-based paint.

(2) A paint-lead hazard is present:

(i) On any friction surface that is subject to abrasion and where the lead dust levels on the nearest horizontal surface underneath the friction surface (e.g., the window sill or floor) are equal to or greater than the dust hazard levels identified in § 745.227(b);

(ii) On any chewable lead-based paint surface on which there is evidence of teeth marks;

(iii) Where there is any damaged or otherwise deteriorated lead-based paint on an impact surface that is cause by impact from a related building component (such as a door knob that knocks into a wall or a door that knocks against its door frame; and

(iv) If there is any other deteriorated lead-based paint in any residential building or child-occupied facility or on the exterior of any residential building or child-occupied facility.

(3) A dust-lead hazard is present in a residential dwelling or child occupied facility:

(i) In a residential dwelling on floors and interior window sills when the weighted arithmetic mean lead loading for all single surface or composite samples of floors and interior window sills are equal to or greater than 40 μg/ft^2 for floors and 250 μg/ft^2 for interior window sills, respectively;

(ii) On floors or interior window sills in an unsampled residential dwelling in a multi-family dwelling, if a dust-lead hazard is present on floors or interior window sills, respectively, in at least one sampled residential unit on the property; and

(iii) On floors or interior window sills in an unsampled common area in a multi-family dwelling, if a dust-lead hazard is present on floors or interior window sills, respectively, in at least one sampled common area in the same common area group on the property.

(4) A soil-lead hazard is present:

(i) In a play area when the soil-lead concentration from a composite play area sample of bare soil is equal to or greater than 400 parts per million; or

(ii) In the rest of the yard when the arithmetic mean lead concentration from a composite sample (or arithmetic mean of composite samples) of bare soil from the rest of the yard (i.e., non-play areas) for each residential building on a property is equal to or greater than 1,200 parts per million.

(i) *Recordkeeping.* All reports or plans required in this section shall be maintained by the certified firm or individual who prepared the report for no fewer than 3 years. The certified firm or individual also shall provide copies of these reports to the building owner who contracted for its services.

[61 FR 45813, Aug. 29, 1996, as amended at 64 FR 42852, Aug. 6, 1999; 66 FR 1239, Jan. 5, 2001; 69 FR 18496, Apr. 8, 2004]

Chapter 7: Lead-Based Paint Inspection

Intentionally Left Blank

Chapter 7: Lead-Based Paint Inspection

How to Do It

1. See Chapters 3, 5 and 16 for guidance on when a lead-based paint inspection is appropriate. A lead-based paint inspection will determine:

   - Whether lead-based paint is present in a house, dwelling unit, residential building, housing development, or child-occupied facility, including common areas and exterior surfaces; and
   - If present, which building components contain lead-based paint.

   The U.S. Department of Housing and Urban Development (HUD) and the U.S. Environmental Protection Agency (EPA) define an inspection as a surface-by-surface investigation to determine the presence of lead-based paint and the provision of a report explaining the results of the investigation. The sampling protocols in this chapter fulfill that definition.

2. The client should hire a certified (licensed) lead-based paint inspector or risk assessor (see 40 CFR part 745). Lists of certified lead-based paint inspectors and risk assessors can be obtained from the EPA website at: ***www.epa.gov/oppt/lead/pubs/traincert.htm***. Laboratories recognized by EPA, under its National Lead Laboratory Accreditation Program (NLLAP), for analysis of lead in paint can also be found at ***www.epa.gov/oppt/lead/pubs/nllap.htm***.

3. The inspector should use the HUD/EPA standard for lead-based paint of equal to or greater than 1.0 mg/cm^2 or 0.5% by weight, as defined by Title X of the Housing and Community Development Act of 1992 (unless HUD and EPA have lowered the standard). If the applicable standard in the jurisdiction is more stringent, the procedures in this chapter will need to be modified. For purposes of the HUD/EPA Lead-Based Paint Disclosure Rule, 1.0 milligrams per square centimeter (mg/cm^2) or 0.5% by weight are the standards that must be used (see Appendix 6) as of the publication of this edition of these *Guidelines*. If a State, Tribe or local government has an EPA-authorized plan for certifying lead-based paint inspectors and has lower lead standards, those lower lead standards would apply to inspections (but not to the Lead Disclosure Rule; paint with lead below the federal threshold is not considered lead-based paint for purposes of that Rule).

   There are other analytical techniques that may be used by a laboratory with NLLAP recognition for analysis of lead in paint.

4. Obtain the *XRF Performance Characteristic Sheet (PCS)* for the X-Ray Fluorescence (XRF) lead paint analyzer to be used in the inspection. It will specify the ranges where XRF results are positive, negative or inconclusive, the calibration check tolerances, and other important information. Only devices with a posted PCS may be used for lead paint inspections. 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, as applicable, and the work will have to be re-done. To obtain the appropriate *XRF Performance Characteristic Sheet,* contact the National Lead Information Center Clearinghouse (1-800-424-LEAD) or download it from the Internet at ***www.hud.gov/offices/lead/lbp/hudguidelines/allpcs.pdf***. *XRF Performance Characteristic Sheets* have been developed by HUD and EPA for most commercially available XRFs. (Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.) *Report lead paint amounts in mg/cm^2* because this unit of measurement does not depend on the number of layers of

non-lead-based paint and can usually be obtained without damaging the painted surface. All measurements of lead in paint should be in mg/cm^2, unless the surface area cannot be measured or if all paint cannot be removed from the measured surface area. In such cases, concentrations may be reported in weight percent (%) or parts per million by weight (ppm).

5. *If the XRF instrument has a radioactive source, follow the radiation safety procedures* explained in this chapter, and as required by the U.S. Nuclear Regulatory Commission and applicable State and local regulations when using XRF instruments.

6. Take at least three calibration check readings before beginning the inspection. Additional calibration check readings should be made at least every 4 hours, after inspection work has been completed for the day, or according to the manufacturer's instructions, whichever is most frequent. If the instrument is to be turned off during the course of an inspection, calibration checks should always be done before the instrument is turned off and again after it has been warmed up (calibration checks do not need to be done each time an instrument enters an automatic "sleep" state while still powered on).

7. When conducting an inspection in a multi-family housing development or building, obtain a complete list of all housing units, common areas, and exterior site areas. Determine which can be grouped together for inspection purposes based on similarity of construction materials and common painting histories. In each group of similar units, similar common areas, and similar exterior sites, determine the minimum number of each to be inspected from the tables in this chapter. Random selection procedures are explained in this chapter.

8. For each unit, common area, and exterior site to be inspected, identify all testing combinations in each room equivalent. A testing combination is characterized by the room equivalent, the component type, and the substrate. A room equivalent is an identifiable part of a residence (e.g., room, house exterior, foyer, etc.). Painted surfaces include any surface coated with paint, shellac, varnish, stain, paint covered by wallpaper, or any other coating. Wallpaper should be assumed to cover paint unless building records or physical evidence indicates no paint is present.

9. Take at least one individual XRF reading on each testing combination in each room equivalent. For walls, take at least four readings (one reading on each wall) in each room equivalent. A different visible color does not by itself result in a separate testing combination. It is not necessary to take multiple XRF readings on the same spot, as was previously recommended, unless the PCS requires such for the XRF instrument being used.

10. Determine whether to correct the XRF readings for substrate interference by consulting the *XRF Performance Characteristic Sheet*. If test results for a given substrate fall within the substrate correction range, take readings on that bare substrate scraped completely clean of paint, as explained in Section IV.E of this chapter.

11. Classify XRF results for each testing combination. Readings above the upper limit of the inconclusive range are considered positive, while readings below the lower limit of the inconclusive range are considered negative. Readings within the inconclusive range (including its boundary values) are classified as inconclusive. Some instruments have a threshold value separating ranges of readings considered positive from readings considered negative for a given substrate. Readings at or above the threshold are considered positive, while readings below the threshold are considered negative.

12. In single-family housing inspections, all inconclusive readings must be confirmed in the laboratory, unless the client wishes to assume that all inconclusive results are positive. Such an assumption may reduce the cost of an inspection, but will probably increase subsequent abatement, interim control, and maintenance costs, because laboratory analysis often shows that testing combinations with inconclusive readings do not in fact contain lead-based paint. Inconclusive readings cannot be assumed to be negative.

13. In multi-family dwelling inspections, XRF readings are aggregated across units and room equivalents by component type. Use the flowchart provided in this chapter (Figure 7.3) to make classifications of all testing combinations or component types in the development as a whole, based on the percentages of positive, negative, and inconclusive readings.

14. If the inspector collected paint-chip samples for analysis, they must be analyzed by a laboratory recognized under the EPA's National Lead Laboratory Accreditation Program (NLLAP) for analysis of lead in paint, and collected in accordance with ASTM E 1729, Standard Practice for Field Collection of Dried Paint Samples for Subsequent Lead Determination, or equivalent. Paint-chip samples are collected when the overall results for a component type are inconclusive by XRF, or were not measured by XRF, or if the inspector chooses to do so if the paint is deteriorated. They may be collected by a properly trained and certified inspector or others, if permitted by State law and recognized by EPA. Paint-chip samples should contain all layers of paint (not just peeled layers) and must always include the bottom layer. If results will be reported in mg/cm^2, including a small amount of substrate with the sample will not significantly bias results. Substrate material should not, however, be included in samples reported in weight percent. Paint from 4 square inches (25 square centimeters) should provide a sufficient quantity for laboratory analysis. Smaller surface areas may be used, but only if the laboratory indicates that a smaller sample is acceptable. In all cases, the surface area sampled must be recorded.

15. The client or client's representative should evaluate the quality of the inspection using the procedures in this chapter.

16. The inspector will prepare an inspection report indicating if and where lead-based paint is located in the unit or the housing development (or building). Inspection reports contain detailed information on the following:

    - Who performed the inspection;
    - Date(s);
    - Inspector's certification number;
    - All XRF readings;
    - Classification of all surfaces into positive or negative (but not inconclusive) categories, based on XRF and laboratory analyses;
    - Specific information on the XRF and laboratory methodologies;
    - Housing unit and sampling location identifiers;
    - Results of any laboratory analyses; and
    - Additional information described in Section IV of this chapter.

17. The report should include a statement that the presence of lead-based paint and the report must be disclosed by the owner (seller / lessor) to prospective new buyers (purchasers) and renters (lessees) of target housing prior to obligation under a sales contract or lease, except that the disclosure does not have to be made when the property is being leased if it is lead-based paint free. (See the discussion of Lead Disclosure Rule in Appendix 6.) The suggested language in the boxes in Section I.A.4 may be used.

I. Introduction

A. Purpose

This chapter explains methods for performing lead-based paint inspections in housing to determine:

- Whether lead-based paint is present in a house, dwelling unit, residential building, housing development, or child-occupied facility, including common areas and exterior surfaces; and
- If present, which building components contain lead-based paint.

The information presented here is intended for both inspectors and persons who purchase inspection services (clients). This chapter provides an inspection protocol, methods for determining the quality of an inspection, and information on how to locate certified lead inspectors.

Defining lead-based paint. Title X ("ten") of the Housing and Community Development Act of 1992, defines lead-based paint inspection (in two places, with slightly different formatting of the same wording) as:

> a surface-by-surface investigation to determine the presence of lead-based paint as provided in section 302(c) of the Lead-Based Paint Poisoning Prevention Act and the provision of a report explaining the results of the investigation. (15 U.S.C. 2681(7), for use by EPA and its stakeholders; and 42 U.S.C. 4851(12), for use by HUD and its stakeholders)

This definition in Title X is based on, and mentions, the earlier Lead-Based Paint Poisoning Prevention Act (Public Law 91-695), enacted in 1971, which described an inspection in its section 302(c) as being an:

> inspection of all intact and nonintact interior and exterior painted surfaces of housing subject to this section for lead-based paint using an approved x ray fluorescence analyzer, atomic absorption spectroscopy, or comparable approved sampling or testing technique. A certified inspector or laboratory shall certify in writing the precise results of the inspection. If the results equal or exceed a level of 1.0 milligrams per centimeter squared or 0.5 percent by weight, the results shall be provided to any potential purchaser or tenant of the housing. (42 U.S.C. 4822(c))

The sampling and testing protocols in this chapter fulfill the definition of lead-based paint inspection, in providing guidance on selecting building components of housing to sample and/or test them and the methods for determining whether they are coated with lead-based paint.

Section 302(c) of the 1971 act, above, established the threshold for lead-based paint as a surface concentration (or "loading") on the basis of weight of lead per area of surface, at 1 mg/cm^2, or a weight concentration on the basis of a weight of lead per weight of paint, at 0.5% by weight. That section also has wording providing for HUD to review the lead-based paint threshold and reduce it if "reliable technology makes feasible the detection of a lower level and medical evidence supports the imposition of a lower level." As of the publication of this edition of these *Guidelines*, in response to a petition received by the EPA on August 10, 2009, HUD and EPA are collaboratively considering whether to lower the threshold level of lead-based paint; they are also looking into whether to lower the lead dust hazard standards.

HUD, consistent with EPA, CDC and OSHA, notes that paint with lead that is deteriorated or disturbed, even if its lead content is below the current EPA and HUD standards, may still pose a human health hazard, this depends largely on how much lead-contaminated dust is generated from the paint and where

that dust is dispersed. Accordingly, HUD recommends, in these *Guidelines*, using lead-safe methods of working with paint that is known or presumed to have lead in it, whether or not it is lead-based paint.

1. Disclosure of Inspections

Federal law requires the disclosure of knowledge of lead-based paint and lead-based paint hazards, or that there is no such knowledge, when owners sell or rent most pre-1978 housing, known as "target" housing. Therefore the results (that is, reports and records) of lead-based paint inspections (as discussed in this Chapter) and risk assessments (as discussed in Chapter 5) must be disclosed to prospective renters (lessees, tenants) of target housing prior to entering into a new lease and renters renewing an old lease (unless the results were previously disclosed to them), if lead-based paint is found, and to prospective purchasers prior to obligation under a sales contract for target housing, whether or not lead-based paint is found. If the inspection described in this chapter finds that lead-based paint is not present in units which are to be leased, the dwelling unit and, for multi-family housing, all other dwelling units characterized by the inspection are exempt from disclosure requirements for rental actions. However, for dwelling units which are being sold (not leased), the owner still has certain legal responsibilities to fulfill under Federal law *even if no lead-based paint is identified.* See the HUD and EPA regulations in 24 CFR part 35, and 40 CFR part 745, respectively, for additional details, and see the regulatory overview in Appendix 6.

You may contact the National Lead Information Center Clearinghouse (1-800-424-LEAD) to obtain HUD and EPA brochures, question-and-answer booklets, the regulations mentioned above (and the descriptive preamble to those regulations), and other information on lead-based paint disclosure. (Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.) See section IV for recommended inspection report language regarding these disclosure requirements.

2. Limitation of this Inspection Protocol

The protocol described here is not intended for investigating housing units where children with elevated blood lead levels are currently residing. Such a protocol can be found in chapter 16 or from the State or local health department; the most stringent investigation protocol should be used.

3. Documentation of Results

The complete set of forms provided at the end of this chapter for use in single-family and multi-family housing may be used; similar forms or computerized reports may also be used to document the results of inspections.

4. Owner's Use of Inspection Reports in Lead Disclosure

In the final report on the inspection, the inspector should advise the client (typically the property owner or manager) that, if the housing is target housing, the owner has certain responsibilities under the Lead Disclosure Rule when the property is being sold or leased, or when a lease is being renewed with revisions. In general, lead disclosure is required in these circumstances, except that disclosure does not have to be made when the target housing is being leased if the inspection has found that it is lead-based paint free.

See the discussion of Lead Disclosure Rule (24 CFR part 35, subpart A, or 40 CFR part 745, subpart F) in Appendix 6 of these *Guideline*). The suggested language in the boxes in Section IV.I.3, Final Report, below, may be used in the cases of lead-based paint being identified, or not identified, in target housing.

B. Qualifications of Inspectors and Laboratories

1. Where to Find Inspectors and Laboratories

Lists of EPA and State-licensed (certified) inspectors can be obtained from the National Lead Information Center Clearinghouse at 800-424-LEAD (5323). The Clearinghouse can also help you locate the appropriate State agency contact to obtain lists of State-licensed (certified) inspectors and other information.

You can go to EPA's Lead Abatement Professionals page, ***http://www.epa.gov/oppt/lead/pubs/traincert.htm***, and click on the map for individual states and tribes which are authorized by EPA to operate their own lead certification programs. For other states, you can click on the Where You Live link on the left column, or go directly to ***http://www.epa.gov/oppt/lead/pubs/leadoff1.htm***, to find the contact information for the EPA Regional Lead Coordinators.

Laboratories recognized under the EPA's National Lead Laboratory Accreditation Program (NLLAP) are updated monthly, and are available at ***http://www.epa.gov/oppt/lead/pubs/nllaplist.pdf***.

2. Qualifications of Inspectors

An inspector must be certified (licensed) by the State or tribe where the testing is to be done if the State or tribe has an EPA-authorized inspection certification program. If the State does not have such a program, the inspector must be certified by EPA. The list of EPA-authorized states and tribes is at the EPA's Lead Abatement Professionals web page identified above.

C. Other Sources of Information

Other sources of information and materials needed for using this protocol include an XRF Performance Characteristic Sheet, U.S. Nuclear Regulatory Commission and State radiation protection regulations, and standards issued by the American Society for Testing and Materials (ASTM). The National Institute of Standards and Technology (NIST) produces Standard Reference Materials (SRMs) and provides supporting documentation for these materials.

1. XRF Performance Characteristic Sheet

An XRF Performance Characteristic Sheet (PCS) defines acceptable operating specifications and procedures for each model of X-Ray Fluorescence (XRF) lead-based paint analyzer. An inspector must follow the XRF Performance Characteristic Sheet for all inspection activities. XRF PCSs are available from the National Lead Information Center Clearinghouse or through the HUD website at ***http://www.hud.gov/offices/lead/lbp/hudguidelines/allpcs.pdf***. If an XRF analyzer does not have a PCS, or if it is not used, or if the data are not analyzed, in accordance with its PCS, the actions undertaken with it are neither a lead-based paint inspection nor paint testing.

2. XRF Radiation Protection Regulations

Regulations that govern radioactive sources used in XRFs are available from State radiation protection agencies (see ***http://nrc-stp.ornl.gov***)and the Nuclear Regulatory Commission (NRC) . The NRC may be contacted toll-free at (800) 368-5642, or ***http://www.nrc.gov/about-nrc/organization/fsmefuncdesc.html***. (Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.) Employers of individuals who use XRF that have radioactive sources should also see OSHA's Ionizing Radiation standard, 29 CFR 1910.1096, and NRC's Standards for Protection Against Radiation, 10 CFR Part 20.

3. ASTM and NIST Standards

Other helpful information and standards are available from ASTM International at (610) 832-9585, or ***www.astm.org/Standard/index.shtml*** including:

- ASTM E1605 Standard Terminology Relating to Lead in Buildings
- ASTM E1613 Standard Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques
- ASTM E 1645 Standard Practice for Preparation of Dried Paint Samples by Hotplate or Microwave Digestion for Subsequent Lead Analysis
- ASTM E1729 Standard Practice for Field Collection of Dried Paint Samples for Subsequent Lead Determination
- ASTM E1775 Standard Guide for Evaluating Performance of On-Site Extraction and Field-Portable Electrochemical or Spectrophotometric Analysis for Lead
- ASTM E1979 Standard Practice for Ultrasonic Extraction of Paint, Dust, Soil, and Air Samples for Subsequent Determination of Lead
- ASTM E2052 Standard Guide for Evaluation, Management, and Control of Lead Hazards in Facilities (As of the publication of this edition of these *Guidelines,* this withdrawn standard being reinstated pending comprehensive updates.)
- ASTM E2120 Standard Practice for Performance Evaluation of the Portable X-Ray Fluorescence Spectrometer for the Measurement of Lead in Paint Films

NIST (301-975-2200 or ***http://www.nist.gov/***; hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.) has developed a series of paint films that have known amounts of lead-based paint and can be used for calibration check purposes. As of the publication of this edition of these *Guidelines,* NIST Standard Reference Material 2579a is available (see section IV.D, below).

D. Paint Testing for Inspections and Risk Assessments

While risk assessments determine the presence of lead-based paint *hazards,* inspections determine the presence of *lead-based paint*. The paint chip sampling and measurement procedures used in

lead-based paint inspections are similar to the procedures for paint sampling used in risk assessment. However, the number of paint measurements or samples taken for a paint inspection is, generally, considerably greater than the number of paint samples required for a risk assessment, because risk assessments measurements for lead in paint are only made for deteriorated paint, not all paint. Inspections measure lead in both deteriorated and intact paint, which involves many more surfaces. Risk assessments always note the condition of paint on surfaces; inspections may not. For dwellings in good condition, a full risk assessment may be unnecessary, and a lead hazard screen risk assessment may be conducted. In a lead hazard screen or risk assessment, the certified risk assessor tests only painted surfaces in deteriorated condition for their lead content. See chapter 5 for methods to determine the condition of paint when conducting a risk assessment.

E. Most Common Inspection Method

Portable XRF lead-based paint analyzers are the most common primary analytical method for inspections in housing because of the demonstrated ability to determine if lead-based paint is present on many surfaces and to measure the paint without destructive sampling or paint removal, as well as the high speed and low cost per sample (see Figure 7.1). Portable XRF instruments expose a building component to electromagnetic radiation in the form of X-rays or gamma radiation. In response to radiation, each element, including lead, emits energy at a fixed and characteristic level. Emission of characteristic x-rays is called "X-Ray Fluorescence," or XRF. The energy released is measured by the instrument's fluorescence detector and displayed. The inspector must then compare this displayed value (reading) with the threshold or inconclusive range specified in the XRF Performance Characteristic Sheet (PCS) for the specific XRF instrument being used, and the specific substrate beneath the painted surface (see section IV.F, below). For instrument – substrate combinations that have a threshold:

FIGURE 7.1 One type of XRF instrument displays its reading of a testing combination.

- If the reading is less than the threshold, then the reading is considered negative for lead-based paint.
- If the reading is greater than or equal to the threshold, then the reading is considered positive.

For instrument – substrate combinations that have an inconclusive range:

- If the reading is less than the lower boundary of the inconclusive range, then the reading is considered negative.
- If the reading is within the inconclusive range, including its boundary values, then the reading is considered inconclusive.
- If the reading is greater than the upper boundary of the inconclusive range, then the reading is considered positive.

As of the publication of this edition of these *Guidelines*, the detection elements and software of all of the XRF analyzers for which HUD has issued PCSs, all of the inconclusive ranges and/or thresholds are based on 1.0 mg/cm^2, so that positive and negative readings are consistent with the HUD definition of

lead-based paint for identification and disclosure purposes. Laboratory analysis is recommended to confirm inconclusive XRF results, as mentioned in Section I.G, below; alternatively, the paint can be presumed to be lead-based paint.

F. XRF Performance Characteristic Sheets and Manufacturer's Instructions

When an XRF instrument is used for testing paint in target housing or pre-1978 child-occupied facilities, it must have a HUD -issued XRF Performance Characteristic Sheet. XRFs must be used in accordance with the manufacturer's instructions and the PCS. The PCS contains information about XRF readings taken on specific substrates, calibration check tolerances, interpretation of XRF readings (see section I.E, above), and other aspects of the model's performance.

If discrepancies exist among the PCS, the HUD *Guidelines* and the manufacturer's instructions, the most stringent guidelines should be followed. For example, if the PCS has a lower (more stringent) calibration check tolerance than the manufacturer's instructions, the PCS should be followed.

These *Guidelines* and the PCS are applicable to all XRF instruments that detect K X rays, L X rays, or both. Most XRF instruments in use at the time of publication of this edition of these *Guidelines* detect K-shell fluorescence (X-ray energy), some instruments, L-shell fluorescence, and some, both K and L fluorescence. In general, L X rays released from greater depths of paint are less likely to reach the surface than are K X rays, which makes detection of lead in deeper paint layers by L X rays alone more difficult. However, L X rays are less likely to be influenced by substrate effects.

G. Inspection by Paint-chip Analysis

Performing inspections by the sole use of laboratory paint-chip analysis is not recommended because it is time-consuming, costly, and requires extensive repair of painted surfaces. Laboratory analysis of paint-chip samples *is* recommended for inaccessible areas or building components with irregular (non-flat) surfaces that cannot be tested using XRF instrumentation. Laboratory analysis is also recommended to confirm inconclusive XRF results, as specified on the applicable XRF Performance Characteristic Sheet, or at the inspector's professional judgment. Some newer laboratory analytical methods can provide results within minutes (see section I.H, below). Only laboratories recognized under the EPA NLLAP may be used for analyzing samples of paint in target housing or pre-1978 child-occupied facilities. Laboratory analysis is more accurate and precise than XRF, but only if great care is used to collect and analyze the paint-chip sample. Laboratory results of paint chip samples should be reported as mg/cm^2. Appendix 1 of these *Guidelines* explains why units of mg/cm^2 are not dependent on the number of overcoats of lead-free paint and why such units of measure are therefore more reliable than weight percent. The dimensions of the area from which a paint-chip sample is removed must be measured as accurately as possible (to the nearest millimeter or 1/16th of an inch) and the sample has to include every layer of paint with minimal substrate included.

Although laboratory results can also be reported as a percentage of lead by weight of the paint sample, percents should only be used when it is not feasible to use mg/cm^2. These two units of measure are not interchangeable. Laboratory results should be reported as mg/cm^2 if the surface area can be accurately measured and if all paint within that area is collected.

In mg/cm^2 measurements, keep the amount of substrate material as small as possible so that the inclusion of the substrate in the sample risks biasing the results as little as possible. However, if reporting weight percent measurements, no substrate may be included because the substrate will "dilute" the amount of lead reported. If a visual examination shows that the bottom layer of paint appears to have "bled" into the substrate, a very thin upper portion of the substrate should

be included in the sample to ensure that all lead within the sample area has been included in the sample. Direct the laboratory to report lead in mg/cm^2 if significant amounts of substrate are included in the sample. If the classification of presence or absence of lead-based paint based on weight percent and mg/cm^2 do not agree (e.g., weight percent exceeds the standard while mass per area value is below the standard) and the contradictory results cannot be resolved the report should state that lead-based paint is present.

See section VI for additional information on laboratory analysis.

H. Additional Means of Analyzing Paint

Methods of analyzing lead in paint are available in addition to XRF and laboratory paint-chip analysis, including transportable instruments and chemical test kits. Because some of these methods involve paint removal or disturbance, repair is needed after sampling, unless the substrate will be removed, encapsulated, enclosed, or repainted before occupancy (see section VI), or if analysis shows that the paint is not lead-based paint, and leaving the damage is acceptable to the client and/or the owner.

1. Mobile Laboratories

Portable instruments that employ anodic stripping voltammetry (ASV) and potentiometric stripping analysis (PSA) are now available. Their use is described in ASTM E1775-07 Standard Guide for Evaluating Performance of On Site Extraction and Field Portable Electrochemical or Spectrophotometric Analysis for Lead, (***www.astm.org/Standard/index.shtml***) which may be used as a basis for evaluating the performance of on-site extraction and electrochemical and spectrophotometric analyses.

In states and tribal lands where EPA is operating a lead program, paint samples for an inspection must be analyzed by a laboratory or testing firm recognized by EPA under the National Lead Laboratory Accreditation Program (NLLAP). If, in these states, an NLLAP laboratory wishes to perform on-site analyses of paint samples, it may do so if its NLLAP recognition includes the type of laboratory operation to be used, whether a mobile laboratory, or a field sampling and measurement organization. See the NLLAP Laboratory Quality System Requirements (LQSR). (As of the publication of this edition of these *Guidelines*, NLLAP was using Revision 3.0 of the LSQR, dated November 5, 2007. ***http://www.epa.gov/lead/pubs/lqsr3.pdf***, especially pages 1-2, 7, 12, and 18-19.) In states or tribal lands where the state or tribe is operating an EPA-authorized lead program, the same requirements generally apply, although there may be some differences.

2. Chemical Test Kits

Chemical test kits, also known as spot test kits, are intended to show a color change when a part of the kit makes contact with the lead in lead-based paint. Because of how long it has been since the application of lead-based paint in residential units was banned, often the surface coat does not contain significant levels of lead. Therefore many spot test kits require exposing all the layers of paint by slicing or some other method.

One type of chemical test kit is based on the formation of lead sulfide, which is black, when lead in paint reacts with sodium sulfide. Another is based on the formation of a red or pink color when lead in paint reacts with sodium rhodizonate.

Although EPA did not find chemical spot test kits sufficiently reliable for use in lead-based paint inspections, and the Agency recommended that they not be used (EPA, 1995b), it appeared that some spot test kits, when used by trained professionals, may be reliable as negative screens (NIST, 2000). During its development of its 2008 Lead Renovation, Repair and Painting Program (RRP) rule (see Appendix 6), EPA published "Lead Paint Test Kit Development; Request for Comments" (71 Federal Register 13561-13563, March 16, 2006) in order to encourage the further development of this method. In the RRP Rule, EPA described criteria for lead test kits that detect lead in paint (***http://www.epa.gov/lead/pubs/testkit.htm***).

Specifically, at 40 CFR 745.88(b)(4) and (c), the RRP rule requires a test kit newly recognized (i.e., after September 1, 2010) by EPA to meet both:

- The negative response criterion: That a false negative response (a negative response, indicating that lead-based paint is not detected) occurs no more than 5 percent of the time for paint at or above the current standard for lead-based paint (1.0 mg/cm^2 or 0.5 percent by weight), with 95 percent confidence; and
- The positive response criterion: That a false positive response (a positive response, indicating that lead-based paint is detected) occurs no more than 10 percent of the time for paint below the current standard for lead-based paint), with 95 percent confidence.

As of the publication of this edition of these *Guidelines*, a lead test kit can be EPA-recognized (see the list at ***http://www.epa.gov/lead/pubs/testkit.htm***) for determining, for RRP rule use, that lead-based paint is not present if it meets EPA's negative response criterion, above. EPA's recognition of such kits will last until EPA publicizes its recognition of the first test kit that meets both the negative response and positive response criteria outlined in the RRP rule. (40 CFR 745.88(b)(3).) As of the publication of this edition of these *Guidelines*, EPA had recognized three lead test kits for use in complying with the false negative response criterion of the RRP rule, but no test kit that meet both its false positive and false negative criteria. Accordingly, when a certified renovator obtains a negative response from an EPA-recognized test kit, i.e., indicating that lead-based paint is not detected, the certified renovator may use the response as part of determining whether the renovation project is exempt from the RRP Rule (but this does not provide an exemption from the Lead Disclosure Rule or the Lead Safe Housing Rule, which require lead-based paint inspections to support the exemption). Similarly, when a certified inspector or risk assessor obtains a negative response from an EPA-recognized test kit – but not a positive response – the response may be mentioned in a lead-based paint inspection, hazard screen or risk assessment report.

HUD and EPA may fully recommend chemical spot test kit use at some point after the publication of this edition of these *Guidelines* for lead-based paint inspections if the technology is demonstrated to be equivalent to XRF or laboratory paint-chip analysis in its ability to properly classify painted surfaces into positive, negative, and, if appropriate, inconclusive categories, with appropriate estimates of the magnitude of sampling and analytical error. XRF Performance Characteristic Sheets currently provide such estimates for XRFs, and analytical error is

well-described for laboratory analysis. Information on test kits or other new technologies for testing for lead in paint can be obtained from the lead test kits website above, and the EPA contact listed there, and from the National Lead Information Center Clearinghouse (1-800-424-LEAD) (hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339) (***http://www.epa.gov/oppt/lead/pubs/nlic.htm***).

II. Summary of XRF Radiation Safety Issues

Radiation hazards associated with the use of XRFs that use radioactive sources are covered in detail in section VII. The shutter of an XRF must never be pointed at anyone, even if the shutter is closed. Inspectors should wear radiation dosimeters to measure their exposure, although excessive exposures are highly unlikely if the instruments are used in accordance with the manufacturer's instructions. If feasible, persons should not be near the other side of a wall, floor, ceiling, or other building component surface being tested.

III. Definitions

Definitions of several key terms used in this chapter are provided here. Although other definitions are available, the definitions and descriptions in this chapter should be used when conducting lead-based paint inspections.

a) **Building Component Types** – A building component type consists of doors, windows, walls, and so on that are repeated in more than one room equivalent in a unit and have a common substrate. If a unique building component is present in only one room, it is considered to be a testing combination. Each testing combination may be composed of more than one building component (such as two similar windows within a room equivalent). Component types can be located inside or outside the dwelling. For example, typical component types in a bedroom would be the ceiling, walls, a door and its casing, the window sash, window casings, and any other distinct surface, such as baseboards, crown molding, and chair rails. If trends or patterns of lead-based paint classifications are found among building component types in different room equivalents, an inspection report may summarize results by building component type, as long as all measurements are included in the report. For example, the inspection may find that all doors and door casings in a dwelling unit are coated with LBP (are "positive").

b) **Lead-based paint** – As of the publication of this edition of these *Guidelines,* lead-based paint means paint or other surface coatings that contain lead equal to or greater than 1.0 mg/cm^2 or 0.5 percent by weight. (Equivalent units for the weight concentration are: 5,000 µg/g, 5,000 mg/kg, or 5,000 ppm by weight.) Surface coatings include paint, shellac, varnish, or any other coating, including wallpaper that covers painted surfaces.

c) **Lead loading** – The mass of lead in a given surface area of a substrate. Lead loading is typically measured in units of milligrams per square centimeter (mg/cm^2). It is also called area concentration.

d) **Room equivalent** – A room equivalent is an identifiable part of a residence, such as a room, a house exterior, a foyer, a staircase within a housing unit, a hallway within a housing unit, or an exterior area (exterior areas contain items such as play areas, painted swing sets, painted sandboxes, etc.). Closets or other similar areas adjoining rooms should not be considered as separate room equivalents unless they are obviously dissimilar from the adjoining room equivalent. Most closets are not separate room equivalents. Exteriors should be included in all inspections. An individual side of an exterior is not considered to be a

separate room equivalent, unless there is visual or other evidence that its paint history is different from that of the other sides. All sides of a building (typically two for row houses, three for each of the units of a side-by-side duplex, or four for freestanding houses) are generally treated as a single room equivalent if the paint history appears to be similar. For multi-family developments or apartment buildings, common areas and exterior sites are treated as separate types of units, not as room equivalents (see section V.C.1 for further guidance).

e) **Substrate** – The substrate is the material underneath the paint. Substrates should be classified into one of six types: brick, concrete, drywall, metal, plaster, or wood. These substrates cover almost all building materials that are painted and are linked to those used in the XRF Performance Characteristic Sheets (PCS). For example, the concrete substrate type includes poured concrete, precast concrete, and concrete block.

   If a painted substrate is encountered that is different from the substrate categories shown on the PCS, select the substrate type that is most similar in density and composition to the substrate being tested. For example, for painted glass substrates, an inspector should select the concrete substrate, because it has about the same density (2.5 g/cm^2) and because the major element in both is silicon.

   For components that have layers of different substrates, such as plaster over concrete, the substrate immediately adjacent to (underneath) the painted surface should be used. For example, plaster over concrete block is recorded as plaster.

f) **Testing Combination** – A testing combination is a unique combination of room equivalent, building component type, and substrate. Visible color may not be an accurate predictor of painting history and is not included in the definition of a testing combination. Table 7.1 lists common building component types that could make up distinct testing combinations within room equivalents. The list is not intended to be exhaustive. Unlisted components that are coated with paint, varnish, shellac, wallpaper, stain, or other coating should also be considered as a separate testing combination.

   Certain building components that are adjacent to each other and not likely to have different painting histories can be grouped together into a single testing combination, as follows:

   - Window casings, stops, jambs and aprons are typically a single testing combination
   - Interior window mullions and window sashes are a single testing combination – do not group interior mullions and sashes with exterior mullions and sashes
   - Exterior window mullions and window sashes are a single testing combination
   - Door jambs, stops, transoms, casings and other door frame parts are a single testing combination
   - Door stiles, rails, panels, mullions and other door parts are a single testing combination
   - Baseboards and associated trim (such as quarter-round or other caps) are a single testing combination (do not group chair rails, crown molding or walls with baseboards)
   - Painted electrical sockets, switches or plates can be grouped with walls

Each of these building parts should be tested separately if there is some specific reason to believe that they have a different painting history. In most cases, separate testing will not be necessary.

Table 7.1 Examples of Interior and Exterior Building Component Types

Commonly Encountered Interior Painted Components That Should Be Tested Include:

Air Conditioners	Counter Tops	Radiators
Balustrades	Crown Molding	Shelf Supports
Baseboards	Doors and Trims	Shelves
Bathroom Vanities	Electrical Fixtures, Painted	Stair Stringers
Beams	Fireplaces	Stair Treads and Risers
Cabinets	Floors	Stools and Aprons
Ceilings	Handrails	Walls
Chair Rails	Newel Posts	Window Sashes and Trim
Columns	Other Heating Units	

Exterior Painted Components That Should Be Tested Include:

Air Conditioners	Fascias	Railing Caps
Balustrades	Floors	Rake Boards
Bulkheads	Gutters and Downspouts	Sashes
Ceilings	Joists	Siding
Chimneys	Handrails	Soffits
Columns	Lattice Work	Stair Risers and Treads
Corner boards	Mailboxes	Stair Stringers
Doors and Trim	Painted Roofing	Window and Trim

Other Exterior Painted Components Include:

Fences	Storage Sheds & Garages
Laundry Line Posts	Swing sets and Other Play Equipment

Table 7.2 provides six examples of different testing combinations. The first example is a wooden bedroom door. This is a testing combination because it is described by a room equivalent (bedroom), component (door), and substrate (wood). If one of these variables is different for another component, that component is a different testing combination. For example, if a second door in the room equivalent is metal, two testing combinations, not one, would be present.

Table 7.2 Examples of Distinct Testing Combinations

Room Equivalent	Building Component	Substrate
Master Bedroom (Room 5)	Door	Wood
Master Bedroom (Room 5)	Door	Metal
Kitchen (Room 3)	Wall	Plaster
Garage (Room 10)	Floor	Concrete
Exterior	Siding	Wood
Exterior	Swing set	Metal

Test Location – The test location is a specific area on a testing combination where either an XRF reading or a paint-chip sample will be taken. For doors separating rooms, each side of the door is assigned to the room equivalent it faces and is tested separately. The same is true of door casings. For prefabricated metal doors where it is apparent that both sides of the door have the same painting history, only one side needs to be tested.

IV. Inspections in Single-Family Housing

Single-family housing inspections should be conducted by a State- or EPA-certified (licensed) lead-based paint inspector using the following seven steps, some of which may be done at the same time:

- List all testing combinations, including those that are painted, stained, shellacked, varnished, coated, or wallpaper which covers painted surfaces.
- Select testing combinations.
- Perform XRF testing (including the calibration check readings).
- Collect and analyze paint-chip samples for testing combinations that cannot be tested with XRF, that had inconclusive XRF results, or for client-approved confirmation of XRF results.
- Classify XRF and paint-chip results.
- Evaluate the work and results to ensure the quality of the paint inspection.
- Document all findings in a plain language summary and a complete report; include language in both the summary and the report indicating that the information must be disclosed to tenants and prospective purchasers in accordance with Federal law (24 CFR part 35 or 40 CFR part 745) (see Appendix 6).

A. Listing Testing Combinations

Develop a list of all testing combinations in all interior rooms, on all exterior building surfaces, and on surfaces in other exterior areas, such as fences, playground equipment, and garages. The "Single-Family Housing LBP Testing Data Sheet" (see Addendum 2) or a comparable data collection instrument may be used for this purpose. An inventory of a house may be completed either before any testing or on a room-by-room basis during testing. HUD encourages inspectors to take the inventory before beginning any testing. This provides the inspector with an overview of the housing to be inspected, identify problems, and helps the inspector organize the inspection work activities.

1. Number of Room Equivalents to Inspect

Test all room equivalents inside and outside the dwelling unit. The final report must include a final determination of the presence or absence of lead-based paint on each testing combination in each room equivalent. For varnished, stained, or similar clear-coated floors, measurements in only one room equivalent are permissible if it appears that the floors in the other room equivalents have the same coating.

Some testing combinations have multiple parts. For example, a window testing combination could theoretically be broken down into the interior sill (stool), exterior sill, trough, sash, apron, parting bead, stop bead, casing, and so on. Because it is highly unlikely that all these parts will have different painting histories, usually they should not be considered separate testing combinations unless their professional judgment and field condition dictate otherwise. (Inspectors should regard parts of building components as separate testing combinations if they have evidence that different parts have separate, distinct painting histories). Windows and doors would typically have at least two combinations, interior and exterior. See the definition of testing combination (section III, above) for guidance on which building component parts may and may not be grouped together.

2. Number of Testing Combinations to Inspect

Inspect each testing combination in each room equivalent, unless similar building component types with identical substrates (such as windows) are all found to contain lead-based paint in the first five interior room equivalents. In that case, testing of that component type in the remaining room equivalents may be discontinued, *if and only if* the purchaser of the inspection services agrees beforehand to such a discontinuation. The inspector should then conclude that similar building component types in the rest of the dwelling unit also contain lead-based paint. For example, if an inspector finds that baseboards in the first five room equivalents are all positive, the inspector – with the client's permission – may conclude that all remaining room equivalents in the unit contain positive baseboards. This is sometimes referred to as a "positive stop."

Because it is highly unlikely that testing combinations *known* (and not just presumed) to have been replaced or added to the building after 1977 will contain lead-based paint, they need not be tested. If the age of the testing combination is in doubt, it should be tested.

FIGURE 7.2 Child's bed showing teeth marks in the painted surface. Paint should be tested for lead.

3. Painted Furniture

Painted furniture that is physically attached to the unit (for example, a built-in desk or dresser) should be included in the inspection as a testing combination. Other painted furniture may also be tested, depending on the client's wishes. Children's furniture (such as cribs or playpens), especially if built before 1978, may contain lead-based paint and can be tested, subject to the client's wishes (see Figure 7.2). Imported products may be more suspect, and therefore tested. Check that the entire face plate of the XRF is flush to a painted surface of the furniture. If this is not possible, the piece of furniture must be presumed to be coated with lead-based paint, or a chip may be taken for lead analysis by an EPA-recognized laboratory.

4. Ceramic Tile and Other Fixtures

Some inspectors and risk assessors test non-paint surfaces such as unpainted ceramic tile and porcelain bathtubs for lead content because these items may be a source of lead exposure during demolition or renovation. These items are not considered lead-based paint; their presence does not need to be included in disclosure under the Lead Disclosure Rule (see Appendix 6). Lead-containing ceramic tile is not a common cause for childhood lead poisoning. However, surface abrading and demolition activities such as breaking or crushing may release lead. For this reason, some inspectors and risk assessors include ceramic tile and bathtubs in pre-rehabilitation inspections/risk assessments and reference the OSHA lead in construction standard (29 CFR 1926.62) in their reports (see Appendix 6).

Ceramic tiles are still available with lead glaze; these are being sold and installed in homes. HUD's American Healthy Homes Survey found some tiles with lead loadings of 1.0 mg/cm^2 or more in homes built after 1977. (HUD, 2011)

5. Building Component Types

Results of an inspection may be summarized by classifying component types across room equivalents if patterns or trends are supported by the data.

6. Substrates

Several types of XRF instruments do not require "substrate correction," needed to correct a systematic bias in an XRF instrument resulting from interference from substrate material beneath the paint. (See Section IV.E, below.) However, all substrates across all room equivalents should be grouped into one of the six substrate categories (brick, concrete, drywall, metal, plaster, or wood) shown on the XRF Performance Characteristic Sheet for the instrument being used. Substrate correction procedures, if required, can then be applied for all building component types with the same substrate. For example, the substrate correction procedure for wooden doors and wooden baseboards can use the same substrate correction value.

B. Number and Location of XRF Readings

1. Number of XRF Readings for Each Testing Combination

XRF testing is required for at least one location per testing combination, except for interior and exterior walls, where four readings should be taken, one on each wall. Analysis (Westat, 1996) of EPA data show a median difference in spatial variation of only 0.1 mg/cm^2 and a change in classification (positive, negative, or inconclusive) occurs less than 5 percent of the time as a result of different test locations on the same testing combination. (Westat, 1996) Multiple readings on the same testing combination or testing location are, therefore, unnecessary, except for interior and exterior walls.

Because of the large surface areas and quantities of paint involved, and the possibility of increased spatial variation, take at least four readings (one reading on each wall) in each room equivalent. (For room equivalents with fewer than four walls, test each wall.) For each set of walls with the same painting history in a room equivalent, test the four largest walls. Classify each wall based on its individual XRF reading. If a room equivalent has more than four walls, calculate the average of the readings, round the result to the same number of decimal places as the XRF instrument displays, and classify the remaining walls with the same painting history as the tested walls, based on this rounded average. When the remaining walls in a room equivalent clearly do not have the same painting history as that of the tested walls, test and classify the remaining walls individually. For exterior walls, select at least four sides and average the readings (rounding the result as described above) to obtain a result for any remaining sides. If there are more than four walls and the results of the tested walls do not follow a classification pattern (for example, one is positive and the other three are negative), test each wall individually.

2. Location of XRF Readings

The selection of the test location for a specific testing combination should be representative of the paint over the areas that are most likely to be coated with old paint or other lead-based coatings. Thus, locations where the paint appears to be thickest should be selected. Locations where paint has worn away or been scraped off should not be selected. Areas over pipes, electrical surfaces, nails, and other possible interferences should also be avoided if possible. All layers of paint should be included and the XRF probe faceplate should be able to lie flat against the surface of the test location.

If no acceptable location for XRF testing exists for a given testing combination, a paint-chip sample should be collected and sent to a lead laboratory recognized by NLLAP for analysis of lead in paint. The sample should include all paint layers and should be taken as unobtrusively as possible. Because paint-chip sampling is destructive, a single sample may be collected from a wall and used to characterize the other walls in a room equivalent (see section VI for additional details on paint-chip sampling). For greater reliability, consider collection and analysis of more than one sample.

3. Documentation of XRF Reading Locations

Descriptions of testing combinations must be sufficiently detailed to permit another individual to find them. While it is not necessary to document the *exact* spot or the *exact* building

component on which the reading was taken, it is necessary to record the *exact* testing combination measured. Current room uses or colors can change and should not be the only way of identifying them. A numbering system, floor plan, sketch or other system may be used to document which testing combinations were tested. While HUD does not require a standard identification system, one that could be used is as follows:

a) **Side identification**

Identify perimeter wall sides with letters A, B, C, and D (or numbers or Roman numerals). Side A for single-family housing is the street side for the address. Side A in multi-family housing is the apartment entry door side.

Side B, C, and D are identified clockwise from Side A as one faces the dwelling; thus Wall B is to the left, Wall C is across from Side A, and Side D is to the right of Side A.

Each room equivalent's side identification follows the scheme for the whole housing unit. Because a room can have two or more entries, sides should not be allocated based on the entry point. For example, giving a closet a side allocation based on how the room is entered would make it difficult for another person to make an easy identification, especially if the room had two closets and two entryways.

b) **Room Equivalent Identification**

Room equivalents should be identified by both a number and a use pattern (for example, Room 5-Kitchen). Room 1 can always be the first room, at the A-D junction at the entryway, or it can be the exterior. Rooms are consecutively numbered clockwise. If multiple closets exist, they are given the side allocation: for example, Room 3, Side C Closet. The exterior is always assigned a separate room equivalent identifier.

c) **Sides in a Room**

Sides in an interior room equivalent follow the overall housing unit side allocation. Therefore, when standing in any four-sided room facing Side C, the room's Side A will always be to the rear, Side B will be to the left, and Side D will be to the right.

d) **Building Component Identification**

Individual building components are first identified by their room number and side allocation (for example, the radiator in Room 1, Side B is easily identified). If multiple similar component types are in a room (for example, three windows), they are differentiated from each other by side allocation. If multiple components are on the same wall side, they are differentiated by being numbered left to right when facing the components. For example, three windows on Wall D are identified as windows D1, D2, and D3, left to right. If window D3 has the only old original sash, it is considered a separate testing combination from the other two windows. Codes or abbreviations for building components and/or locations may be used in order to shorten the time needed for data entry. If codes or abbreviations are used, the inspection records and the inspection report must include a table showing their meaning.

A sketch of the dwelling unit's floor plan is often helpful, but is not required by this protocol. Whatever documentation is used, a description of the room equivalent and testing combination identification system must be included in the final inspection report.

C. XRF Instrument Reading Time

The recommended time to open an XRF instrument's shutter to obtain a single XRF result for a testing location depends on the specific XRF instrument model and the mode in which the instrument is operating. The *XRF Performance Characteristic Sheet* provides information on this issue.

To ensure that a constant amount of radiation is delivered to the painted surface, the open-shutter time that permits radiation from the radioactive source to strike the painted surface and then stimulate florescence in the paint that reaches the instrument's detector must be increased as the source ages and the source weakens. Almost all commercially available XRF instruments automatically adjust for the age of the source. (Some instruments adjust for source decay in some but not all modes; operators should check with the manufacturers of their instruments to determine whether these differences need to be accommodated). The following formula should be employed for instruments that use radioactive sources and that requiring manual adjustment of the open-shutter time:

$$\text{Open-Shutter Time} = 2^{(\text{Age}/\text{Half-life})} \times \text{Nominal Time}$$

where:

- Age is the age (in days) of the radioactive source, starting from the date the manufacturer says the source had its full radiation strength;
- *Half-life* is the time (in days) it takes for the radioactive material's activity to decrease to one-half its initial level; and
- *Nominal Time* is the recommended nominal number of seconds for open-shutter time to expose the surface to the X-rays from the radioactive source, when the source is at its full radiation strength, and is obtained from the *XRF Performance Characteristic Sheet.*

For example, if the age of the radioactive source is equal to its half-life (the length of time in which the number of radioactive atoms is reduced to one half of the current number of radioactive atoms), the open-shutter time should be twice the nominal time in order to get the same amount of exposure to the radiation from the decaying source. XRFs that use radioactive sources typically use cobalt-57 (with a half life of 270 days) or cadmium-109 (with a half life of 464 days). Thus, if the recommended nominal time for a particular model of XRF instrument is 15 seconds on the date of manufacture of the source, the open-shutter time should be doubled to 30 seconds 270 days later for cobalt sources and 464 days later for cadmium sources. This would be repeated at the same half-life intervals for each source as it decays further. For example, at 540 days (i.e., two half-lives) after manufacture of an XRF instrument of this model if it has a cobalt source should have its open-shutter time be 60 seconds (i.e., two times two, or four times the nominal time), at 810 days (i.e., three half-lives), 120 seconds (i.e., two multiplied by itself three times, that is, eight times the nominal time), and so on.

XRF Performance Characteristic Sheets (PCS) typically report different inconclusive ranges or thresholds (see section IV.G, below) for different nominal times and different substrates. This may affect the number of paint-chip samples that must be collected as well as the length of time required for the inspection. Some XRF devices have different modes of operation with different nominal reading times. Inspectors must use the appropriate inconclusive ranges and other criteria specified on the PCS for each XRF model, mode of operation and substrate. For example, inconclusive ranges specified for a 30-second nominal reading cannot be used for a 5-second nominal reading, even for the same instrument and the same substrate.

Inspectors should record the source age (or the date the manufacturer says the source had its full radiation strength) in the field notes for the inspection. Optionally, the inspector may include this information in description of the XRF testing method in the inspection report.

D. XRF Calibration Check Readings

In addition to the manufacturer's recommended warm up and quality control procedures, the XRF operator should take the quality control readings recommended below, unless these are less stringent than the manufacturer's instructions. Quality control for XRF instruments involves readings to check calibration. Most XRFs cannot be calibrated on-site; actual calibration can only be accomplished in the factory. You should also review ASTM E211900, 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. Frequency and Number of Calibration Checks

For each XRF instrument, two sets of XRF calibration check readings are recommended at least every 4 hours. The first is a set of three nominal-time XRF calibration check readings to be taken before the inspection begins. The second occurs either after the day's inspection work has been completed, or at least every 4 hours, whichever occurs first. To reduce the amount of data that would be lost if the instrument were to go out of calibration between checks, and/or if the manufacturer recommends more frequent calibration checks, the calibration check can be repeated more frequently than every 4 hours. If the XRF manufacturer recommends more frequent calibration checks, the manufacturer's instructions should be followed. Calibration should also be checked before the XRF is turned off (for example, to replace a battery or before a lunch break) and after it is turned on again. For example, if an inspection of a large house took 6 hours, there would be three calibration checks: one at the beginning of the inspection, another after 4 hours, and a third at the end of the inspection.

If the XRF is not turned off as the inspector travels from one dwelling unit to the next, calibration checks do not need to be done after each dwelling unit is completed. For example, in multi-family housing, calibration checks do not need to be done after each dwelling unit is inspected; once every 4 hours is usually adequate. Some inspectors do a calibration check between units for two reasons: first, if the instrument goes out of calibration during the inspection of the unit, only that unit needs to be reinspected, and, second, if the inspector inadvertently misses a calibration check, the period between checks is less likely to exceed 4 hours.

Some instruments automatically enter a "sleep" or "off" state when not being used continually to prolong battery life. It is not necessary to perform a calibration check before and after each "sleep" state episode, unless the manufacturer recommends otherwise.

2. Calibration Check Standard Materials

Portable XRF calibration check readings are taken on the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) or NIST Certified Reference Material using the nominal 1.0 mg/cm^2 paint film (or nearly 1.0 in older sets) within the SRM. The complete set of paint films can be obtained by calling (301) 975-2200 or using the NIST SRM site at ***http://www.***

nist.gov/srm/index.cfm . As of the publication of this edition of these *Guidelines*, the SRM for ***Lead Paint Films for Portable XRF Analyzers*** is a set of paint films numbered SRM 2579a, its cost was $397. (At some point, this SRM may be depleted and NIST may begin selling another SRM in its place; its number (possibly 2579b) may be found by searching the NIST SRM site for "Lead Paint Films," or asking NIST staff for an SRM for Lead Paint Films)

Calibration checks should be taken through the SRM paint film with the film positioned at least 1 foot (0.3 meters) away from any potential source of lead. The NIST SRM film should not be placed on a tool box, suitcase, or surface coated with paint, shellac, or any other coating to take calibration check readings. Rather, the NIST SRM film should be attached to a solid (not plywood) wooden board or other non-metal rigid substrate such as drywall, or attached directly to the XRF probe. The SRM should be positioned so that readings of it are taken when it is more than 1 foot (0.3 meters) away from a potential source of error. For example, the NIST SRM film can be placed on top of a 1 foot (0.3 meter) thick piece of Styrofoam or other lead-free material, as recommended by the manufacturer before taking readings.

3. Recording and Interpreting Calibration Check Readings

Each time calibration check readings are made, three readings should be taken. These readings should be taken using the nominal time which will be used during the inspection, selected from among those specified in the PCS. The open shutter time should be adjusted, if necessary, to reflect the age of the radioactive source (see section IV.C, above). The readings can be recorded on the "Calibration Check Test Results" form (Form 7.2 in Addendum 2), on a comparable form, or stored in the instrument's memory, and printed out or transferred to a computer later. The average of the three calibration check readings should be calculated, rounded to the same number of decimal places as the XRF instrument displays, and recorded on the form.

Large deviations from the NIST SRM value will alert the inspector to problems in the instrument's performance. If the observed calibration check average is outside of the acceptable calibration check tolerance range specified in the instrument's PCS, the manufacturer's instructions should be followed to bring the instrument back into control. A successful calibration check should be obtained before additional XRF testing is conducted. Readings not accompanied by successful calibration checks at the beginning and end of the testing period are unreliable and should be repeated after a successful calibration check has been made. If a backup XRF instrument is used as a replacement, it must successfully pass the initial calibration check test before retesting the affected test locations. (Current sheets are available at ***www.hud.gov/offices/lead/lbp/hudguidelines/allpcs.pdf***.)

This procedure assumes that the HUD/EPA lead-based paint standard of 1.0 mg/cm^2 is being used. If a different standard is being used, other NIST SRMs should be used to determine instrument performance against the different standard (see Section IV D 2). At the time of the publication of this edition of these *Guidelines*, , however, no method for determining XRF performance characteristics using different standards has been developed.

E. Substrate Correction

XRF readings are sometimes subject to systematic biases as a result of interference from substrate material beneath the paint. The magnitude and direction of bias depends on the substrate, the specific XRF instrument being used, and other factors such as temperature and humidity. Results

can be biased in either the positive or negative direction and may be quite high.

1. When Substrate Correction Is Not Required

Some XRF instruments do not need to have their readings corrected for substrate bias on any substrate. Other instruments may only need to apply substrate correction procedures on specific substrates and/or when XRF results are below a specific value. The *XRF Performance Characteristic Sheet* should be consulted to determine the requirements for a specific instrument and each mode of operation (e.g., nominal time, or time required for intended precision). XRF instruments which do not require correction for any substrate, or require corrections on only a few substrates, have an advantage in that they simplify and shorten the inspection process.

2. Substrate Correction Procedure

XRF results are corrected for substrate bias by subtracting a correction value determined separately in each house for each type of substrate where lead paint values are in the substrate correction range indicated on the XRF Performance Characteristic Sheet (PCS). In single-family housing, the substrate correction value is determined using the specific instrument(s) used in that house. The correction value (formerly called "Substrate Equivalent Lead" or "SEL") is an average of six XRF readings, with three taken from each of two test locations that have been scraped visually clean of their paint coating. The locations selected for removal of paint should have an initial XRF reading on the painted surface of less than 2.5 mg/cm^2, if possible. If all initial readings on a substrate type are greater than 2.5 mg/cm^2, the locations with the lowest initial reading should be chosen. Because available data indicate that surfaces with XRF readings in excess of about 3.0 mg/cm^2 or 4.0 mg/cm^2 are almost always coated with lead-based paint, and since bleed-through of lead into the substrate may occur, or pipes and similarly interfering building components may be behind the material being evaluated, locations with such high readings should be avoided for substrate correction.

After all XRF testing has been completed but before the final calibration check test has been conducted, XRF results for each substrate type should be reviewed. If any readings fall within the range for substrate correction for a particular substrate, obtain the substrate correction value.

On each selected substrate requiring correction, two different testing combinations must be chosen for paint removal and testing. For example, if the readings are inconclusive for some wooden baseboards, select two baseboards, each from a different room. If some wooden doors also require substrate correction, the inspector should take substrate correction readings on one door and one baseboard. Selecting the precise location of substrate correction should be based on the inspector's ability to remove paint thoroughly from the substrates, the similarity of the substrates, and their accessibility. The XRF probe faceplate must be able to be placed over the scraped area, which should be completely free of paint or other coatings.

The size of the area from which paint is taken depends on the size of the analytical area of the XRF probe faceplate; normally, the area is specified by the manufacturer. To ensure that no paint is included in the bare substrate measurement, the bare area on the substrate should be slightly larger than the analytical area on the XRF probe faceplate.

In all, six readings must be taken for each substrate type that requires correction. All six must be averaged together. Take three readings on the first *bare* substrate area. Record

the substrate and XRF readings on the "Substrate Correction Values" form (Form 7.3 in Addendum 2) or a comparable form. Repeat this procedure for the second *bare* substrate area and record the three readings on the same form. Substrate correction values should be determined using the same instrument used to take readings on the painted surfaces. If more than one XRF model was used to take readings, apply the substrate correction values as specified on each instrument's PCS.

Compute the correction value for each substrate type that requires correction by computing the average of all six readings as shown below and recording the results on the "Substrate Correction Values" form. The formula given below should be used to compute the substrate bias correction value for XRF readings taken on a bare substrate that is not covered with NIST SRM film. A different formula should be used when SRM film must be placed over the bare substrate. The PCS specifies when this correction is necessary and provides the formula for computing the correction value.

For each substrate type requiring substrate correction, transfer the correction values to the "Single-Family Housing LBP Testing Data Sheet" (Form 7.1). Correct XRF readings for substrate interference by subtracting the correction value from each XRF reading.

Example: Suppose that a house has 50 testing combinations with wood substrates. The PCS states that a correction value for XRF results taken on those wood testing combinations that have values less than 4.0 mg/cm^2 must be computed. Select two test locations from the testing combinations that had uncorrected XRF results of less than 2.5 mg/cm^2. Completely remove the paint from these two test locations and take three nominal-time XRF readings on the bare substrate at each location. The six XRF readings at the two random locations are:

Master Bedroom Wood Door (mg/cm^2)			Kitchen Wood Baseboard (Room 4) (mg/cm^2)		
First	Second	Third	First	Second	Third
1.32	0.91	1.14	1.21	1.03	1.43

The correction value is the average of the six values:

Correction value = (1.32 + 0.91 + 1.14 + 1.21 + 1.03 + 1.43) mg/cm^2 / 6 = 1.17 mg/cm^2

In this same house, three different wood testing combinations were inspected for lead-based paint and the XRF results are: 1.63 mg/cm^2, 3.19 cm/mg^2, and 1.14 mg/cm^2. Correcting these three XRF measurements for substrate bias produce the following results:

First corrected measurement = 1.63 mg/cm^2 – 1.17 mg/cm^2 = 0.46 mg/cm^2

Second corrected measurement = 3.19 mg/cm^2 – 1.17 mg/cm^2 = 2.02 mg/cm^2

Third corrected measurement = 1.14 mg/cm^2 – 1.17 mg/cm^2 = -0.03 mg/cm^2

The third corrected result shown above is an example of how random error in XRF measurements can cause the corrected result to be less than zero. (Random measurement error is present whenever measurements are taken). Note that correction values can be either positive or negative. In short, negative corrected XRF values should be reported if supported by the data.

Finally, suppose an XRF result of 1.24 mg/cm^2 has a correction value of negative 0.41 mg/cm^2. Subtracting a negative number is the same as adding its positive value. Therefore, the corrected measurement would be:

Corrected result = 1.24 mg/cm^2 – (-0.41 mg/cm^2) = 1.24 mg/cm^2 + 0.41 mg/cm^2 = 1.65 mg/cm^2

3. Negative Values

If more than 20 percent of the corrected values are negative, the instrument's lead paint readings and/or the substrate readings are probably in error. Calibration should be checked and substrate measurements should be repeated.

F. Discarding Readings

If the manufacturer's instructions call for the deletion of readings at specific times, *only* readings taken at those specific times should be deleted. Similarly, readings between a successful calibration check and a subsequent unsuccessful calibration check must be discarded. Readings should not be deleted based on any criteria other than what is specified by the manufacturer's instructions or the *HUD Guidelines.* For example, a manufacturer may instruct operators to discard the first XRF reading after a substrate change. If so, *only* the first reading should be discarded after a substrate change.

G. Classification of XRF Results

XRF results are classified as positive, negative, or inconclusive.

A positive classification indicates that lead is present on the testing combination at or above the HUD/EPA standard; as of the publication of this edition of these *Guidelines,* the standard is 1.0 mg/cm^2. A positive XRF result is any value greater than the upper bound of the inconclusive range, or greater than or equal to the threshold, as specified on the applicable XRF Performance Characteristic Sheet (PCS).

A negative classification indicates that lead is not present on the testing combination at or above the HUD/EPA standard. A negative XRF result is any value less than the lower bound of the inconclusive range, or less than the threshold, specified on the PCS.

An *inconclusive* classification indicates that the XRF cannot determine with reasonable certainty whether lead is present on the testing combination at or above the HUD/EPA standard. An inconclusive XRF result is any value falling within the inconclusive range on the PCS (including the boundary values defining the range). In single-family housing, all inconclusive results should be confirmed by analysis by a laboratory recognized by EPA, under NLLAP, for analysis of lead in paint, unless the client wishes to assume that all inconclusive results are positive.

Positive, negative, and inconclusive results apply to the actual testing combination and to any repetitions of the testing combination that were not tested in the room equivalents. Positive results also apply to similar component types in room equivalents that were not tested. For example, suppose that one baseboard in a room equivalent is tested, and that the inspector decided that all four baseboards are a single testing combination. The single XRF result applies to all four baseboards in that room equivalent.

When an inconclusive range is specified on the PCS, the inconclusive range includes its upper and lower bounds. XRF results are classified as positive if they are greater than the upper boundary of the inconclusive range, negative if they are less than the lower boundary of the inconclusive range, or inconclusive otherwise. For example (as in the table below), if the inconclusive range is 0.51 mg/

cm^2 to 1.49 mg/cm^2, an XRF result of 0.50 mg/cm^2 is considered negative, because it is less than 0.51; a result of 0.6 mg/cm^2 is inconclusive; and a result of 1.5 mg/cm^2 is positive. Results of 0.51 mg/cm^2, 1.00 mg/cm^2, or 1.49 mg/cm^2 would be inconclusive. If the instrument reads to only one decimal place (such as 0.5 mg/cm^2), the reading is treated as having a 0 in the second decimal place (as if the reading were 0.50 mg/cm^2) for classifying the result with respect to its inconclusive range.

	Inconclusive Range in PCS		
	Lower limit (mg/cm^2)	Upper limit (mg/cm^2)	
Reading (mg/cm^2)			**Classification**
0.50	Below lower limit		Negative
0.51	At lower limit		Inconclusive
0.60	Above lower limit	Below upper limit	Inconclusive
1.00	Above lower limit	Below upper limit	Inconclusive
1.49		At upper limit	Inconclusive
1.50		Above upper limit	Positive

Different XRF models have different inconclusive ranges, depending on the specific XRF model and the mode of operation. The inconclusive range may also be substrate-specific.

In some cases, the upper and lower limits of the inconclusive range are equal; that value is called the *threshold*. If the reading is less than the threshold, then the reading is considered negative. If the reading is equal to or greater than the threshold, then the reading is considered positive.

Use of the inconclusive range and threshold is detailed in the performance characteristic sheet. The categories include substrate-corrected results, if substrate correction is indicated. XRFs with *only* threshold values listed on the PCS are advantageous in that classifications of results are either positive or negative (no XRF readings are inconclusive).

Note that the final inspection report should **not** list inconclusive readings as a third category in addition to positive and negative. There are two options for addressing inconclusive readings:

- A paint chip may be sampled and sent to a laboratory recognized by EPA, under NLLAP, for analysis of lead in paint.
- If the client agrees, all inconclusive readings may be assumed to be positive. It is not permissible to assume any inconclusive reading is negative.

H. Evaluation of the Quality of the Inspection

The person responsible for purchasing inspection services – the homeowner, property owner, housing authority, prospective buyer, occupant, contractor, etc.; also known as the client – should consider evaluating the quality of the work using one or more of the methods listed below. Evaluation methods include direct observation, immediate provision of results, repeated testing, and time-and-motion analysis. Direct observation of the inspection should be used whenever possible. If this quality evaluation is to be conducted, the inspection contract should outline the financial penalties that will occur

if an inspector fails to perform as contracted during any visit. The certified lead-based paint inspection firm remains responsible, of course, for performing the inspection properly, even when the client, or a representative, has evaluated the quality of the work.

1. Direct Observation

An evaluation of a lead-based paint inspection is best made if a knowledgeable observer is present for as much of the XRF testing as possible. This is the only way to ensure that all painted, varnished, shellacked, wallpapered, stained, or other coated testing combinations are actually tested, and that all XRF readings are recorded correctly. Employ as the observer someone who is trained in lead-based paint inspection and who is independent of the inspection firm.

If it is not feasible for the client or the client's representative to be present throughout the inspection, that person should conduct unannounced and unpredictable visits to observe the inspection process. The number of unannounced visits will depend on the results of prior visits. When observing ongoing XRF testing, review the test results for the room equivalent currently being tested and for the previously inspected room equivalent. Even if the first visit is fully satisfactory, follow-up visits should be conducted throughout the inspection.

2. Immediate Provision of Results

The client, or a representative, should ask the inspector to provide copies or printouts of results on completed data forms immediately following the completion of the inspection or on a daily basis. Alternatively, the client, or a representative, should visually review the inspector's written results to ensure that they are properly recorded for all surfaces that require XRF testing. If surfaces have been overlooked or recorded incorrectly, the inspection process should be stopped and considered deficient. Clients should retain daily results to ensure that the data in the final report are the same as the data collected in the home.

3. Repeated Testing of 10 Surfaces

Data from HUD's private housing lead-based paint hazard control program show that it is possible to successfully retest painted surfaces without knowing the exact spot which was tested.

Select 10 testing combinations at random from the already compiled list in the "Single-Family Housing LBP Testing Data Sheet" for retesting (see forms in Addendum 2 of this chapter). Observe the inspector during the retesting. If possible, the same XRF instrument used in the original inspection should be used in the retesting. If the XRF instrument used in the original inspection is not available and cannot be returned to the site, use an XRF of the same model for retesting. Use the same procedures to retest the 10 testing combinations. The 10 repeat XRF results should be compared with the 10 XRF results previously made on the same testing combinations.

The repeat readings and the original readings should not be corrected for substrate bias for the purpose of this comparison. The average of the 10 repeat XRF results should not differ from the 10 original XRF results by more than the retest tolerance limit. The procedure for calculating the retest tolerance limit is specified in the PCS. If the limit is exceeded, the procedure should be repeated using 10 different testing combinations. If the retest tolerance limit is exceeded again, the original inspection is considered deficient.

4. Time-and-Motion Analysis

Anyone who contracts for a lead-based paint inspection can also perform a simple check to determine if the inspector had sufficient time to complete the number of housing units reported as being tested in the time allotted. Usually, inspections require at least 1 to 2 hours per housing unit using technology in common use at the time of publication of these *Guidelines*, with the number of rooms and the complexity of the surfaces among the factors that affect the inspection duration. A one-bedroom apartment may require considerably less time. If the inspector's on-site time is significantly less than the expected duration, the situation should be looked into further to determine if the inspector actually completed the work described in the report.

I. Documentation in Single-Family Housing

1. Data Forms

Data can be recorded on handwritten forms, electronically, or by a combination of these two methods. XRF readings can be entered on handwritten forms, such as the set of forms provided in Addendum 2 – Data Collection Forms (or comparable forms). Because handwriting and keyboard entry can result in transcription errors, handwritten and keyboard-entered forms should be examined for missing data and copying errors.

2. Electronic Data Storage

Electronic data storage is recommended only if the data recorded are sufficient to allow another person to find the testing combination that corresponds to each XRF reading. Electronically stored data should be printed in hard copy either daily or at the completion of the inspection, unless the inspector (or the inspection firm) has an electronic data archiving procedure in place. The data should be examined for extraneous symbols, extra data, and missing data, including missing test location identification. In most cases, electronic data storage is supplemented by manual data recording of sampling location, operator name, and other information, although some XRF instruments allow at least some of this supplemental information to be stored on the instrument.

3. Final Report

The final report must include both a summary and complete information about the site, the inspector, the inspection firm, the inspection process, and the inspection results. Report writing is an important element of completing lead-based paint inspections. The professional responsibilities of an inspector include writing reports that are well-written, understandable, and meet EPA requirements. Clients, such as owners, are encouraged to request report revisions for clarity and regulatory compliance.

The full report should include a complete data set, including:

- Date of each inspection.

- Address of building.
- Date of construction.
- Apartment numbers (if applicable).
- Name, address, and telephone number of the owner or owners of each residential dwelling or child-occupied facility.
- Name, signature, and certification number of each certified inspector and/or risk assessor conducting testing.
- Name, address, and telephone number of the certified firm employing each inspector and/or risk assessor, if applicable.
- Each testing method and device and/or sampling procedure employed for paint analysis, including quality control data and, if used, the serial number of any x-ray fluorescence (XRF) device.
  - It is typical to include the name of the instrument manufacturer and model number, as well.
- Specific locations of each painted component tested for the presence of lead-based paint.
  - It may be helpful to provide the numbering system or sketches that identify building components and room equivalents.
- The results of the inspection expressed in terms appropriate to the sampling method used.
  - The report should start with a plain-language summary of the results of the inspection.
    - As part of its overview of the results of the inspection, the summary should answer two questions:
      - Is there lead-based paint in the house?
      - If lead-based paint is present, where is it located?
  - The report should include the final classification of all testing combinations into positive or negative categories, including a list of testing combinations, or building component types and their substrates, which were classified but not individually tested (see below).
  - It is typical to include tables or listings of all XRF readings (including calibration check readings), and of the results of any paint-chip analyses that were performed (including the name, address, telephone number and NLLAP recognition number of the laboratory(ies) that conducted the analyses). If codes or abbreviations for building components and/or locations have been used in order to shorten the time needed for data entry, the inspection report must include a table showing their meaning.

As noted above, *the final report should* ***not*** *list inconclusive readings as a third category in addition to positive and negative.* The report should include the actual readings for any testing combinations for which readings were inconclusive, and were classified as positive by assumption, **or** which, after the XRF testing, were analyzed by a laboratory recognized by EPA, under NLLAP, for analysis of lead in paint, and what the results of that analysis were, including the paint level and whether or not it is lead-based paint.

Note that final classifications are needed for building component types and their substrates that were not actually tested in the single-family property. For example, if the client wants to suspend testing on testing combinations that were found to be positive in the first five room equivalents and are assumed to be positive in the remaining rooms, the final report should list those testing combinations that are assumed to be positive.

The summary should also contain language regarding disclosure, such as one of the following blocks of text, based on whether lead-based paint was found or was not found, respectively:

Recommended Report Language On Disclosure Where Lead-Based Paint Was Identified in Target Housing

Results of this inspection must be provided to new lessees (tenants) and prospective buyers of this property under Federal law (24 CFR part 35 and 40 CFR part 745) before they become obligated under a lease or sales contract. The complete report must be provided by the owner to prospective buyers and it must be made available to prospective tenants, and to renewing tenants if they have not been provided the information previously. The inspector's plain language summary of the report must be provided to the client (e.g., property owner or manager) when the complete report is provided. The landlord (lessor) or seller is also required to distribute an educational pamphlet approved by the U.S. Environmental Protection Agency and include the Lead Warning Statement in the leases or sales contracts to ensure that parents have the information they need to protect their children from lead-based paint hazards. Complete disclosure requires the landlord/sellers and renters/buyers (and their agents) to sign and date acknowledgement that the required information and materials were provided and received. Also, prospective buyers must be provided the opportunity to have their own lead-based paint inspection, lead hazard screen or risk assessment performed before the purchase agreement is signed; the standard period is 10 days, but this period may be changed or waived by agreement between the seller and prospective buyer. EPA regulations require the inspector to keep the inspection report for at least 3 years.

(See section IV of chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* for further details; see ***www.hud.gov/lead***.)

Recommended Report Language For Disclosure Where No Lead-Based Paint Was Identified in Target Housing

The results of this inspection indicate that no lead in amounts greater than or equal to 1.0 mg/cm^2 in paint was found on any building components, using the inspection protocol in chapter 7 of the *HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (current Revision as of the date of the inspection).* However, some painted surfaces may contain levels of lead below 1.0 mg/cm^2, which could create lead dust or lead-contaminated soil hazards if the paint is turned into dust by abrasion, scraping, or sanding. This report should be kept by the inspector and the owner, and all future owners for the life of the dwelling. EPA regulations require the inspector to keep the inspection report for at least 3 years.

Sales: Disclosure is required when selling this dwelling. The complete report must be provided by the owner (seller) to prospective buyers. The inspector's plain language summary of the report must be provided to the client (e.g., property owner or manager) when the complete report is provided. The seller is required to distribute the report, an educational pamphlet approved by the U.S. Environmental Protection Agency, and include the Lead Warning Statement in the sales contract to ensure that parents have the information they need to protect their children from lead-based paint hazards. Complete disclosure requires the seller (and any agents) to sign and date acknowledgement that the required information and materials were provided and received. Furthermore, prospective buyers must be provided the opportunity to have their own lead-based paint inspection, lead hazard screen and/or risk assessment performed before the purchase agreement is signed; the standard period is 10 days, but this period may be changed or waived by agreement between the seller and prospective buyer.

Leases: This dwelling qualifies for the exemption in 24 CFR part 35 and 40 CFR part 745 for target housing being *leased* that is free of lead-based paint, as defined in the rule. No disclosure is required when renewing a lease or leasing this dwelling to new tenants.

(See section IV of chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* for further details; see ***www.hud.gov/lead***.)

Detailed documentation of the XRF testing should also be provided in the full report, including the raw data upon which it was based. The single-family housing forms provided at the end of this chapter or comparable forms would serve this purpose.

For a leased home, where no lead-based paint is identified during an inspection, the building owner is exempt from the requirements of the disclosure rule. However, when a housing unit with no lead-based paint is being sold, the owner still has responsibilities under the Disclosure Rule (e.g., providing a lead hazard information pamphlet to potential buyers), so owners should take measures to ensure the preservation and availability of the reports for the life of the building. For

leasing properties where no lead-based paint is identified, it is strongly recommended that owners retain inspection reports for the life of the building, in order to prove that leases in the building are exempt from the disclosure rule. Owners may wish to make arrangements with inspectors to store their copy of the report for longer than the 3 years required of the inspector (40 CFR 745.227(i); this also applies to risk assessment reports). (See Appendix 6 for more information on the Disclosure Rule.)

V. Inspections in Multi-family Housing

This section emphasizes the additional considerations for random sampling of large housing buildings or projects. The protocols mentioned in earlier sections are not repeated here. It will be necessary to read section IV on single-family housing to implement the protocol for multi-family housing.

Use of the multi-family protocol is less time-consuming and more cost effective than inspecting all units in a given housing development or building because in most instances a pattern can be determined after inspecting a fraction of the units. The number of units tested is based on the date of construction and the number of units in the housing development.

- For purposes of this chapter only, multi-family housing is defined as any group of more than four units that are similar in construction from unit to unit.

A. Statistical Confidence in Dwelling Unit Sampling

The number of similar units, similar common areas or exterior sites to be tested (the sample size) is based on the total number units, similar common areas or exterior sites in the building(s), as specified in Table 7.3. Use the table for sampling each set of similar units, each set of similar common areas, and each set of exterior sites, separately (that is, do *not* add the number of units, common areas and exterior sites, and then use the table for the total). For pre-1960 or unknown-age buildings or developments with 1,040 or more similar units, similar common areas or exterior sites, test 5.8 percent of them, and round up any fraction to the next whole number. For 1960-77 buildings or developments with 1,000 or more units, test 2.9 percent of the units, and round up any fraction to the next whole number. For reference, the table shows entries from 1500 to 4000 in steps of 500. For example, in a development built in 1962, with 200 similar units, 20 similar common areas, and 9 similar exterior sites, sample 27 units, 16 common areas, and all 9 exterior sites.

If lead levels in *all* units, common areas or exterior sites tested are found to be below the 1.0 mg/cm^2 standard, these sample sizes provide 95 percent confidence that:

- For pre-1960 housing units, less than 5 percent or fewer than 50 (whichever is less) units, common areas or exterior sites, have lead at or above the standard; and
- For 1960 to 1977 housing units, less than 10 percent or fewer than 50 (whichever is less) units, common areas or exterior sites, have lead at or above the standard.

The National Survey of Lead and Allergens in Housing (***http://www.hud.gov/offices/lead/researchers.cfm***) showed that there are fewer lead paint hazards in 1960-1977 housing than in older housing (Jacobs et al., 2002). A higher margin of error was allowed for 1960-1977 housing units to focus resources on housing with the greatest hazards. Refer to Appendix 12 of these *Guidelines* for the statistical calculations for this table. The Appendix shows the details of the calculation for pre-1960-1977 housing, which are the same for 1960-1977 housing except for using the 10 percent criterion rather than the 5 percent criterion used for older housing.

Although the data set used to develop sample sizes in multi-family housing was not randomly selected from all multi-family housing developments in the nation (no such data set is available), analyses drawn from the data are likely to err on the side of safety and public health for at least two reasons: First, the prevalence and amounts of lead-based paint are highest in pre-1960 housing developments. The sampling approach used here focuses inspection efforts on buildings where a greater chance of lead-based paint hazards exist.

The statistical rationale and calculations used to develop sample sizes in multi-family housing is based on a data set which contains approximately 164,000 XRF readings from 23,000 room equivalents in 3,900 units located in 65 housing developments. Statistical and theoretical analyses completed for HUD are available through the Lead Clearinghouse at 1-800-424-LEAD and in Appendix 12.

Second, and perhaps more important, none of the 65 developments had lead-based paint in 5 to 10 percent of the units. That indicates lead-based paint in this range is likely to be quite rare and that plausible increases in sampling to improve detection in this range will fail to improve confidence in the results significantly. Most painting follows a pattern: Property owners or managers often paint all surfaces, all components within a room, or similar components in all rooms in a unit when there is tenant turnover. It is unlikely that lead-based paint distributions are completely random, as assumed in the 1995 edition of the *Guidelines.* From the available data, there appears to be no significant benefit to increasing the number of units to be sampled to detect a prevalence rate of 5 to 10 percent, because few developments are likely to be in that range. In short, the sampling design presented here will yield a more targeted, cost-effective approach to identifying lead-based paint where it is most likely to exist.

B. Selection of Housing Units, Common Areas, and Exterior Site Areas.

The first step in selecting housing units is to identify buildings in the development with a common construction based on written documentation or visual evidence of construction type. Such buildings can be grouped together for sampling purposes. For example, if two buildings in the development were built at the same time by the same builder and appear to be of similar construction, all of the units in the two buildings can be grouped for sampling purposes, as can the common areas, and exterior site areas. Units can have different sizes, floor plans, and number of bedrooms and still be grouped allowing use of table 7.3 to determine the minimum number to be inspected. Similar common areas can be grouped for sampling purposes using the table to determine the minimum number to be inspected, as can similar exterior sites. (Do *not* add the number of units, common areas and exterior sites, and then use the table for the total.)

Table 7.3 Number of Units to be Tested in Multi-family Building or Developments*

Number of Similar Units, Similar Common Areas, or Similar Exterior Sites	Pre-1960 or Unknown-Age Building or Development: Number of Units to Test *	1960-1977 Building or Development: Number of Units to Test *
1-10	All	All
11-13	All	10
14	All	11
15	All	12
16-17	All	13
18	All	14
19	All	15
20	All	16
21-26	20	16
27	21	17
28	22	18
29	23	18
30	23	19
31	24	19
32	25	19
33-34	26	19
35	27	19
36	28	19
37	29	19
38-39	30	20
40-48	31	21
49-50	31	22
51	32	22
52-53	33	22
54	34	22
55-56	35	22
57-58	36	22
59	37	23
60-69	38	23
70-73	38	24
74-75	39	24
76-77	40	24

Number of Similar Units, Similar Common Areas, or Similar Exterior Sites	Pre-1960 or Unknown-Age Building or Development: Number of Units to Test *	1960-1977 Building or Development: Number of Units to Test *
78-79	41	24
80-88	42	24
89-95	42	25
96-97	43	25
98-99	44	25
100-109	45	25
110-117	45	26
118-119	46	26
120-138	47	26
139-157	48	26
158-159	49	26
160-177	49	27
178-197	50	27
198-218	51	27
219-258	52	27
259-279	53	27
280-299	53	28
300-379	54	28
380-499	55	28
500-776	56	28
777-939	57	28
940-1004	57	29
1005-1022	58	29
1023-1032	59	29
1033-1039	59	30
1500	87	44
2000	116	58
2500	145	73
3000	174	87
3500	203	102
4000	232	116

* For brevity, "Number of Units" and "Number of Units to Test" are used, but the number to test is the same for similar units, similar common areas, and similar exterior sites.

The specific units to be tested should be chosen *randomly* from a list of all units in each building or buildings. (For brevity, just "units" are mentioned in describing the random selection procedure, but the procedure is the same for similar units, similar common areas, and similar exterior sites.) The "Selection of Units" form (Form 7.4) or a comparable form may be used to aid in the selection process. A complete list of all units in each group should be used and a separate identifying sequential number must be assigned to each unit. For example, if apartment addresses are shown as 1A, 1B, 2A, 2B etc., they must be given a sequence number (1, 2, 3, 4, etc.).

Obviously, units without identifiers could not be selected for inspection and would thus bias the sampling scheme. The list of units should be complete and verified by consulting building plans or by a physical inspection of the development.

Specific units to be tested should be selected randomly using the formula below, and a table of random numbers or the random number function on a calculator. Tables of random numbers are often included in statistics books. Today's common full-function computer spreadsheet software products (e.g., Apple's Numbers, Corel's Quattro Pro, Microsoft's Excel, and OpenOffice.org's Calc,)[1] have random number generator functions of sufficient quality for use in lead-based paint inspections. Inspectors are, therefore, advised to use them to obtain the random numbers, which can then be used to select the specific numbered units. A unit number is selected by rounding up the product of the random number times the total number of units in the development to the *next* whole number. That is:

Housing Unit number = Random number *times* Total number, rounded *up,* where:

Housing Unit number = the identification number for a unit in a list;

Random number = a random number between 0 and 1; *and*

Total number = the total number of units in a list of units.

For example, if there is a total of 50 units in the development, and one of the random numbers is 0.196411, the product of the total number of units *times* that random number (50 x 0.196411) is 9.82055, which is rounded up to 10, which would point to the 10th unit on the list of units.

The same unit may be selected more than once by this procedure. For example, another of the random numbers in the 50-unit development example above could be 0.18347, for which the product (50 x 0.18347) would be 9.1735, which is also rounded up to 10, pointing to the same 10th unit on the list. Because each unit should be tested only once, duplicate selection should be documented and then the duplicate unit should be discarded. The selection procedure should be continued until an adequate number of units have been selected.

The "Selection of Units" form (Form 7.4 in Addendum 2) is completed by filling in as many random numbers as are needed in the appropriate column. Numbers for the third column are obtained by multiplying the total development size by each random number. Numbers for the fourth column are obtained by rounding up from the previous calculation to the next whole number. If the whole number in the fourth column has already been selected, that selection should not be entered again. The notation "DUP" should be entered to show that the selection was a duplicate. This process should continue until the required number of distinct sample numbers has been selected. Common areas and exterior room equivalents should be identified at this time, but they are not considered to be separate units. Addendum 1, Examples of Lead-Based Paint Inspections, includes detailed guidance on the random selection procedure in multi-family housing, and other information about single-family and multi-family inspections.

[1] Product names are provided for reference, without endorsement of the products or their manufacturers.

C. Listing Testing Combinations and Common Areas

The "Multi-family Housing LBP Testing Data Sheet" form (Form 7.5 in Addendum 2) – or a comparable form – should be used to list the testing combinations in each unit, common area and exterior site that was selected for inspection. In multi-family housing, the inventory of testing combinations often will be similar for units that have the same number of bedrooms. The inspector should, however, list testing combinations that are unique to each tested unit. For example, some units may contain built-in cabinets while others do not. The selection of testing combinations should, therefore, be carried out independently in each inspected unit.

As in single family housing, take readings on all testing combinations in all room equivalents in each unit selected for testing. However, common areas need to be identified and tested as well.

Common Areas

Similar common areas and similar exterior sites must always be tested, but in some cases they can be sampled in much the same way that dwelling units are. Common areas and building exteriors typically have a similar painting history from one building to the next. In multi-family housing, each common area (such as a building lobby, laundry room, or hallway) can be treated like a dwelling unit. If there are multiple similar common areas, they may be grouped for sampling purposes in exactly the same way as regular dwelling units are. However, dwelling units, common areas and exterior sites cannot all be mixed together in a single group.

All testing combinations within each common area or on building exteriors selected for testing must be inspected. This includes playground equipment, benches and miscellaneous testing combinations located throughout the development. The specific common areas and building exteriors to test should be randomly selected, in much the same way as specific units are selected using random numbers. (See section IV.B, above.)

The number of common areas to test should be taken from Table 7.3. In this instance, common areas and building exteriors can be treated in the same way as housing units (although they are not to be confused with true housing units).

D. Classification of XRF Results in Multi-family Housing

The inspector should record each XRF reading for each testing combination on the "Multi-family Housing LBP Testing Data Sheet," (Form 7.5) or a comparable form, and indicate whether that testing combination was classified as positive, negative, or inconclusive as described previously for single-family housing.

When the inspection is completed in all of the selected units and the classification rules have been applied to all XRF results, the "Multi-family Housing: Component Type Report" form (Form 7.6) or a comparable form should be completed. Building component types – groups of like components constructed of the same substrate in the multi-family housing development – are aggregated on this form. For example, grouping all interior walls would create an appropriate component type if all walls are plaster. Grouping all doors would not be appropriate; however, if some doors are metal and some are wood. At least 40 testing combinations of a given component type in a multi-family housing development must be tested to obtain the desired level of confidence in the results for that component type. (Refer to Appendix 12 of these *Guidelines* for the statistical rationale for this minimum number of component types to test.) If fewer than 40 testing combinations of a given component type were tested, test additional combinations of that component type. If fewer than 40 components of a given type exist in the units to be tested, test all of the components that do exist.

In some cases additional sampling of the specific component may not be necessary. If no lead at or above the standard is found on that component type, additional measurements should be taken in other units to increase the sample size to 40. However, if all or most of the sampled component types are positive, no further sampling is needed, provided that the building owner agrees with this reduction of testing. For example, if 20 out of 60 doors are tested, and the majority is positive for lead-based paint, all similar doors in the buildings may be presumed positive; only those doors tested and found negative may be treated as negative. Note that the inspector and owner may not presume a component is negative. All required XRF testing and/or laboratory analysis must be completed to conclude that any or all components included in a given component type are negative.

On the "Multi-family Housing: Component Type Report" form, the substrate and the component for each component type should be recorded under the heading "Description" (for example, wooden interior doors), as should the total number of testing combinations included in the component type. In addition, for each component type, the aggregated positive, negative, and inconclusive classifications should be recorded as described below. Record the number and percentage of testing combinations classified as:

- **Positive** for lead-based paint. This is based upon a positive XRF reading in accordance with the XRF's Performance Characteristic Sheet;
- **Low Inconclusive** for lead-based paint. This is based on having XRF readings less than the midpoint of the XRF's inconclusive range (if the XRF instrument does not have an inconclusive range (that is, it has a threshold value), this aggregation element should not be provided);
- **High Inconclusive** (high) for lead-based paint. This is based on having XRF readings equal to or greater than the midpoint of the XRF's inconclusive range (if the XRF instrument does not have an inconclusive range (that is, it has a threshold value), this aggregation element should not be provided); and
- **Negative** for lead-based paint.

The "Multi-family Decision Flowchart" (figure 7.3) should be used to interpret the aggregated XRF testing results in the "Multi-family Housing: Component Type Report" form. The flowchart is applied separately to each component/substrate type (wood doors, metal window casings, etc.) and shows one of the following results:

- **Positive:** Lead based-paint is present on one or more of the components.
- **Negative:** Lead based-paint is not present on the components throughout the development. (Lead may still be present at lower loadings and hazardous leaded dust may be generated during modernization, renovation, repair, remodeling, maintenance, painting or other disturbances of painted surfaces.)

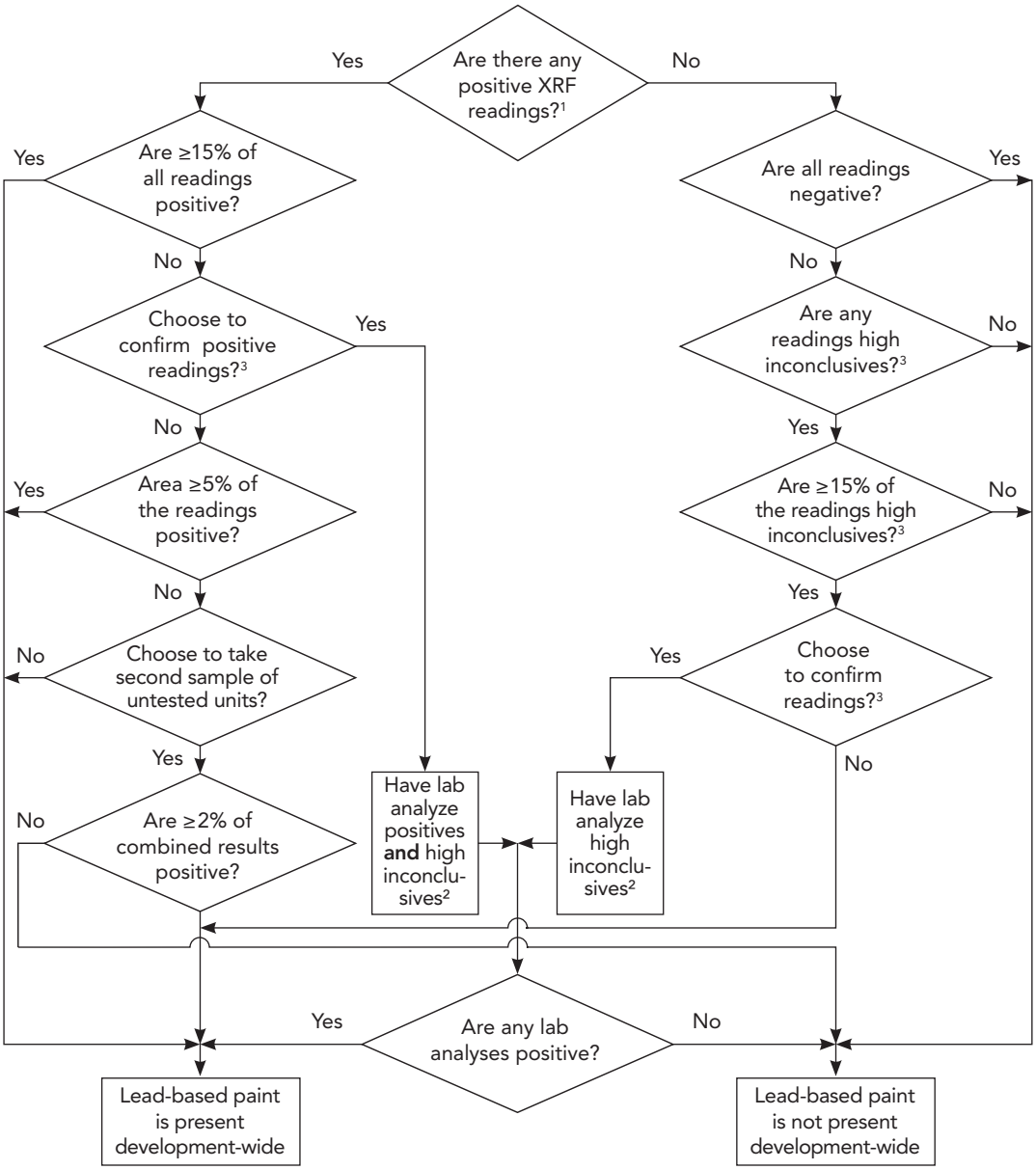
These results are obtained by following the flowchart. The decision that lead-based paint is present is reached with 99 percent confidence if 15 percent or more of the components are positive. (Refer to Appendix 12 for the statistical rationale for this percentage.) The decision that lead-based paint is not present throughout the development is reached if:

(1) 100 percent of the tested component types are negative, or

(2) 100 percent of the tested component types are classified as either negative or inconclusive *and* all of the inconclusive classifications have XRF readings less than the midpoint of the inconclusive range for the XRF in use.

- Note that the midpoint of the inconclusive range is *not* a threshold; it is used only for classifying XRF readings in multi-family housing in conjunction with information about other XRF readings as

FIGURE 7.3 Multi-family Decision Flowchart



[1] "Positive," "negative," and "inconclusive XRF readings are determined in accordance the XRF instrument's Performance Characteristic Sheet (PCS) as described in Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead Hazards in Housing*.

[2] A high inconclusive reading is an XRF reading at or above the midpoint of the inconclusive range (if it equals) around 1.0 mg/cm^2 for the instrument model that is used (see PCS).

For example, if the model's PCS states the inconclusive range is 0.41 to 1.39, then the midpoint would be 0.90. A high inconclusive reading would be from 0.90 to 1.39, and a low inconclusive reading would be from 0.41 to 0.39.

[3] You may assume any part or coating contains lead-based paint, even without XRF or laboratory analysis. Similarly, you may confirm any XRF reading by laboratory analysis.

described here. (See section 2 below for guidance on what to do when the percentage of positive readings is less than 5%.)

- For cases with greater than or equal to 5% positives *and* less than 15% positives, as well as no positives but greater than 15% high inconclusives, some confirmatory laboratory testing may be needed to reach a final conclusion, unless the client wishes to assume the validity of the XRF results and that all inconclusives are positive.
  - For each testing combination with an inconclusive XRF reading at or above the midpoint of the inconclusive range, a paint-chip sample should be analyzed by a laboratory recognized by the EPA NLLAP for the analysis of lead in paint.
  - If all the laboratory-analyzed samples are negative, it is not necessary to test inconclusive XRF results below the midpoint of the inconclusive range.
  - If, however, *any* laboratory results are positive on a component type, all inconclusives equal to or above the midpoint of the inconclusive range should be analyzed, or they should be presumed to be positive.
- Once all laboratory results have been reported, the "Multi-family Housing: Component Type Report" form should be updated to include the laboratory results and classifications (either positive or negative).

The "Multi-family Decision Flowchart" is based on data collected by EPA in a large field study of XRF instruments (EPA 1995b). Percentages were chosen so that, for each component type, there is a 98 percent chance of correctly concluding that lead-based paint is either absent on all components or present on at least one component of a given type. Thus, the probability that a tested component type will be correctly classified is very high.

Percentages of positive or inconclusive results are computed by dividing the number in each classification group by the total number of testing combinations of the component type that were tested. For example, if 245 wooden doors in a multi-family housing development were tested and 69 were classified as inconclusive with XRF readings less than the midpoint of the inconclusive range, 28 percent [(69 / 245) x 100 percent = 28.2 percent] should be recorded on the form in the "<1.0 percent" columns under the heading "Inconclusive."

1. Unsampled Housing Units

If a particular component type in the sampled units is classified as positive, that same component type in the unsampled units is also classified as positive. For those cases where the number of positive components is small, further analysis may determine if there is a systematic reason for the specific mixture of positive and negative results.

For example, suppose that a few porch railings tested negative, but most tested positive. Examination of the sample results in conjunction with the building records showed that the porch railings classified as positive were all original and the railings classified as negative were all recent replacements. The records did not reveal which units had replaced railings, and due to historic preservation requirements, the replacement railings were identical in appearance to the old railings. Thus, all unsampled original porch railings could be classified as positive, and all unsampled recently replaced porch railings could be classified as negative if at least 40 of the replaced porch railings had been tested.

2. Fewer than 5% Positive Results

Where a small fraction of XRF readings, less than 5 percent, of a particular component type are positive, several choices are available:

- First, the inspector may confirm the results by laboratory analysis, which is considered definitive when performed as described in section VI, below; a laboratory lead result of 1.0 mg/cm^2 or greater (or 0.5 percent by weight or greater) is considered positive.
- Second, the inspector may select a second random sample (using unsampled units only) and test the component type in those units. If less than 2.5% of the combined set of results is positive, the component type may be considered as having lead-based paint in isolated locations, but not having lead-based paint development-wide, with a reasonable degree of confidence. Individual components that are classified positive should be considered as being lead-based painted and managed or abated appropriately.
- Finally, if the client chooses not to confirm the results by laboratory analysis and not to take a second set of measurements, then the component type should be considered as having lead-based paint development-wide.

The inspector may wish to advise the client that the cost of additional XRF testing or laboratory analysis is usually much less than the cost of lead abatement or interim control projects. This is of particular interest in the situation where few results are positive, because there is a significant chance that the paint, development-wide, may not be lead-based.

Whatever approaches are used, all painted individual surfaces found to be positive for lead must be included in the inspection report, regardless of development-wide conclusions.

E. Documentation in Multi-family Housing

The method for documentation is identical for multi-family and single-family housing (see section IV.I), with the following exception: Use forms 7.2 through 7.6 for multi-family housing (see Addendum 2) or comparable forms, not the single-family housing forms.

When lead-based paint has been found in some units it must be managed or treated as such in those units, even if the inspection indicates that it is not present development-wide.

VI. Laboratory Testing for Lead in Paint-chip Samples

For inconclusive XRF results, areas that cannot be tested using an XRF instrument, and for client-approved confirmation of XRF, a paint-chip sample should be collected using the protocol outlined here and in Appendix 13.2 of these *Guidelines* and/or ASTM E1729, Standard Practice for Field Collection of Dried Paint Samples for Subsequent Lead Determination. The sample should be analyzed by a laboratory recognized under the EPA National Lead Laboratory Accreditation Program (NLLAP) for the analysis of lead in paint using the analytical method(s) it used to obtain the laboratory's recognition. If a paint-chip sample cannot be collected, the inspection report should include a list of surfaces where paint-chip samples were needed but not taken; the paint on these components is presumed positive.

A. Number of Samples

Only one paint-chip needs to be taken for each testing combination. Additional samples can be collected as a quality control measure, if desired, and are recommended.

B. Size of Samples

The paint-chip sample should be taken from a 4-square-inch (25-square-centimeter) or larger area that is representative of the paint on the testing combination, as close as possible to any XRF reading location and, if possible, unobtrusive (see Figure 7.4). This area may be a 2 by 2 inch (5 by 5 centimeter) square, or a 1 by 4 inch (2½ by 10 centimeter) rectangle, or have any other dimensions that equal at least 4 square inches (25 square centimeters). Regardless of shape, the dimensions of the surface area must be accurately measured (to the nearest 1/16th of an inch or millimeter) and recorded, so that laboratory results can be reported in mg/cm^2. Results should be reported as percent by weight if the dimensions of the surface area cannot be accurately measured or if all paint within the sampled area cannot be removed. In these cases, lead should be reported in ppm or percent by weight, *not* in mg/cm^2. Smaller surface areas can be used if acceptable to the laboratory. The 4-square-inch (25-square-centimeter) area practically guarantees that a sufficient amount of paint will be collected for laboratory analysis. As a result, samples will sometimes weigh more than required for some laboratory analysis methods. Smaller-sized paint-chips may be collected if permitted by the laboratory (see ASTM E1729). In all cases, the inspector should consult with the NLLAP-recognized laboratory selected regarding specific requirements for the submission of samples for lead-based paint analysis.

FIGURE 7.4 Preparing to take a paint-chip sample for laboratory analysis.

C. Inclusion of Substrate Material

Inclusion of small amounts of substrate material in the paint-chip sample will result in minimal error if results are reported in mg/cm^2, but including any amount of substrate can result in less precise results, with worse effect as the amount of substrate increases. Substrate material shall not be included if results are to be reported in weight percent (or ppm) (see Figure 7.5).

FIGURE 7.5 Removing paint-chip sample.

D. Repair of Sampled Locations

Property owners or managers should ensure that areas from which paint-chip samples are collected should be repaired and cleaned, unless the area will be removed, encapsulated, enclosed,

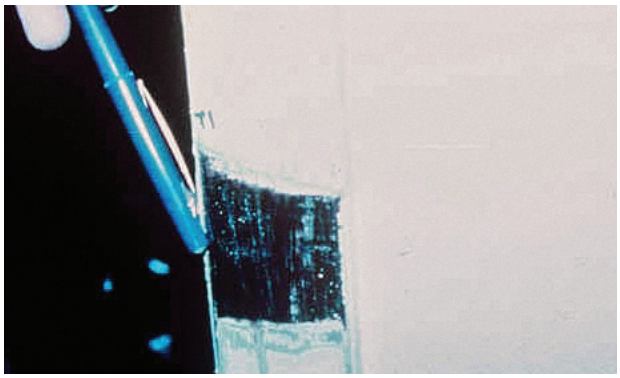


FIGURE 7.6 Damage caused by removal of paint-chip from substrate.

or repainted before occupancy. (Lead-based paint inspectors and risk assessors are not generally responsible for repainting, unless specified in their contracts.) Repairs can be completed by repainting, spackling, or any other method of covering that renders the bare surface inaccessible. Cleanup should be done with wet wiping and rinsing, and it should be done on both the surface and the floor underneath the surface sampled. The new covering or coating should have the same expected longevity as new paint or primer. Repair is not necessary if analysis shows that the paint is not lead-based paint and leaving the damage is acceptable to the client and/or the owner (see Figure 7.6).

E. Classification of Paint-chip Sample Results

Any paint inspections may be carried out using only paint-chip sampling and laboratory analysis at the option of the client, such as the property owner or manager or other purchaser of the inspection services. This option is not recommended because it is time consuming, costly, and requires extensive repairs. Paint-chip sampling also has opportunities for errors, such as inclusion of substrate material (for results in weight percent), failure to remove all paint from an area (including paint that has bled into a substrate) and laboratory error. Nevertheless, paint-chip sampling generally has a smaller error than does XRF and is, therefore, appropriate as a final decision-making tool. Laboratory results of 1.0 mg/cm^2 or greater, or 0.5 percent or greater, are to be considered positive. If the laboratory reports both mg/cm^2 and weight percent for a sample, if either result is positive, use that one for final classification, or both, if they are both positive. In the rare situation where more than one paint-chip sample from a single testing combination is analyzed, the combination is considered positive if any of those samples is positive. All other results are negative. No inconclusive range is reported for laboratory measurements.

F. Units of Measure

Results should be reported in mg/cm^2, the primary unit of measure for lead-based paint analyses of surface coatings. Results should be reported as percent by weight only if the dimensions of the surface area cannot be accurately measured or if not all paint within the sampled area can be removed. In these cases, results should not be reported in mg/cm^2, but in weight percent.

Weight measurements are usually reported as micrograms per gram (µg/g), milligrams per kilogram (mg/kg), or parts per million (ppm) by weight. For example, a sample with 0.2 percent lead may also be reported as 2,000 µg/g lead, 2,000 mg/kg lead, or 2,000 ppm lead.

G. Sample Containers

Samples should be collected in sealable rigid containers such as screw-top plastic centrifuge tubes, rather than plastic bags which generate static electricity and make quantitative transfer of the entire paint sample in the laboratory impossible. Paint-chip collection should include collection of all the paint layers from the substrate, but collection of actual substrate should be minimized. Refer to ASTM E 1729 and Appendix 13 of these *Guidelines* for further details on collection of paint-chip samples.

H. Laboratory Analysis Methods

Several standard laboratory technologies are useful in quantifying lead levels in paint-chip samples. These methods include, but are not limited to, Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES), Anodic Stripping Voltammetry (ASV), and Potentiometric Stripping Analysis (PSA).

For analytical methods that require sample digestion, samples should be pulverized so that there is adequate surface area to dissolve the sample before laboratory instrument measurement. In some cases, the amount of paint collected from a 4-square-inch (25-square centimeter) area may exceed the amount of paint that can be analyzed successfully. It is important that the actual sample mass analyzed not exceed the maximum mass the laboratory has successfully tested using the specified method. If subsampling is required to meet analytical method specifications, the laboratory must homogenize the paint-chip sample (unless the entire sample will eventually be analyzed and the results of the subsamples combined). Without homogenization, subsampling would likely result in biased, inaccurate lead results (see ASTM E 1645 Standard Practice for Preparation of Dried Paint Samples by Hotplate or Microwave Digestion for Subsequent Lead Analysis, and ASTM E1979 Standard Practice for Ultrasonic Extraction of Paint, Dust, Soil, and Air Samples for Subsequent Determination of Lead).

If the sample is properly homogenized and substrate inclusion is negligible, the result can be reported as a loading, in milligrams per square centimeter (mg/cm^2), the preferred unit, or as percent by weight, or both. The following equation should be used to report the results in milligrams per square centimeter:

$$mg/cm^2 = \frac{\text{weight of lead from sample subsample (in mg)} \times \left(\frac{\text{total sample weight (in g)}}{\text{subsample weight (in g)}} \right)}{\text{area (in } cm^2\text{)}}$$

To report results in weight percent, the following equation should be used:

$$\text{Weight percent} = \frac{\text{weight of lead from subsample (in µg)}}{\text{subsample weight (in µg)}} \times 100\%$$

To report results in micrograms per gram (µg/g), the following equation should be used:

$$\mu g/g = \frac{\text{weight of lead from subsample (in µg)}}{\text{subsample weight (in g)}}$$

If the laboratory reports results in both mg/cm^2 and weight percent, and if one result is positive and the other negative, the sample is classified as positive.

Whatever the preparation techniques of paint-chip samples (including homogenization, grinding, and digestion), and instrument selection and operation selected, the inspector should verify, prior to the collection and submission of samples, that the laboratory is approved to perform the appropriate analytical methodologies. Methods should be applied to paint-chip materials of approximately the same mass and lead loading (also called area concentration, measured in mg/cm^2) as those samples anticipated from the field.

Because of the potential for sample mass to affect the precision of lead readings, laboratory analysis reference materials processed with field samples for quality assurance purposes should have close to the same mass as those used for paint-chip samples. Refer to ASTM E1645 or equivalent methods for further details on laboratory preparation of paint-chip samples, and refer to ASTM E1613, ASTM E2051, or equivalent methods on analysis of samples for lead, and the related E1775 Guide for Evaluating Performance of On-Site Extraction and Field-Portable Electrochemical or Spectrophotometric Analysis for Lead.

I. Laboratory Selection

A laboratory used for lead-based paint analysis must be recognized under EPA's National Lead Laboratory Accreditation Program (NLLAP) for analysis of lead in paint, with one exception. The exception is for analyzing samples collected where States or Tribes operate an EPA-authorized lead-based paint inspection certification program that has paint testing requirements different from the EPA requirements, in which case the State or Tribal requirements must be followed. NLLAP-recognized laboratories are required to use the same analytical methods for analyzing the sample that they used to obtain NLLAP recognition.

EPA established NLLAP to provide the public with laboratories that have a demonstrated capability for analyzing lead in paint-chip, dust, and/or soil samples at the levels of concern stated in these *Guidelines*. NLLAP monitors the analytical proficiency, management and quality control procedures of each laboratory participating in the program. NLLAP does not specify or recommend analytical methods. Information on this program can be obtained by calling the National Lead Information Center at 1-800-424-LEAD. (Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.) Useful information on the NLLAP program is available on the EPA web site at ***http://www.epa.gov/lead/pubs/nllap.htm***.

To participate in NLLAP, a laboratory must, as summarized on the EPA's NLLAP web page, ***http://www.epa.gov/lead/pubs/nllap.htm***:

- Be accredited by an organization EPA recognizes as an accrediting body for lead sample analysis. As part of the accreditation process, a laboratory undergoes a systems audit, including an on-site visit, by one of the accrediting bodies. To apply for accreditation as a lead sample analysis laboratory recognized under NLLAP, laboratories contact an accrediting body. NLLAP specifies quality control and data reporting requirements, as described in its "Laboratory Quality System Requirements," (LQSR) which, as of the publication of this edition of these *Guidelines*, was in version 3 (***http://www.epa.gov/lead/pubs/lqsr3.pdf***). EPA has developed a Model Memorandum of Understanding (***http://www.epa.gov/lead/pubs/nllapmou.pdf***) for other organizations, including States and Tribes, to become NLLAP accrediting bodies. As of the publication of these *Guidelines*, EPA recognized three such NLLAP accrediting bodies.

- Participate successfully in the periodic (currently quarterly) Environmental Lead Proficiency Analytical Testing Program (ELPAT), administered by the AIHA Proficiency Analytical Testing Programs, LLC (an affiliate of the American Industrial Hygiene Association (AIHA)) in cooperation with the Centers for Disease Control and Prevention's (CDC's) National Institute for Occupational Safety and Health (NIOSH), and EPA. The proficiency testing samples used in ELPAT consist of various levels of lead in paint, dust, and soil matrices. An accredited laboratory is recognized only for the analysis of only those matrices for which it is proficient; the laboratory

decides which matrices it will analyze for lead for purposes of obtaining NLLAP recognition. Field-portable XRF measurement of lead in paint does not involve collecting a sample of the paint, so it is not covered by NLLAP, and the measurements need not be performed by an NLLAP-recognized laboratory. See Chapter 7 for further guidance.

Field-portable XRF analysis has been used for measurement of lead in dust (Sterling, 2000; Harper, 2002) or soil (EPA, 2004; Binstock, 2009) with varying degrees of success; these methods do involve collecting a sample of the medium, so samples collected from target housing or pre-1978 child-occupied facilities, must be analyzed by a laboratory recognized by NLLAP for analysis of lead in the particular medium. The laboratory may be a mobile laboratory, field sampling and measurement organization, or a fixed-site laboratory, as discussed in Section II.E.6, above.

Information on NLLAP, including an up-to-date list of fixed-site and mobile laboratories recognized by NLLAP, can be obtained on the EPA web site at ***http://www.epa.gov/lead/pubs/nllap.htm***, or by calling the National Lead Information Center at 800-424-LEAD. (Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.)

J. Laboratory Report

The laboratory report for analysis of paint samples for lead should include both identifying information and information about the analysis. At a minimum, this should include the information outlined in the LQSR version 3's section 5.10.2, Test Reports. In addition to the minimum requirements in that section, test reports containing the results of sampling must include specified sampling information, if available. (Inspectors may find the LQSR version 3's Appendix I, Acronyms and Glossary of Terms Associated with the NLLAP, helpful.)

VII. XRF Hazards

As the U.S. Nuclear Regulatory Commission (NRC) notes, "ionizing radiation (such as x-rays and cosmic rays) is more energetic than non-ionizing radiation. Consequently, when ionizing radiation passes through material, it deposits enough energy to break molecular bonds and displace (or remove) electrons from atoms. This electron displacement creates two electrically charged particles (ions), which may cause changes in living cells of plants, animals, and people." (***www.nrc.gov/about-nrc/radiation/health-effects/radiation-basics.html***)

XRF instruments used in accordance with the manufacturer's instructions will not cause significant exposure to ionizing radiation. The operator should be trained by the instrument's manufacturer (or equivalent), instrument's shutter should never be pointed at anyone, even if the shutter is closed, it should be in the operator's possession at all times, it should not be dropped or tossed, and no one should ever defeat or override any of its safety mechanisms.

Some portable XRF instruments used for lead-based paint inspections contain one or more radioactive isotopes that emit X-rays and gamma radiation; some portable XRF instruments use an X-ray tube to generate X-rays. Proper safety training and handling of these instruments is required to protect the instrument operator and any other persons in the immediate vicinity during XRF usage.

A. Licenses and Certifications for Using XRFs with Radioactive Sources

In addition to training and certification in lead-based paint inspection, a person using a portable XRF instrument for inspection that has (one or more) radioactive X-ray sources must have valid licenses or permits from the appropriate Federal, State, and local regulatory bodies to possess (through ownership or lease), and to operate, such an instrument.

All portable XRF instrument operators should be trained by the instrument's manufacturer (or equivalent). XRF operators using an instrument with a radioactive source should provide related training, licensing, permitting, and certification information to the person who has contracted for their services before an inspection begins. Depending on the State, such operators may be required to hold three forms of proof of competency: manufacturer's training certificate (or equivalent) for the operator, a radiation safety license for the firm or entity using the XRF, and a State lead-based paint inspection certificate or license to perform the requested inspection services. To help ensure competency and safety, HUD and EPA recommend that clients hiring inspectors who will use XRF instruments with a radioactive source hire only those who hold all three forms of proof of competency.

The regulatory body responsible for oversight of the radioactive materials contained in portable XRF instruments depends on the type of material being handled. Some radioactive materials are federally regulated by the NRC; others are regulated at the State level. States are generally categorized as "agreement" or "non-agreement" States. An agreement State has an agreement with NRC to regulate radioactive materials that are generally used for medical or industrial applications. (***www.nrc.gov/about-nrc/state-tribal/agreement-states.html***) (Most radioactive materials found in XRF instruments are regulated by agreement States). For non-agreement States, NRC retains this regulatory responsibility directly. At a minimum, however, most State agencies require prior notification that a specific XRF instrument is to be used within the State. Fees and other details regarding the use of portable XRF instruments vary from State to State. Contractors who provide inspection services must hold current licenses or permits for handling XRF instruments, and must meet any applicable State or local laws or notification requirements.

Requirements for radiation dosimetry by the XRF instrument operator (wearing dosimeter badges to monitor exposure to radiation) are generally specified by State regulations, and vary from State to State. In some cases, for some isotopes, no radiation dosimetry is required. Because the cost of dosimetry is low, it should be conducted, even when not required, for the following four reasons:

- XRF instrument operators have a right to know the level of radiation to which they are exposed during the performance of the job. In virtually all cases, the exposure will be far below applicable exposure limits.
- Long-term collection of radiation exposure information can aid both the operator (employee) and the employer. The employee benefits by knowing when to avoid a hazardous situation; the employer benefits by having an exposure record that can be used in deciding possible health claims.
- The public benefits by having exposure records available to them.
- The need for equipment repair can be identified more quickly.

B. Safe Operating Distance

FIGURE 7.7 Lead inspectors should operate XRF instruments at a safe distance from others.

All XRF Instruments: XRF instruments used in accordance with manufacturer's instructions will not cause significant exposure to ionizing radiation. But the instrument's shutter should never be pointed at anyone, even if the shutter is closed. The safe operating distance between an XRF instrument and a person during inspections depends on the source type, radiation intensity, quantity (if any) of radioactive material, and the density of the materials being surveyed. As the radiation source intensity increases, the required safe distance also increases. Placing materials, such as a wall, in the direct line of fire, reduces the required safe distance. Persons should not be near the other side of a wall, floor, ceiling or other surface being tested. Operators should verify that this is indeed the case prior to initiating XRF testing activities, and check on it during testing (see Figure 7.7).

XRF Instruments with Radioactive Sources: According to NRC rules regarding radioactive sources of radiation, the radiation dose to a member of the general public must not exceed 2 millirems per hour. (10 CFR 20.1301(a)(2). (The regulation can be found through ***http://ecfr.gpoaccess.gov/***, or at ***http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-1301.html***.) This can be compared to the 0.07 millirems per hour the NRC says is the average American radiation dose. One of the most intense sources used in portable XRF instruments is a 40-millicurie ^{57}Co (Cobalt-57) radiation source. Other radiation sources in current use for XRF testing of lead-based paint generally produce lower levels of radiation. Generally, an XRF operator conducting inspections according to manufacturer's instructions would be exposed to radiation well below the regulatory level. One study found that exposures to radiation during operation of a Scitec MAP 3 XRF were 132 microrem/day (Wisconsin, 1994). Typically, XRF instruments with lower gamma radiation intensities can use a shorter safe distance provided that the potential exposure to an individual will not exceed the regulatory limit.

If these practices are observed, the risk of excessive exposure to ionizing radiation is extremely low and will not endanger any inspectors or occupants present in the dwelling.

References

Binstock, 2009. Binstock, D.A.; Gutknecht, W.F. McWilliams, A.C. "Lead in Soil - An Examination of Paired XRF Analysis Performed in the Field and Laboratory ICP-AES Results," *International Journal of Soil, Sediment and Water*. 2:2(1), 2009. ***http://scholarworks.umass.edu/intljssw/vol2/iss2/***

EPA, 1995b. U.S. Environmental Protection Agency, *A Field Test of Lead-Based Paint Testing Technologies: Technical Report,* EPA 747-R-95-002b, May 1995.

EPA, 2004. U.S. Environmental Protection Agency, X-ray Fluorescence (XRF) Instruments. Frequently Asked Questions (FAQ). ***http://epa.gov/superfund/lead/products/xrffaqs.pdf***

Harper, 2002. Harper M, Hallmark TS, Bartolucci AA. A comparison of methods and materials for the analysis of leaded wipes. *J. Environmental Monitoring,* 4(6):1025-33, December 2002. ***http://pubs.rsc.org/en/Content/ArticleLanding/2002/EM/b208456m***

HUD, 2011. U.S. Department of Housing and Urban Development, American Healthy Homes Survey: Lead and Arsenic Findings. April 2011. ***http://portal.hud.gov/hudportal/documents/huddoc?id=AHHS_REPORT.pdf***

Jacobs, 2002. Jacobs David E., Robert P. Clickner, Joey Y. Zhou, Susan M. Viet, David A. Marker, John W. Rogers, Darryl C. Zeldin, Pamela Broene, and Warren Friedman. The prevalence of lead-based paint hazards in U.S. housing. *Environmental Health Perspectives*. 2002 Oct; 110(10): A599-606. ***http://www.ncbi.nlm.nih.gov/pubmed/12361941***

NIST, 2000. Rossiter, W.J., Jr., M. G. Vangel, M.E. McKnight and G. Dewalt, *Spot Test Kits for Detecting Lead in Household Paint: A Laboratory Evaluation,* National Institute of Standards and Technology, U.S. Department of Commerce, May 2000. NISTIR 6398. ***http://fire.nist.gov/bfrlpubs/build00/PDF/b00034.pdf***

Sterling, 2000. Sterling DA, Lewis RD, Luke DA, Shadel BN. A portable x-ray fluorescence instrument for analyzing dust wipe samples for lead: evaluation with field samples. Environmental Research, 83(2):174-9, June 2000. ***http://www.sciencedirect.com/science/article/pii/S0013935100940581***.

Westat, 1996. Westat, Inc., "An Analysis and Discussion of the Single Family Inspection Protocol Under the 1995 HUD Guidelines: Draft Report."

Wisconsin 1994. Wisconsin Department of Health and Social Services, memo from Mark Chamberlain dated April 28, 1994.

Addendum 1: Examples of Lead-Based Paint Inspections

A. Example of a Single-Family Housing Inspection

The inspector completed the "Single-Family Housing LBP Testing Data Sheet," recording "bedroom (room 5)" as the room equivalent and listing "plaster" as the first substrate. The completed inventory of testing combinations in the bedroom indicated the presence of wood, plaster, metal, and drywall substrates. Brick and concrete substrates were not present in the bedroom. Descriptions of all testing combinations in the bedroom were recorded. Completed form 7.1, Single Family LBP Test Data Sheet, shows the completed inventory for all testing combinations in the bedroom. (Completed forms are found in Addendum 2, after the blank forms.)

Before any XRF testing, the inspector noted the date and starting time in her field notes, and then performed the manufacturer's recommended warm up procedures. The film was placed more than 12 inches (0.3 meters) away from any other surface. The inspector then took three calibration check readings (1.18 mg/cm^2, 0.99 mg/cm^2, and 1.07 mg/cm^2) on the NIST SRM with a lead level of 1.02 mg/cm^2. Results of the first calibration check readings were recorded on the "Calibration Check Test Results" form (see Completed Form 7.2).

The inspector then averaged the three readings (1.08 mg/cm^2), and computed the calibration difference (1.08 mg/cm^2 - 1.02 mg/cm^2 = 0.06 mg/cm^2) and compared this to the calibration check tolerance shown in the *XRF Performance Characteristic Sheet* (see Completed Form 7.2) for the particular XRF make, model and testing mode used. The calibration difference was not greater than the 0.20 calibration check limits around the NIST SRM standard of 1.02 mg/cm^2, that is, the difference was within the range of 0.82 mg/cm^2 to 1.22 mg/cm^2, inclusive. The instrument was considered in calibration, and XRF testing could begin.

For each component type measured in a room equivalent, the inspector entered the replication number to record its amount/quantity type in that room equivalent. There were two closet doors in the room that were just like each other, so the replication number was 2. During the inspection, some components were not tested. To maintain a complete inventory of surfaces in the house, the inspector used the applicable code from the list at the bottom of Form 7.1. The codes were CPT = carpeted floor; ED = Entry Denied, for situations in which the owner, tenant or someone else denied the inspector access to the room or to test the particular component; IN = Inaccessible, for physical reasons, such as for situations in which the room was locked, debris in front of a window prevented reaching the window safely, etc.; and NC = Not Coated/Painted surface, for those surfaces that are not varnished, painted, lacquered or otherwise coated.

The inspector recorded the results from the XRF testing in the bedroom on the "Single-Family Housing LBP Testing Data Sheet." At that point, the inspector was able to complete this form only through the XRF Reading column (see Completed Form 7.1). The remainder of the form was completed after the testing combinations in the house were inspected and correction values for substrate bias were computed. The inspector then moved on to inspect the next room equivalent.

The other bedroom, the kitchen, a living room, and a bathroom were also inspected. Three substrates – wood, drywall, and plaster – were found in these room equivalents. XRF testing for lead-based paint was conducted, using the same methodology employed in the first bedroom (room 5). After these five room equivalents were tested, the inspector noticed that all baseboards and all crown molding of the same substrate had XRF values of more than 5.0 mg/cm^2. The client had agreed earlier that testing could be abbreviated in this situation, so no further baseboard and crown molding testing combinations were tested in the remaining room equivalents. All similar remaining untested baseboard and crown molding with identical substrates were classified as positive in the final report based on the results of those tested. The raw data for the tested baseboards and crown moldings were also included in the final report.

Four hours after the initial calibration check readings, the inspector took another set of three calibration check readings. (If the inspection had taken less than 4 hours, as is common, the second calibration check test would have been conducted at the end of the inspection.) The readings were 1.45 mg/cm^2, 1.21 mg/cm^2, and 1.10 mg/cm^2; the inspector recorded the results on the "Calibration Check Test Results" form (Completed Form 7.2). The inspector then averaged the three readings (1.25 mg/cm^2), and computed the calibration difference (1.25 mg/cm^2 - 1.02 mg/cm^2 = 0.23 mg/cm^2) and compared this to the calibration check tolerance shown in the *XRF Performance Characteristic Sheet* on Completed Form 7.2. The calibration difference exceeded the 0.20 calibration check tolerance. The inspector then marked "Failed calibration check" on the data sheets for those room equivalents that had been inspected since the last – successful calibration check test, and consulted the manufacturer's recommendations. After trying, the instrument could not be brought back into control. Consequently, the inspector began using a backup instrument, after performing a calibration check and manufacturer's warm up and quality control procedure. The calibration check test showed that the backup instrument was operating acceptably. The inspector used the backup instrument to reinspect the room equivalents checked with the first instrument, and then all the other room equivalents in the home. Next, because substrate correction was required for all results on wood and metal below 4.0 mg/cm^2 as specified in the *XRF Performance Characteristic Sheet* for the XRF model in use, the inspector prepared to take readings for use in the substrate correction computations. Using the random number function on a calculator and the list of sample location numbers, the inspector randomly selected two testing combinations each with wood and metal substrates where initial readings were less than 2.5 mg/cm^2, removed the paint from an area on each selected testing combination slightly larger than the faceplate of the XRF instrument, took three readings on the bare substrates, and recorded the readings on the "Substrate Correction Values" form (Completed Form 7.3). The inspector calculated the correction values for each substrate by averaging the six readings from the two test locations, rounded the result to the 2 places after the decimal point that the XRF instrument displayed, and recorded the information in the Correction Value row. The inspector then transferred the correction values to the "Single-Family Housing LBP Testing Data Sheet" for each corresponding substrate.

After the inspector had finished taking the readings needed to compute the substrate correction values, the inspector took another set of three calibration check readings. The inspector recorded the results on the "Calibration Check Test Results" form, under Second Calibration Check, for readings taken by the backup XRF instrument (Completed Form 7.2). The second (and final) calibration check average did not exceed the 0.20 calibration check tolerance. The inspector, therefore, deemed the XRF testing to be complete.

The inspector then calculated the corrected readings by subtracting the substrate correction value from each XRF result taken on a wood or metal substrate. The substrate correction value was obtained by averaging readings on bare surfaces that had initially measured less than 2.5 mg/cm^2 with the paint still on the surface (Completed Form 7.3). The inspector also used the inconclusive ranges obtained from the XRF Performance Characteristic Sheet (0.41 mg/cm^2 to 1.39 mg/cm^2) for the particular XRF make, model and testing mode used, for all substrates except plaster (inconclusive range 1.01 mg/cm^2 to 1.09 mg/cm^2). Based on the valid window sill XRF readings, including substrate corrections for wood, there were initially 10 positive results, 2 inconclusive results, and 3 negative results in the bedroom. The two inconclusive results required paint-chip sampling with laboratory confirmation; this resulted in one positive and one negative result.. When she completed entering information into the tables, and turned off and stored her equipment, the inspector noted the date and ending time of the inspection in her field notes.

B. Example of Multi-family Housing Inspection

This section presents a simple example of a multi-family housing development inspection. An actual inspection would have many more testing combinations than are provided here.

The inspector's first step was a visual examination of the development to be tested. During this pre-testing review, buildings with a common construction and painting history were identified and the date of construction – 1962 – was determined. The construction and painting history of all the units was found to be similar, so that units in the development could be grouped together for sampling purposes. The inspector determined that the development had 55 units, and by consulting Table 7.3, determined that 22 units should be inspected.

The inspector used the "Selection of Housing Units" form (Completed Form 7.4) to randomly select units to inspect. The total number of units, 55, was entered into the first column of the form. The random numbers generated from a calculator (a computer's spreadsheet program or database program could have been used as well) were entered into the second column. The first random number, 0.583, was multiplied by 55 (the total number of units), and the product, 32.0 (which showed the first decimal place of the 32.065 calculator result), was entered in the third column. The product was rounded up from 32.1 to 33, and 33 was written in the fourth column, indicating that the 33rd unit would be tested. Other units were selected using the same procedure. When a previously selected unit was chosen again, the inspector crossed out the repeated unit number and wrote "DUP" (for duplicate) in the last column. The inspector continued generating random numbers until 35 distinct units had been selected for inspection.

Some detailed guidance on the random selection process is as follows:

- An option, if more than half of the units are to be inspected, is to randomly determine the units that would *not* be inspected and then to select the remaining units for inspection.
- Random numbers: When using the random number, which will be a long string of digits, you may use just a few decimal place digits of the random number for the calculation:
  - — When there are under 100 units being inspected, you may use just the first three decimal places.
  - — For more than 100 units, you may use just the first four decimal places,
  - — For more than 1000 units, you may use just the first five decimal places.

— Option: If you are using a computer to do the multiplication as well as generating the random number, you may use the random number as the computer generates it, without shortening it.

✦ Multiplications: In order to be clear on the form about how units are selected when the multiplication gives a result close to a whole number, the following procedure (or an equivalent procedure) should be used:

— If the first decimal place of the product is from .1 to .8 (such as 55 times 0.107 = 5.885 in the second row of the filled-in Form 7.4), you may record and use just the **first** decimal place (such as 5.8). The housing unit number, which is the round-up to the next whole number, is 6 in this case.

— If the first decimal place of the product is .0 (such as 55 times 0.873 = 48.015 in the third row of the form), or .9 (such as 55 times 0.636 = 34.980 in the fourth row from the bottom of the form), you may record and use just the **first two** decimal places, 48.01 and 34.98 in these two cases. The housing unit numbers, which are the round-ups to the next whole number, are 49 and 35 in these two cases.

— Options: You may record and use the first two decimal places for all multiplications. If you are using a computer to do the multiplication as well as generating the random number, you may let the computer do the calculation without shortening the product. An example of the formulas that could be used is the following (showing the first three rows of the spreadsheet):

1	Total Number of Units	Random Number*	Random Number times Total Number of Units #	Round up for Unit Number to be Sampled
2	55	=RAND()	=A2*B2	=INT(C2+1)
3	55	=RAND()	=A3*B3	=INT(C3+1)

After identifying units to be inspected, the inspector conducted an inventory of all painted surfaces within the selected units. The inspector completed Form 7.5, the "Multi-family Housing LBP Testing Data Sheet" for every testing combination found in each room equivalent within each unit. This multi-family Form 7.5 is intentionally the same as the single family Form 7.1, and the instructions on using the form for single family housing, in Section A of this Addendum 1, above, apply to using it for multi-family housing. (Completed forms are found in Addendum 2, after the blank forms.) Completed Form 7.5 is an example of the completed inventory for the bedroom of the first unit to be inspected. The inventory showed that the bedroom was composed of four substrates and eight testing combinations of the following components: (1) one ceiling beam, (2) two doors, (3) four walls, (4) one window casing, (5) two door casings, (6) three shelves, (7) two support columns, and (8) one radiator. Where more than one of a particular component was present, except walls, one was randomly selected for XRF testing. Component location descriptions were recorded in the "Test Location" column. Drywall and brick substrates were not present in the bedroom.

Testing combinations not common to all units were added to the inventory list. The inspector also noted which types of common areas and exterior areas were associated with the selected units, identified each of these common and exterior areas as a room equivalent, and inventoried the corresponding testing combinations **based on the appropriate number of common areas and exteriors as is required by table 7.3.**

The inspector inventoried the remaining 34 units selected and their associated types of common areas and exterior areas before beginning XRF testing in the development. Alternatively, the inspector could have inventoried each room equivalent as XRF testing proceeded.

After completing the inventory, the inspector went to the first unit selected for sampling, and noted the date and starting time in her field notes. She then performed the XRF manufacturer's recommended warm up and quality control procedures successfully. Then the inspector took three calibration check readings on a 1.02 mg/cm^2 NIST SRM film. The calibration check was accomplished by attaching the film to a wooden board and placing the board on a flat wooden table. Readings were then taken with the probe at least 12 inches (0.3 meters) from any other potential source of lead. The following readings were obtained: 1.12, 1.00, and 1.08 mg/cm^2. These calibration check results were recorded on the "Calibration Check Test Results" form (Completed Form 7.2). The difference between the first calibration check average and 1.02 mg/cm^2 (NIST SRM) was not greater than the 0.3 mg/cm^2 calibration check tolerance limit obtained from the *XRF Performance Characteristic Sheet* for the particular XRF make, model and testing mode used, indicating that the XRF instrument was in calibration and that XRF testing could begin. (See the single-family housing example, in section A, above, of this addendum, for a description of what to do when the calibration check tolerance is exceeded.)

The inspector began XRF testing in the bedroom by taking one reading on each testing combination listed on the inventory data sheet. XRF testing continued until all concrete, wood, and plaster component types were inspected in the bedroom. The XRF readings were recorded on the "Multi-family Housing LBP Testing Data Sheet" form (Completed form 7.5). According to the XRF Performance Characteristic Sheet (PCS), the XRF instrument in use did not require correction for substrate bias for any of the substrates encountered in the development, so the XRF classification column was completed at that time. The inspector used the rules for classifying the XRF readings as positive, negative, or inconclusive. The inspector also used the inconclusive ranges obtained from the PCS (0.41 mg/cm^2 to 1.39 mg/cm^2). The midpoint of the inconclusive range was then calculated to be 0.90 mg/cm^2 ([0.41 mg/cm^2 + 1.39 mg/cm^2]/2 = 0.90 mg/cm^2). The results of the classifications were recorded in the Classification column of the "Multi-family Housing LBP Testing Data Sheet" form. Classifications for all testing combinations within the unit were computed in the same manner as for the bedroom.

Once inspections were completed in all of the 35 selected units of the development, the inspector completed the "Multi-family Housing: Component Type Report" form (Completed Form 7.6). A description of each component type was recorded in the first column, the total number of each tested component type was entered in the second column, and the number of testing combinations classified as positive for each component type from the "Multi-family Housing LBP Testing Data Sheet" (Completed Form 7.5) was calculated and entered in the third column. The inspector then did the same for the testing combinations classified as negative, that is, XRF readings up to and including 0.40 mg/cm^2, and for inconclusive classifications with XRF readings less than the midpoint of the inconclusive range, that is, XRF readings from 0.41 mg/cm^2 to 0.89 mg/cm^2, and for inconclusive classifications with XRF readings equal to or greater than the mid-point of the inconclusive range, that is 0.90 mg/cm^2 to 1.39 mg/cm^2. Using these readings and the total number of the component type sampled, the inspector computed and recorded the percentages of positive, negative, and inconclusive classifications for each component type.

After entering the number of testing combinations for each component type in the "Multi-family Housing Component Type Report" form, the inspector noticed that only 34 wood door casings had been inspected. Because it is necessary to test at least 40 testing combinations of each component type, the inspector arranged with the client to test six more previously untested door casings. Additional units were randomly selected from the list of unsampled units. An initial calibration check test was successfully completed and the six door casings were tested for lead-based paint. Another calibration check test indicated that the XRF instrument remained within acceptable limits. The inspector then updated the "Multi-family Housing: Component Type Report" form by crossing out with one line the row of the form that showed the original, insufficient number of component types for testing; the inspector then wrote the information on the full 40 wood door casings in a new row.

The inspector used the "Multi-family Decision Flowchart" (figure 7.3) to evaluate the component type results. Because 100 percent of the plaster walls and metal baseboards tested negative for lead, the inspector concluded that no lead-based paint had been detected on any plaster walls or metal baseboards in the development, including those in uninspected units, and entered "NEG" in the Overall Classification column. The inspector also observed that shelves, hall cabinets, and window casings had no positive results. For all of the other component types, 15% or more of the readings for each type were positive; after choosing *not* to perform additional XRF readings or laboratory analysis on those components, that is, to rely on the XRF readings, the inspector entered "POS" in the Overall Classification column for them. For the shelves, all the XRF results were negative or inconclusive and less than 0.90 mg/cm^2 ("low inconclusive") so the inspector, in accordance with the flowchart, entered "NEG" in the Overall Classification column. The hall cabinets and window casings were classified as inconclusive with some readings greater than or equal to 0.90 mg/cm^2 ("high inconclusive"). The inspector determined that over 15 percent of the readings taken on these component types were high inconclusives. The inspector chose to take additional samples for laboratory analysis, to see if any or all of the samples would be determined to be negative by laboratory analysis.

The inspector collected paint-chip samples from the inconclusive component types, but only from testing combinations where XRF readings were equal to or greater than 0.90 mg/cm^2, the midpoint of the inconclusive range. Paint-chip samples were taken from 32 sampling locations: 12 hall cabinets, 7 window casings and 13 metal radiators. The paint-chip samples were collected from a 4-square-inch (25 square-centimeter) surface area on each component. Each paint-chip sample was placed in a hard-shelled plastic container, sealed, given a uniquely-numbered label, and sent to the laboratory for analysis. A chain of custody form describing the samples was included in the submission. When she competed entering the information on the form, and turned off and stored her equipment, the inspector noted the date and ending time of the inspection in her field notes.

The laboratory returned the results to the inspector, who entered the laboratory results and classifications on the appropriate "Multi-family Housing LBP Testing Data Sheet" (Form 7.5). Laboratory results of all 7 paint-chip samples taken from the window casings were classified as negative. The laboratory results of 5 samples from the hall cabinets were classified as positive, and 7 as negative. The metal radiator results were classified as 9 positives and 4 negatives.

The "Multi-family Decision Flowchart" was applied to the results shown in the "Multi-family Housing: Component Type Report" to determine the appropriate classification for each component type. The inspector classified all shelves and window casings as negative, based either on the XRF substrate-corrected readings and the laboratory confirmation analysis, respectively. Therefore,

no further lead-based paint testing was required for the shelves and window casings. About 9.1 percent (none positive by XRF analysis and 5 positive by lab analysis of the 55 that were inspected) of all hall cabinets in the housing development had lead-based paint. About 70 percent of the metal radiator paint chips were positive by lab analysis.

Final decisions made by the development client regarding the hall cabinets and radiators that have some lead-based paint were based on various factors, including:

- The substantially lower cost of inspecting all hall cabinets in the development versus replacing all of those cabinets;
- The higher cost but shorter time frame to strip or replace radiators without testing versus testing and only treating radiators with lead-based paint;
- Future plans, including renovating the buildings within three years; and
- The HUD/EPA disclosure rule requirements regarding the sale or rental of housing with lead-based paint.

In this case, the client chose to remove the positive and untested radiators to be stripped offsite and reinstalled. The client also arranged for testing hall cabinets in all of the unsampled units to determine which were positive, and which were negative. To verify the accuracy of the inspection services, the client asked the inspector to retest 10 testing combinations. The retest was performed according to instructions obtained from the *XRF Performance Characteristic Sheet.* The client appointed an employee to randomly select 10 testing combinations from the inventory list of 2 randomly selected units. The employee observed the inspector retesting the 10 selected testing combinations, using the same XRF instrument and procedures used for the initial inspection. A single XRF reading was taken from each of the 10 testing combinations. The average of the 10 repeat XRF results was calculated to be 0.674 mg/cm^2, and the average of the 10 previous XRF results was computed to be 0.872 mg/cm^2. The absolute difference between the two averages was computed to be 0.198 mg/cm^2 (0.872 mg/cm^2 minus 0.674 mg/cm^2). The Retest Tolerance Limit, using the formula described in the *XRF Performance Characteristic Sheet* for the particular XRF make, model and testing mode used, was computed to be 0.231. Because 0.198 mg/cm^2 is less than 0.231 mg/cm^2, the inspector concluded that the inspection had been performed competently. The final summary report also included the address of the inspected units, the date(s) of inspection, the starting and ending times for each inspected unit, and other information described in section V.I of chapter 7.

At the end of the work shift, the inspector took a final set of three calibration check readings using the same procedure as for the initial calibration check. The following readings were obtained: 0.86, 1.07 and 0.94 mg/cm^2. The average of these readings is 0.97 mg/cm^2. The difference between 0.97 mg/cm^2 and the NIST SRM's 1.02 mg/cm^2 is -0.08 mg/cm^2, which is not greater in magnitude than the 0.30 mg/cm^2 calibration check tolerance for the instrument used. The inspector recorded that the XRF instrument was in calibration, and that the measurements taken between the first and second calibrations could be used.

Addendum 2:
Data Collection Forms

1. Single Family Housing LBP Testing Data Sheet (Form 7.1) – Blank
2. Single Family Housing LBP Testing Data Sheet (Form 7.1) – Completed
3. Calibration Check Test Results (Form 7.2) – Blank
4. Calibration Check Test Results (Form 7.2) – Completed
5. Substrate Correction Values (Form 7.3) – Blank
6. Substrate Correction Values (Form 7.3) – Completed
7. Selection of Housing Units (Form 7.4) – Blank
8. Selection of Housing Units (Form 7.4) – Completed
9. Multi-family Housing LBP Testing Data Sheet (Form 7.5) – Blank
10. Multi-family Housing LBP Testing Data Sheet (Form 7.5) – Completed
11. Multi-family Housing: Component Type Report (Form 7.6) – Blank
12. Multi-family Housing: Component Type Report (Form 7.6) – Completed

Single-Family Housing LBP Testing Data Sheet

Page _____ of _____

Address/Unit No. ______________________ Date ______________

Room Equivalent ______________________

XRF Serial No. ____________ Inspector Name ____________ Signature ____________

Sample ID#	Substrate	Component	Color	Test Locations	XRF Reading	Correction Value	Result	Classification (pos, neg, inc)	Laboratory Result	UNITS	Final Classification
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	
										mg/cm^2 %	

1997 Revision

Form 7.1

Single-Family and Multifamily Testing LBP Testing Data Sheet

Address/Unit No. 918 Fenway Drive **Date** August 19, 2012

Room Equivalent Bedroom 1 (Room 5)

XRF Serial No. RS-1967 **Inspector Name** Mo Smith **Signature** Mo Smith

Sample ID#	Substrate	Component	Replication Number**	Test Locations*	XRF Reading	Correction Value	Result	Classification (pos, neg, inc)	Laboratory Result	Choose units	Final* Classification (pos or neg)
819.1	Plaster	Wall	5	Wall A Center	1.12 mg/cm²	NA	1.12 mg/cm²	POS		mg/cm² ppm	
819.2	Plaster	Wall	5	Wall B Left	0.92 mg/cm²	NA	0.92 mg/cm²	NEG		mg/cm² ppm	POS
819.3	Plaster	Wall	5	Wall C Right	1.31 mg/cm²	NA	1.31 mg/cm²	POS		mg/cm² ppm	
819.4	Plaster	Wall	5	Wall D Right	1.12 mg/cm²	NA	1.12 mg/cm²	POS		mg/cm² ppm	
819.5	Drywall	Wall	4	Closet Wall A	1.81 mg/cm²	NA	1.81 mg/cm²	POS		mg/cm² ppm	
819.6	Drywall	Wall	4	Closet Wall B	1.62 mg/cm²	NA	1.62 mg/cm²	POS		mg/cm² ppm	
819.7	Drywall	Wall	4	Closet Wall C	2.11 mg/cm²	NA	2.11 mg/cm²	POS		mg/cm² ppm	
819.8	Drywall	Wall	4	Closet Wall D	1.85 mg/cm²	NA	1.85 mg/cm²	POS		mg/cm² ppm	
819.9	Wood	Window Sill	3	Wall C Left	2.23 mg/cm²	NA	2.23 mg/cm²	POS		mg/cm² ppm	
819.10	Wood	Window Sash	3	Wall C Left	2.40 mg/cm²	NA	2.40 mg/cm²	POS		mg/cm² ppm	
819.11	Wood	Door	2	Wall A Center	4.20 mg/cm²	NA	4.20 mg/cm²	POS		mg/cm² ppm	
819.12	Metal	Door Frame	2	Wall A Center	5.50 mg/cm²	NA	5.50 mg/cm²	POS		mg/cm² ppm	
819.13	Wood	Baseboard	4	Wall D Right	>9.9 mg/cm²	NA	>9.9 mg/cm²	POS		mg/cm² ppm	
819.14	Wood	Chair rail	1	Wall B Center	1.0 mg/cm²	NA	1.0 mg/cm²	INC	5400	mg/cm² (ppm)	POS
										mg/cm² ppm	
	While one wall (sample 819.2) was determined to be negative by XRF, the walls as a whole in this room are classified as positive because of the variability in painted surfaces due to patching and repairs has the average lead loading be 1.12 mg/cm²; specifically, (1.12 + 0.92 + 1.31+ 1.12)/4 = 1.12, which is at least 1.0.									mg/cm² ppm	
										mg/cm² ppm	
										mg/cm² ppm	
	Sample 819.14 was inconclusive, for this XRF, at 1.0 mg/cm². Laboratory testing confirmed LBP. with the paint concentration being at least 5000 ppm.									mg/cm² ppm	
										mg/cm² ppm	

* Maintain a complete inventory of surfaces, components or rooms that are not tested. Use CPT=Carpeted floor; ED=Entry Denied; IN=Inaccessible; NC=Not Coated/Painted surface

** **No. of Replications:** The number of times a specific room equivalent, component, substrate, and color combination occurs. For example, if four walls are characterized by the same testing combination, the number of replications would be four.

Calibration Check Test Results

Page _____ of _____

Address/Unit No. _____

_____

Device _____

Date _____ XRF Serial No. _____

Contractor _____

Inspector Name _____ Signature

NIST SRM Used _____ mg/cm^2 Calibration Check Tolerance Used _____ mg/cm^2

First Calibration Check

NIST SRM			First Average	Difference Between First Average and NIST SRM*
First Reading	Second Reading	Third Reading		

Second Calibration Check

NIST SRM			Second Average	Difference Between Second Average and NIST SRM*
First Reading	Second Reading	Third Reading		

Third Calibration Check *(if required)*

NIST SRM			Third Average	Difference Between Third Average and NIST SRM*
First Reading	Second Reading	Third Reading		

Fourth Calibration Check *(if required)*

NIST SRM			Fourth Average	Difference Between Fourth Average and NIST SRM*
First Reading	Second Reading	Third Reading		

* If the difference of the Calibration Check Average from the NIST SRM film value is greater than the specified Calibration Check Tolerance for this device, consult the manufacturer's recommendations to bring the instrument back into control. Retest all testing combinations tested since the last successful Calibration Check test.

Calibration Check Test Results

Address/Unit No. Fenway Gardens Housing Complex
Oldtown, Maryland 21334

Device WXY Company, Inc. XRF 2.1

Date August 19, 2012 **XRF Serial No.** RS-1967

Contractor RIGAH PG Testing, Inc

Inspector Name Mo Smith **Signature** Mo Smith

NIST SRM Used 1.02 mg/cm² **Calibration Check Tolerance Used** _____ mg/cm²

First Calibration Check Initial reading 8:43 AM

NIST SRM			First Average	Difference Between First Average and NIST SRM*
First Reading	Second Reading	Third Reading		
1.12	1.00	1.08	1.07	0.05

Second Calibration Check Midday Reading: 11:35 AM

NIST SRM			Second Average	Difference Between Second Average and NIST SRM*
First Reading	Second Reading	Third Reading		
0.86	1.07	0.89	0.94	-0.08

Third Calibration Check *(if required)* End of testing 2:22 PM

NIST SRM			Third Average	Difference Between Third Average and NIST SRM*
First Reading	Second Reading	Third Reading		
1.45	1.21	1.10	1.25	0.23
Failed Calibration Check				

Fourth Calibration Check *(if required)*

NIST SRM			Fourth Average	Difference Between Fourth Average and NIST SRM*
First Reading	Second Reading	Third Reading		

*** If the difference of the Calibration Check Average from the NIST SRM film value is greater than the specified Calibration Check Tolerance for this device, consult the manufacturer's recommendations to bring the instrument back into control. Retest all testing combinations tested since the last successful Calibration Check test.**

Substrate Correction Values

Address/Unit No. _____

_____

Date _____ XRF Serial No. _____

Inspector Name _____ Signature _____

Use this form when the *XRF Performance Characteristics Sheet* indicates that correction for substrate bias is needed.

_____

_____

Substrate			Brick	Concrete	Drywall	Metal	Plaster	Wood
Location	1	First Reading						
		Second Reading						
		Third Reading						
	2	First Reading						
		Second Reading						
		Third Reading						
Correction Value (Average of the Six Readings)								

Transfer Correction Value for each substrate to the 'Correction Value' column of the LBP Testing Data Sheet.

Notes:

Substrate Correction Values

Address/Unit No. 918 Fenway Drive
Oldtown, Maryland 21334

Date August 19, 2012 **XRF Serial No.** RS-1967

Inspector Name Mo Smith **Signature** Mo Smith

Use this form when the *XRF Performance Characteristics Sheet* indicates that correction for substrate bias is needed.

Substrate			Brick	Concrete	Drywall	Metal	Plaster	Wood
Location	1	First Reading				0.10		
		Second Reading				0.09		
		Third Reading				0.09		
	2	First Reading				0.10		
		Second Reading				0.09		
		Third Reading				0.11		
Correction Value (Average of the Six Readings)						0.10		

Transfer Correction Value for each substrate to the 'Correction Value' column of the LBP Testing Data Sheet.

Notes: Metal: Location 1 - Door frame, Side B, Room 2 (Dining room)
Location 2 - Door Frame, Side C, Room 3 (Kitchen)

Selection of Housing Units

Page ______ of ______

Testing Site ____________________________ Year Built ________ Date ________________

Inspector Name ______________________ Signature ________________ Number of Distinct Units to be Sampled [ ]

Total Number of Units	Random Number*	Random Number times Total Number of Units #	Round up for Unit Number to be Sampled	Distinct Unit Number

* Obtain from a hand-held calculator, spreadsheet or database.

Round down to 1 decimal place (e.g., 23.7), except if x.0+or x.9+, then round down to 2 decimal places (e.g., 47.02 or 34.98).

2012 Revision Form 7.4

Selection of Housing Units

Testing Site Fenway Gardens Housing Complex Year Built 1962 Date August 16, 2012

Inspector Name Mo Smith Signature Mo Smith Number of Distinct Units to be Sampled 22

Total Number of Units	Random Number*	Random Number times Total Number of Units #	Round up for Unit Number to be Sampled	Distinct Unit Number
55	0.583	32.0	33	1
55	0.107	5.8	6	2
55	0.873	48.01	49	3
55	0.085	4.6	5	4
55	0.961	52.8	53	5
55	0.111	6.1	7	6
55	0.575	31.6	32	7
55	0.241	13.2	14	8
55	0.560	30.8	31	9
55	0.884	48.6	~~49~~	DUP
55	0.341	18.7	19	10
55	0.851	46.8	47	11
55	0.574	31.5	~~32~~	DUP
55	0.221	12.1	13	12
55	0.103	5.6	~~6~~	DUP
55	0.375	20.6	21	13
55	0.625	34.3	35	14
55	0.395	21.7	22	15
55	0.095	5.2	~~6~~	DUP
55	0.772	42.4	43	16
55	0.761	41.8	42	17
55	0.515	28.3	29	18
55	0.855	47.02	48	19
55	0.679	37.3	38	20
55	0.636	34.98	~~35~~	DUP
55	0.622	34.2	~~35~~	DUP
55	0.323	17.7	18	21
55	0.431	23.7	34	22

*** Obtain from a hand-held calculator, spreadsheet or database.**

 # Round down to 1 decimal place (e.g., 23.7), except if x.0+or x.9+, then round down to 2 decimal places (e.g., 47.02 or 34.98).

Multifamily Housing LBP Testing Data Sheet

Page _____ of _____

Address/Unit No. ______________________________ Date ______________

Room Equivalent ______________________________

XRF Serial No. ______________ Inspector Name ______________ Signature ______________

Sample ID#	Substrate	Component	Color	Replication Number	Test Location	XRF Reading	Correction Value	Corrected Reading	Classification (pos, neg, inc)	Laboratory Result	UNITS	Laboratory Classification
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	
											mg/cm^2 %	

1997 Revision

Form 7.5

Single-Family and Multifamily Testing LBP Testing Data Sheet

Address/Unit No. 918 Fenway Drive **Date** August 19, 2012

Room Equivalent Bedroom 1 (Room 5)

XRF Serial No. RS-1967 **Inspector Name** Mo Smith **Signature** Mo Smith

Sample ID#	Substrate	Component	Replication Number**	Test Locations*	XRF Reading	Correction Value	Result	Classification (pos, neg, inc)	Laboratory Result	Choose units	Final* Classification (pos or neg)
819.1	Plaster	Wall	5	Wall A Center	1.12 mg/cm²	NA	1.12 mg/cm²	POS		mg/cm² ppm	
819.2	Plaster	Wall	5	Wall B Left	0.92 mg/cm²	NA	0.92 mg/cm²	NEG		mg/cm² ppm	POS
819.3	Plaster	Wall	5	Wall C Right	1.31 mg/cm²	NA	1.31 mg/cm²	POS		mg/cm² ppm	
819.4	Plaster	Wall	5	Wall D Right	1.12 mg/cm²	NA	1.12 mg/cm²	POS		mg/cm² ppm	
819.5	Drywall	Wall	4	Closet Wall A	1.81 mg/cm²	NA	1.81 mg/cm²	POS		mg/cm² ppm	
819.6	Drywall	Wall	4	Closet Wall B	1.62 mg/cm²	NA	1.62 mg/cm²	POS		mg/cm² ppm	
819.7	Drywall	Wall	4	Closet Wall C	2.11 mg/cm²	NA	2.11 mg/cm²	POS		mg/cm² ppm	
819.8	Drywall	Wall	4	Closet Wall D	1.85 mg/cm²	NA	1.85 mg/cm²	POS		mg/cm² ppm	
819.9	Wood	Window Sill	3	Wall C Left	2.23 mg/cm²	NA	2.23 mg/cm²	POS		mg/cm² ppm	
819.10	Wood	Window Sash	3	Wall C Left	2.40 mg/cm²	NA	2.40 mg/cm²	POS		mg/cm² ppm	
819.11	Wood	Door	2	Wall A Center	4.20 mg/cm²	NA	4.20 mg/cm²	POS		mg/cm² ppm	
819.12	Metal	Door Frame	2	Wall A Center	5.50 mg/cm²	NA	5.50 mg/cm²	POS		mg/cm² ppm	
819.13	Wood	Baseboard	4	Wall D Right	>9.9 mg/cm²	NA	>9.9 mg/cm²	POS		mg/cm² ppm	
819.14	Wood	Chair rail	1	Wall B Center	1.0 mg/cm²	NA	1.0 mg/cm²	INC	5400	mg/cm² (ppm)	POS
										mg/cm² ppm	
	While one wall (sample 819.2) was determined to be negative by XRF, the walls as a whole in this room are classified as positive because of the variability in painted surfaces due to patching and repairs has the average lead loading be 1.12 mg/cm²; specifically, (1.12 + 0.92 + 1.31+ 1.12)/4 = 1.12, which is at least 1.0.									mg/cm² ppm	
										mg/cm² ppm	
										mg/cm² ppm	
	Sample 819.14 was inconclusive, for this XRF, at 1.0 mg/cm². Laboratory testing confirmed LBP. with the paint concentration being at least 5000 ppm.									mg/cm² ppm	
										mg/cm² ppm	

* Maintain a complete inventory of surfaces, components or rooms that are not tested. Use CPT=Carpeted floor; ED=Entry Denied; IN=Inaccessible; NC=Not Coated/Painted surface

** **No. of Replications:** The number of times a specific room equivalent, component, substrate, and color combination occurs. For example, if four walls are characterized by the same testing combination, the number of replications would be four.

Form 7.1 (Single Family Housing) and Form 7.5 (Multifamily Housing)

Multifamily Housing: Component Type Report

Page ______ of ______

Address/Unit No. ____

____

Date ______________________ XRF Serial No.______________________

Inspector Name ______________________ Signature ______________________

Description	Number of Readings	POSITIVE		INCONCLUSIVE*				NEGATIVE		Comp. Type Classif.
		Number	Percent	Low		High		Number	Percent	
				Number	Percent	Number	Percent			

1997 Revision

Form 7.6

* Lower Boundary: ________ Upper Boundary: ________ Midpoint: ________

Multifamily Housing: Component Type Report

Address/Unit No. Fenway Gardens Housing Complex

Date August 19, 2012 **XRF Serial No.** RS-1967

Inspector Name Mo Smith **Signature** Mo Smith

Description	Number of Readings	POSITIVE		INCONCLUSIVE*				NEGATIVE		Comp. Type Classification
				Low		High				
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Wood Shelves	83	4	4.8	5	6.0	9	10.8	65	78.3	NEG
Wood Doors	110	40	36.4	12	10.9	8	7.3	50	45.5	POS
Wood door Casings	34	6	17.6	5	14.7	5	14.7	18	52.9	POS
Wood Hall Cabinets	60	5	8.3	8	13.3	12	20.0	35	58.3	POS
Wood Window Stools	110	60	54.4	30	27.3	10	9.1	10	9.1	POS
Wood Window Casings	63	0	0.0	0	0.0	0	0.0	63	100	NEG
Plaster Walls	110	0	0.0	10	9.1	9	8.2	91	82.7	NEG
Concrete Support Columns	40	40	100	0	0.0	0	0.0	0	0.0	POS
Concrete Ceiling Beams	40	40	100	0	0.0	0	0.0	0	0.0	POS
Metal Baseboards	45	0	0.0	0	0.0	0	0.0	45	100	NEG
Metal Gutters	50	20	40.0	8	16.0	2	4.0	20	40.0	POS
Brick Stairway	50	10	20.0	4	8.0	6	12.0	30	60.0	POS
Metal Radiators*	55	0	0.0	11	20.0	13	23.6	31	56.4	POS
Wood Door Casings	40	12	30.0	5	12.5	5	12.5	18	45.0	POS
Metal Radiators* Retest of high inconclusive	13	9	69.2					4	30.7	POS

2012 Revision

Form 7.6

*** Lower Boundary:** 0.80 **Upper Boundary:** 1.10 **Midpoint:** 0.95

Addendum 3: XRF Performance Characteristics Sheets

For current XRF Performance Characteristics Sheets, see the HUD website at: ***http://www.hud.gov/offices/lead/guidelines/hudguidelines/Allpcs.pdf***.

Chapter 15: Clearance

TABLES

FIGURES

Chapter 15: Clearance

How To Do It

1. **Qualifications for clearance examiners**. The owner, funding agency, certified abatement contractor, or certified renovation contractor should select the clearance examiner, preferably before lead-based paint hazard control work begins.

   - Clearance on all projects involving abatement (as defined by EPA) must be done by a certified risk assessor or a certified lead-based paint inspector. Check with EPA regarding qualifications for clearance of non-abatement activities.

   - For properties covered by HUD's Lead Safe Housing Rule, and those of some State regulations, clearance of non-abatement work may be performed by a certified risk assessor or lead-based paint inspector, or by a certified sampling technician, if the sampling technician is working in single family units or a multi-family dwelling unit and the associated common areas. If the clearance requires development of a random sampling plan, a certified inspector or risk assessor must develop the plan and supervise the sampling technician in its use. Not all States or localities have certified sampling technicians, and some require that non-abatement clearance be conducted only by certified risk assessors or inspectors.

   - For clearing projects covered by the EPA's Renovation, Repair, and Painting (RRP) rule, a certified risk assessor, certified lead-based paint inspector, or certified dust sampling technician can perform clearance. (See below regarding clearing multi-family housing projects.)

   - To eliminate conflicts of interest, these *Guidelines* recommend the use of a clearance examiner who is completely independent of the contractor who performs the work. HUD's Lead Safe Housing Rule requires such independence for clearance of most work in HUD-assisted target housing. (See Appendix 6 for details.)

2. **Determine the clearance area**. Obtain information from the client regarding the nature and location of the work and the dust containment (if any); for an abatement, project, validate or obtain a copy of the abatement site plan. Then determine the clearance area (i.e., the dwelling units, common areas, rooms, and/or exterior areas that are subject to the clearance examination). Clearance examiner should explain all aspects of the examination to the client.

3. **Preclearance worksite inspection on behalf of the client (optional):** As part of deciding, once the lead hazard control, renovation or maintenance work has been completed, the cleanup is done, and the floors are sealed (if necessary), whether to call for the clearance examiner, the client, contractor or maintenance supervisor may conduct a visual assessment of the clearance area to determine if there is any deteriorated paint, visible settled dust, paint chips, or paint-related debris in the interior or around the exterior of the building(s). If conducted, this preliminary visual assessment should be conducted in all the dwelling units and rooms in the clearance area, except that it may be conducted in a sample of dwelling units and related common areas in a multi-family property. After the visual assessment is passed, it may also be useful to take dust samples for quick onsite analysis before calling the clearance examiner.

4. **Wait one hour for dust to settle**. Before beginning the clearance examination, wait at least 1 hour after the hazard control, renovation, or maintenance work is finished, the cleanup is done, and the floors are sealed (if necessary) to allow any leaded-dust particles to settle. Do not enter the work area during that period.

5. **Conduct visual assessment**. Conduct a visual assessment (called a visual inspection by EPA) of the clearance area to determine if there is any deteriorated paint, visible settled dust, paint chips, or paint-related debris in the interior or around the exterior of the building(s). The visual assessment should be conducted in all the dwelling units and rooms in the clearance area, except that it may be conducted in a sample of dwelling units and related common areas in a multi-family property (see chapter 7 for unit/common area sampling methods).

6. **Complete visual assessment form**. Complete a visual assessment form for clearance, such as Form 15.1 in this chapter. If any unexplained deteriorated paint or visible dust, paint chips, or paint-related debris are found, inform the client and request that hazard controls and/or cleanup be completed, as necessary, so that dust sampling can proceed. See 24 CFR 35.1340(c) for more details of what is required under the Lead Safe Housing Rule for HUD-assisted housing (see Appendix 6).

7. **Conduct dust sampling**. After the clearance area has passed visual assessment, conduct clearance dust-wipe sampling of floors, interior window sills, and window troughs using the protocol in this chapter and Appendix 13.1, or ASTM Standard E 1728 (***www.astm.org/Standard/index.shtml***).

8. **Complete a dust sampling form** for clearance, such as Form 15.2 in this chapter.

9. **Submit dust samples for analysis** for lead to a laboratory recognized for analysis of lead in dust by the EPA's National Lead Laboratory Accreditation Program (NLLAP).

10. **Interpret the laboratory results** by comparing them to the applicable standards. In most jurisdictions, these will be the EPA clearance standards described in this chapter. If State or local standards differ from the EPA standards and the work being cleared is subject to HUD or EPA lead-based paint regulations, the most protective standards (EPA, State, or local) apply. If the work being cleared is not subject to HUD or EPA regulations, use State or local standards, if they exist. If State or local standards do not exist, use the EPA standards.

11. **Notify the client of the results of laboratory tests** as soon as they are received, so residents can reoccupy the clearance area as soon as possible if clearance is achieved, or recleaning can be started quickly if dust-lead levels exceed applicable standards.

12. **If clearance is achieved**, go to step 15. If not, go to follow steps 13 and 14.

13. **Repeat cleaning if clearance is not achieved**. If dust-lead levels are equal to or greater than the applicable standards, the client should order repeated cleaning. Clean all surfaces that the failing samples represent. Keep the clearance area secure until clearance is achieved.

14. **Continue sampling and repeat cleaning until the clearance area achieves compliance with applicable clearance standards**. Failure to achieve clearance is usually caused by inadequate cleaning and/or results when surfaces have not been made smooth and cleanable. Sometimes additional hazard control work is necessary.

15. **Complete related construction and final clearance**. After clearance has been achieved, any related construction work that does not disturb a surface with lead-based paint (all work that does disturb painted surfaces or that could generate leaded dust should be completed as part of the lead hazard control effort). If any additional paint-disturbing work is to be done in the clearance area, there should be another final clearance examination after such work to assure that the space is safe for occupancy. (See Section VII.C of Chapter 8.)

16. **Prepare report**. Prepare and deliver to the client a report of the clearance examination. You may use a format such as Form 15.3 in this chapter that includes all the information required in 24 CFR 35.1340(c) for reports on projects other than abatement, and in 40 CFR 745.227(e)(10) for reports on abatement projects. You may use the Clearance Report Review Worksheet (Form 15.4) to ensure that all the required information is included in the clearance report. See also the example of a filled-out Worksheet in Form 15.5.

17. **Compliance with disclosure and notification regulations**. The owner must disclose the scope and results of lead hazard control work, including clearance examination results, to lessees (tenants) and purchasers of the property under Federal law before they become obligated under a lease or sales contract. Also, if the housing is receiving Federal assistance, current residents must be notified within 15 days of receipt by the owner, of the scope and results of lead hazard control work, including the results of clearance examinations, in accordance with the HUD Lead Safe Housing Rule. See Appendix 6 for additional information.

I. Introduction

Clearance refers generally to combined visual and quantitative environmental evaluation procedures used to determine that no lead-based paint hazards remain in the area being cleared after lead hazard controls or paint-disturbing renovation or maintenance have been done. The specific procedures used depend on exactly what the client wants to know and what regulations and standards apply.

A. Regulations Pertaining to Clearance

The U.S. Environmental Protection Agency (EPA) issued regulations and standards at 40 CFR 745.227(e) that apply to clearance whenever abatement of lead-based paint hazards is conducted in most pre-1978 housing nationwide. These regulations apply to all abatements (i.e., measures intended to permanently eliminate lead-based paint hazards). They require that the area being cleared be free of deteriorated lead-based paint and visible dust, debris, paint chips and other residue from the work, and that lead in settled dust be below specified standards.

The U.S. Department of Housing and Urban Development (HUD) issued the Lead Safe Housing Rule, which addresses clearance at 24 CFR 35.1340(b). The regulation applies to clearance after paint stabilization, interim controls, standard treatments, rehabilitation, or ongoing lead-based paint maintenance. HUD's standards and procedures for clearance are the same as those for EPA-regulated abatement, although there are some differences in the qualifications for clearance examiners. The clearance procedures and standards described in this chapter conform to EPA and HUD regulations.

In renovations where the contract between the renovation firm and the property owner or another Federal, State, Territorial, Tribal, or local regulation requires dust clearance sampling by a certified sampling professional, EPA's Renovation, Repair and Painting (RRP) Rule allows for optional dust clearance testing in lieu of the "cleaning verification" procedure.

In projects covered by the EPA's RRP Rule for which clearance is *not* required, EPA's cleaning verification process is required. (See the description in Appendix 6.)

Some States, Indian Tribes and local governments have issued standards for clearance that may differ somewhat from the Federal requirements. In general, the most protective standards (EPA, State, or local) apply. If the EPA has authorized the State or Tribe's lead certification program, its clearance standards apply rather than the EPA's. If a local clearance standard exists and is more stringent than the State standard, use the local standard. If the work being cleared is not subject to HUD or EPA regulations, use State or local standards, if they exist. If no State or local standards exist, use the EPA standards.

If the applicable (EPA, State or local) clearance standards for lead in dust are not met, EPA and HUD require that cleaning be repeated and additional visual assessments dust testing performed until the area meets clearance standards. If dust-lead levels determined by a clearance examination remain above the clearance standards, the work is not complete; levels of lead in dust must be within clearance standards for the work to be complete.

B. Purpose and Scope of Clearance

The primary purpose of the standard EPA-HUD clearance examination is to determine whether the clearance area is safe for occupancy or for entry by unprotected workers. The clearance report must include, among other elements described in Section X.B, below, information about the lead

hazard control work, which may only be available from the owner or the contractor. You may use the Clearance Report Review Worksheet to insure that the clearance report is complete (See Form 15.4).

If exterior work was performed, the clearance examiner determines, by a visual assessment, if the ground near the work is free of debris, and, through soil-lead sampling and analysis by a laboratory recognized by NLLAP for analysis of lead in soil, if the concentration of lead in nearby soil is below the applicable soil-lead standards. Guidance on optional purposes of clearance examinations is provided in this chapter.

In this chapter, the work that generates the need for a clearance examination is referred to as "the work," regardless of whether it is abatement or interim controls of lead-based paint or lead-based paint hazards, rehabilitation, renovation, remodeling, or maintenance.

The standard Federal clearance examination has four main phases:

1. A visual assessment of: (a) interior clearance areas to identify any deteriorated paint that may be lead-based and visible dust and debris and (b) exterior areas, if exterior work was performed, to identify any deteriorated paint that may be lead-based and paint chips or other debris near the work surfaces;

2. The collection and analysis of dust samples from interior spaces by wipe sampling;

3. Interpretation of dust sampling results, and follow-up dust testing if the initial results failed to meet applicable standards and additional cleaning is necessary; and

4. Preparation and signing of the clearance report.

Interior clearance may not be necessary if the work was only on the outside and building openings (windows, doors, and vents) were tightly closed or sealed during the work. Airborne dust sampling is not recommended for clearance purposes in lead hazard control work because the results vary due to air flow, particle size, and available dust. In addition, most children are *not* lead-poisoned by inhalation (ATSDR, 1988)

Interior and exterior areas being cleared should be free of deteriorated paint that is or may be lead-based because deteriorated lead-based paint has been determined to be a lead-based paint hazard. Clinical cases of childhood lead poisoning (i.e., cases with relatively high levels of lead in the blood) often result from ingestion of leaded paint chips. If testing has shown that deteriorated paint is not lead-based, the deteriorated paint need not be repaired for the purpose of passing clearance. Interior areas being cleared should also be free of visible dust, loose paint chips and paint-related debris, and exterior areas should be free of paint chips and paint-related debris. Repair of deteriorated paint and cleanup of interior dust, paint chips, and paint-related debris must occur before dust samples are taken because the repair of the paint and cleaning of dust and debris may contaminate the area.

The collection and analysis of dust samples is a critical part of the interior clearance examination. Lead in settled house dust is the most common source of childhood lead exposure. A visual examination alone is not adequate for determining if the interior of a residence is safe for occupancy, because small dust particles are not visible to the naked eye (NCHH, 2002). Lead hazard control work and rehabilitation, renovation, remodeling, and maintenance often generate a considerable amount of leaded-dust. Studies have indicated that cleaning of leaded-dust can be accomplished

only with care and skill (HUD, 1991; NCHH, 2004). Therefore, HUD requires clearance dust sampling to determine if the work area has been cleaned adequately to meet the EPA dust clearance standard(s).

The report of the clearance examination documents the findings. The clearance examination protects *all* parties involved – the job contractor or other workers, the owner, insurance companies, and the residents. Clearance provides the contractor and the owner with an objective determination that the job site was left free of lead-based paint hazards. Clearance assures that children will be safe from lead hazards in the area being cleared as long as the work remains intact and there are not exterior sources contaminating the area. To keep the property lead-safe, the owner should follow lead-safe maintenance practices if it is known or suspected that lead-based paint remains on the property (see Chapter 6). Also, it is recommended that pre-1960 multi-family rental properties be reevaluated by a risk assessor at 2-year intervals following initial interim controls (see Chapter 5, Section VII), and may be required for housing receiving federal assistance covered HUD Lead Safe Housing Rule (see Appendix 6 for details).

A voluntary consensus standard, ASTM E2271, Standard Practice for Clearance Examinations Following Lead Hazard Reduction Activities in Dwellings, and in Other Child Occupied Facilities, may also be used for determining whether a clearance area passes or fails a clearance examination. (***http://www.astm.org/Standards/E2271.htm***) (The version of the standard as of the publication of these *Guidelines* is ASTM E2271 – 05a(2012)e1; the ASTM website should be checked to see if a subsequent edition or standard is current at the time the ASTM standard is being considered for use as part of the clearance process for a job.)

C. De Minimis Area – Minimal Area of Paint Disturbance when Clearance Is Not Required

HUD regulations do not require clearance if the total amount of paint disturbed by non-abatement work is no more than a small or minimal amount. This amount is called a *de minimis* area or *de minimis* amount. Specifically, the *de minimis* areas are areas up to:

(1) 20 square feet on exterior surfaces,

(2) 2 square feet in any one interior room or space, or

(3) 10 percent of the total surface area on an interior or exterior type of component with a small surface area (such as windowsills, baseboards, and trim).

Note that the HUD *de minimis* thresholds are different from the EPA's *minor repair and maintenance activities* thresholds (40 CFR 745.83) under its RRP Rule for work that that disrupts:

(1) 6 square feet or less of painted surface per room for interior activities; or

(2) 20 square feet or less of painted surface for exterior activities;

provided that none of the work practices prohibited or restricted by 40 CFR 745.85(a)(3) were used and where the work does not involve window replacement or demolition of painted surface areas (see Appendix 6 for details).

II. Qualifications for Clearance Examiners

A. Regulatory Qualifications

Clearance examinations are regulated by EPA and HUD, as well as by States and Tribes with EPA-authorized lead certification programs for inspection, risk assessment, or dust sampling technicians.

EPA regulations recognize two disciplines as being qualified to perform clearance examinations following abatement of lead-based paint hazards: certified risk assessors, and certified lead-based paint inspectors. Some EPA-authorized States and Tribes, however, permit only certified risk assessors to perform clearance examinations.

In addition to risk assessors and lead-based paint inspectors, HUD regulations (at 24 CFR 35.1340(b)(1)) and EPA Renovation, Repair, and Painting (RRP) regulations (at 40 CFR 745.90(a)(1)) recognize a third category, certified dust sampling technicians (originally called "clearance technicians"). These technicians are qualified to perform many non-abatement clearances, because their training does not cover random sampling, they may not conduct non-abatement clearances of multi-family properties in which clearance involves random sampling of dwelling units except under the circumstances and supervision described in the following paragraph. EPA does not allow dust clearance testing in lieu of post-renovation cleaning verification, except in limited circumstances. EPA recommends that any property owners who choose to have dust clearance testing performed after a renovation use a certified inspector, risk assessor, or dust sampling technician.

HUD regulations permit certified sampling technicians to perform clearances after non-abatement work if the clearance examination is approved and the report is signed by a certified risk assessor or lead-based paint inspector. Because sampling technicians do not have the training to randomly select dwelling units, common areas and/or exterior areas for sampling in multi-family properties, for multi-family properties where units are to be randomly selected under either the HUD regulations or the EPA's RRP Rule, the certified risk assessor or lead-based paint inspector must perform the random selection and instruct the sampling technician to conduct clearance work where selected. Also, sampling technicians do not have the training to determine that specified hazard control work has been completed (see Section VIII, below, for an explanation of this optional activity).

B. Conflicts of Interest

For clearance to achieve its purpose there must be integrity in the process, in appearance as well as in fact. People performing hazard control, rehabilitation, or maintenance work and the cleanup following such work must not know where clearance dust samples will be taken. To achieve this goal, clearance examiners should be as independent as possible of those performing the work. The clearance examiner's only concern should be that compliance with clearance standards has been achieved.

It is best practice for the owner (or the agency administering public assistance funding the work) to retain the clearance examiner, rather than having the contractor who performs the work do so. In addition, the clearance examiner should not be paid, employed, or otherwise compensated by the hazard-control or renovation contractor. The independence of the clearance examiner is generally required in projects covered by HUD's Lead Safe Housing Rule (24 CFR 35.1340(f)). It should be noted that, under EPA regulations pertaining to abatement and renovation, an abatement or renovation contractor may select and pay the clearance examiner.

Some owners of multiple dwelling units may wish to have work performed by their own trained crews, rather than contract for such services. In this case it is best practice that clearance be performed by an independent third party whose payment is not dependent on completion of the job within any particular time period. HUD regulations do permit property owners to use clearance examiners in their employ, however, provided the same in-house employees do not conduct both the work and its clearance examination. Ultimately, it is the professional integrity of those performing clearance that will determine whether the process succeeds. To minimize any perceived conflict of interest it is strongly recommended that the clearance examiner be completely independent from the person performing the lead-hazard control treatments (see above regarding HUD's Lead Safe Housing Rule).

This does not mean that job supervisors should not perform their own visual assessments of the quality of the cleaning job performed by their workers as a "pre-clearance" step. Owners, contractors, or public agencies may also find it useful to take their own pre-clearance dust samples for quick onsite analysis (using, for example, portable XRF, anodic stripping voltammetry (ASV), or potentiometric stripping analysis (PSA) technology) before calling in the clearance examiner. If the pre-clearance determination is that the area is not ready for the clearance examiner, the supervisor must order the work area to be recleaned. Such pre-clearance assessments and follow-up will make it more likely that clearance standards are met the first time around (see Section VI.A.3, below).

The clearance procedures contained in this chapter should always be included in the job specifications so that performance responsibilities are clear.

III. Time Between Completion of Cleanup and Clearance

Clearance dust sampling should be performed no sooner than one hour after completion of the final cleanup to permit airborne leaded-dust to settle. Clearance dust sampling is for *settled* leaded-dust, not airborne leaded dust, because the main source of lead exposure for children is through contact with contaminated surfaces followed by ingestion through hand-to-mouth contact. While often performed for asbestos abatement projects, air sampling does not appear to be a useful tool for determining if clearance has been achieved in lead hazard control work. Because asbestos fibers are known to have low settling velocities (that is, they take a long time to settle out of the air), air sampling can be used to determine the effectiveness of the cleanup effort in asbestos abatement jobs. But because dust particles typically generated during lead hazard control jobs are larger, denser, more spherical, and heavier, settling time is much faster. A one-hour waiting time is recommended because the additional amount of leaded-dust that would settle onto floors after one hour has been empirically found to be much less than the clearance standard for floors (40 µg/ft^2) or window sills (250 µg/ft^2) (Choe, 2000).

Entry into the area should be prohibited, and openings from the clearance area should remain closed during the waiting period to keep turbulence and resuspension of particulate matter to a minimum, as well as minimize any potential for cross contamination or unauthorized entry.

IV. The Clearance Area, and Sampling of Units, Rooms, or Areas

A. Determining the Clearance Area and Schedule

A matter of critical importance in the design of a clearance examination is determining the area that must be examined (the clearance area). Clearance examiners should reach an understanding on this with their clients as early as possible. Misunderstanding can lead to costly disputes and delays. Clearance examiners must know in advance the scope of the clearance examination (e.g., the rooms, dwelling units, common areas and/or exterior areas to be cleared) in order to make sound sampling plans and reliable fee estimates. Contractors or other persons performing the work and the associated cleaning must understand in advance the clearance examination process (i.e., visual assessment followed by dust testing), but they must not be informed about the specific sampling locations, in order to avoid their biasing their cleanup activities, even if unintentionally.

Clients should be informed that dust samples will be taken on window troughs, as well as window sills and floors, as part of the clearance examination after interior work has been done. Otherwise contractors or maintenance staff may neglect to clean window troughs (see Section VI.C.3 and Figure 15.2, below, for a definition and illustration of window troughs).

It is also suggested that the clearance examiner discuss with the client any job-specific factors that may affect the schedule for the examination and the speed with which laboratory results are needed. Possible factors include the need for reoccupancy of the clearance area or for contractors to do additional work (see Section VI.E, below, for a discussion of laboratory turnaround).

1. Interior Clearance Areas

For clearance following interior work, these *Guidelines* define the following three clearance categories, each with a different clearance area (see Section VI.C.1 and Table 15.1, below):

Category 1. No containment of dust in the rooms or common areas in which work is conducted. Because other rooms or common areas where no work was done may be contaminated, clearance must cover/represent the entire space (e.g., work area and all the rooms in the dwelling unit and/or the common areas that are associated with the work area).

Category 2. Dust has been contained to the work area. Clearance covers at least the area within the containment, plus the floor outside the containment area (to make sure contamination has not spread), plus passageways used by workers walking to and from the work area. (Alternatively, clearance Category 1 may be used.) To determine a Category 2 clearance area, the clearance examiner must know exactly where the containment was located and what passageways were used by workers.

Category 3. "Worksite only" clearance. This category of clearance is acceptable following a small amount of contained interior work not intended to be abatement that takes a short time to complete. In these cases, the clearance area may be limited to the rooms in which work has been done. (Alternatively, clearance Categories 1 or 2 may be used.)

The critical factors in determining the clearance area are: (1) the location of the work (i.e., what rooms, if interior, and what surfaces, if exterior); (2) the type and location of dust containment during the work; (3) whether the work was a low-dust or high-dust job; and (4) the duration of the job. The best way to obtain information on these factors is to observe the work in progress.

If the clearance examiner cannot observe the work in progress, he or she should request the information from the client and should determine the clearance area based on the information received. Record the information that forms the basis for the clearance area determination and include it in the final report (see Section IV.A.3, below).

Dust containment. EPA regulations on clearance following abatement (at 40 CFR 745.227(e)(8)) make the clearance area dependent on dust containment. Similarly, HUD regulations on clearance following activities other than abatement (at 24 CFR 35.1340(b)(2)) incorporate the clearance steps set forth in the EPA abatement regulation. For projects covered by the EPA's RRP Rule but not HUD's Lead Safe Housing Rule or a State or local regulation, if clearance is performed after the work as an alternative to cleaning verification, the clearance must be of at least the work area.

For interior work that may create high dust levels, containment generally includes such steps as: temporarily turning off heating, ventilating, and air-conditioning (HVAC) systems; sealing vents; and installing primitive airlocks with protective sheeting over doors to rooms in which work is being done; and covering the floors of work areas and passageways used by workers with disposable, impermeable protective sheeting. The use of primitive airlocks over work-area doors and the temporary elimination of HVAC airflow are the key methods for containing dust spread to the work area. (See Chapter 8 for a detailed discussion of containment methods as a part of worksite preparation.)

For interior work that will not create high dust levels, containment may be as little as laying protective sheeting on the floor where the surfaces will be disturbed.

Although clearance of rooms and spaces outside the containment area may not be required (except for the floor just outside the containment), complete clearance of all rooms in a dwelling unit and/or other associated spaces provides assurance that all living areas are free of lead-based paint hazards. Therefore, owners and lead hazard control contractors should carefully consider the benefits of cleaning and clearing areas outside the containment relative to the additional cost, which is often marginal.

FIGURE 15.1 Windows sealed to prevent migration of dust outside.

2. Clearance Area Following Exterior Work

Category 4. Exterior areas must be cleared following work that has disturbed or may have disturbed exterior lead-based paint. Interior clearance is not necessary following exterior work if the only work being done is on the outside and if there is dust containment due to a tightly closed opening between exterior and interior spaces (e.g. window and/or door). In this type of containment, windows, doors, vents, and other building openings near the work area are sealed or tightly closed to prevent migration of dust from the outside to the inside during the work (see Figure 15.1). If building openings near the work area are not sealed or tightly closed, clearance must be conducted in interior spaces that may have been affected. Exterior clearance is not explicitly required by EPA and HUD regulations if the only work being done is on the inside of the building. However, in such cases, exterior contamination could occur if material is thrown out of windows or unwrapped waste is laid on the ground. Therefore the clearance examiner should perform a visual assessment of the grounds near the building(s) and ask the client to remove any paint chips and other paint-related debris that are found.

Exterior clearance following exterior paint work consists of a visual assessment for visible surface dust, debris and residue, only. It is not necessary to sample soil or exterior dust unless the owner or contractor wishes to have additional assurance of no remaining hazards (see Section VII, below). The visual assessment should cover exterior painted surfaces (to identify deteriorated paint) and ground areas, vegetation and horizontal building surfaces (e.g., exterior window sills, porch floors and railings) on which dust and debris may have fallen as a result of the work. If a child under age 6 uses a porch, balcony, deck, or similar space as a play area, inspect the space thoroughly if it is near the surfaces on which work was done to make sure it is free of visible dust and debris (see Figure 15.2). In deciding the area of the exterior visual assessment, the clearance examiner should take into account the nature, extent, location, and duration of the work and the design of the containment used to limit the spread of dust and paint chips. Generally, 10 to 20 feet is an adequate distance out from the sides of the building where work was done, depending on the characteristics of work.

FIGURE 15.2 Visible paint chips and debris in the soil.

Under the standard HUD-EPA clearance procedure, the clearance examiner is not required to determine whether abatement or interim controls of soil-lead hazards have been performed satisfactorily and as specified. Therefore it is not necessary to conduct a visual assessment to identify bare soil that may have been untreated or to take soil samples. However, soil samples may be collected as an option (see Section VII, below).

3. Information for Clearance Area Determination

The clearance examiner should record information about the nature of the work in writing, whether in a narrative, a list, or on a floor plan.

- Record the source of the information (e.g., the client, the contractor, or from direct on-site observation of the work in progress).
- Record the clearance area agreed to with the client. If the agreed-upon clearance area differs from the clearance examiner's recommendation, include a written explanation of the basis for the recommendation.
- Include information about the characteristics of the work and the agreed-upon clearance area in the clearance examiner's report.

If the clearance examiner cannot obtain sufficient information on which to select Category 2 or 3 for interior clearance, the appropriate clearance category is Category 1.

B. Sampling of Rooms, Units or Areas

Note that, for the purposes of clearance sampling, hallways, stairways, entry rooms/lobbies and other significant definable spaces are considered "rooms" as well as spaces normally considered as rooms, such as bedrooms, bathrooms, living rooms, kitchens, dining rooms, family rooms. Similarly, for clearance sampling purposes, a hallway, lobby or other space within a multi-family building is considered a "unit" or a "room," as applicable.

1. Sampling Rooms within a Unit

When conducting clearance in a single-family dwelling unit, the visual assessment should be conducted in all rooms and exterior work areas within the clearance area, unless the clearance is of the worksite only (Category 3), but if the clearance area contains more than four rooms it is not necessary to collect dust samples in every room or space.

For Category 1 clearance, If the work areas were not contained, all rooms in the unit must be sampled or represented by sampling. EPA and HUD regulations on clearance require that dust samples be collected in four selected rooms in the work area (or all of the work area rooms, if fewer than four), and allow additional rooms to be sampled. The rooms selected for dust sampling are intended to be those in which young children are most likely to be exposed to dust-lead hazards. These should include, as a higher priority, the rooms in which the work was done and, as a lower priority, those rooms in which the young children sleep and/or play. (See Section VI.C.2, below.)

For Category 2 clearance, in which dust has been contained to the work area, the sampling locations are the same as for single-surface sampling Category 1, above, plus one floor sample outside of, and within 10 feet of, each containment area, and one floor sample along each passageway used by workers walking to and from the work area.

For Category 3, worksite-only clearance, the clearance area includes at least the rooms in which work was done. If the work was done in one room, the room selection is the same as for Category 1, above. If the worksite-only clearance area contains more than one room, see Section VI.C.2, especially Table 15.1, for information on room selection and sampling locations.

If there are no dust-lead hazards in the selected rooms, it is assumed that there are no such hazards in the other, unsampled, rooms. If any of the selected rooms do have dust-lead hazards, it is assumed that the other, unsampled, rooms also have them. People performing hazard control, rehabilitation, maintenance, and associated cleanup work must ***not*** know which rooms will be sampled for dust. Section VI.C.2, below, provides detailed information on selecting rooms for dust sampling. Section IX, below, provides guidance on interpreting dust sampling results and when recleaning and resampling are needed.

Clearance examiners and their clients may, if they wish, choose to collect dust samples in more than four rooms. In addition, state, tribal and/or local requirements may require more rooms to be tested. Some clearance examiners prefer to sample in ***all*** rooms in which high-dust paint-disturbing work is done. This approach has higher initial costs for the clearance examiner's time and laboratory analysis than does sampling in only four rooms, but it may save time and money in the long run because the greater amount of information allows a more focused and less costly recleaning and resampling effort if dust-lead levels exceed applicable standards.

2. Sampling Units within a Multi-family Property

If the clearance area encompasses many dwelling units in a large multi-family building or complex of similar buildings, random sampling of dwelling units, common areas and building exteriors is an option for both the visual assessment and dust sampling under the following conditions:

- For properties built during the period 1960-1977 (inclusive), random sampling of units is acceptable if the area to be cleared includes more than 10 dwelling units that have a common construction and painting history.
- For properties built before 1960, random unit sampling is acceptable if the area to be cleared includes more than 20 dwelling units that have a common construction and painting history.

This guidance applies most clearly to a large multi-family building, but it may also be applied to a group of single-family or a group of multi-family properties that are all of similar construction, were built at approximately the same time (i.e., within 2 or 3 years of each other), and have a similar painting history. If the number of units to be cleared is less than the applicable number indicated above (i.e., fewer than 11 or 21, depending on year of construction), all units must be sampled, because sampling fewer than all units would not be statistically reliable. Regardless of whether units and common areas are sampled, sampling of rooms within dwelling units should follow the guidance provided in Section IV.B.1, above, and in Section VI.C.2, below.

If the number of dwelling units in the clearance area qualifies for the unit sampling option (i.e., more than 10 dwelling units built between 1960 and 1977 (inclusive) or more than 20 units built before 1960), the visual assessment and the clearance dust sampling can be performed in randomly selected dwelling units, common areas and exterior surfaces. (The same approach is used for clearance of multiple common areas or exterior areas.) The random sampling can be performed for a portion of the housing development or for all of it. In either case the randomly selected units and common areas represent a specified group of housing units and common areas. The contractor must not know in advance which units and areas will be sampled, as this could bias the results, even if unconsciously. It is necessary to choose an adequate number of randomly selected units and common areas based on Table 7.3 of Chapter 7 and instructions associated with that table. Significant cost savings could be realized with such a sampling plan.

However, the implications of random clearance sampling should be understood fully before it is used. First, if the random sampling shows that levels of leaded dust are too high, it will be necessary to re-clean not only the affected rooms or components in the selected dwelling unit or units, but also in all the other units that the randomly selected units were meant to represent. Alternatively, all the unsampled units could be sampled individually to determine which need recleaning. The costs of repeated sampling should be compared with the costs of repeated cleaning. Regardless of whether all the represented units are sampled or recleaned, a further delay in permitting residents back into the area is possible when using random clearance sampling. Second, there has been a significant failure rate in attaining compliance with clearance dust standards. In the "Evaluation of the HUD Lead Hazard Control Grant Program" using the 1995 EPA interim guidance standards (see 60 FR 47248, September 11, 1995), with 2682 dwellings going through clearance, the failure rates at initial clearance were 20 percent for floors at 100 $\mu g/ft^2$; 6 percent for interior windowsills at 500 $\mu g/ft^2$; and 7 percent for window troughs at 800 $\mu g/ft^2$ (NCHH, 2004). In the HUD Abatement Demonstration Project using the earlier interim standards, failure rates on the initial wipe tests were 19 percent for floors at 200 $\mu g/ft^2$; 14 percent

for windowsills at 500 µg/ft^2; and 33 percent for window troughs at 800 µg/ft^2 (HUD, 1991). In one large abatement job for a public housing authority, 15 percent of the housing units failed the clearance tests and required recleaning (Jacobs, 1993a). All of these failures rates were based on standards considerably higher, i.e., less stringent, than current EPA standards. These failure rates can be partially attributed to variable contractor performance.

In spite of all these caveats, there is one special situation that may lend itself well to random clearance sampling. A large *vacant* apartment building or housing development that will not be immediately reoccupied following the work could conceivably be randomly sampled at the end of the project and, if necessary, completely recleaned. Alternatively, all units could be sampled to determine which ones require recleaning.

Whether random clearance sampling or unit-by-unit clearance sampling is performed, repeated clearance sampling should *always* be performed in all units that required recleaning. In short, most cases of lead hazard control will require that clearance dust sampling be conducted in every unit treated. The basic exception is if less than *de minimis* amounts of painted surfaces are disturbed.

V. Visual Assessment

The visual assessment that is part of the standard EPA-HUD clearance procedure has two fundamental purposes: (1) to identify any remaining deteriorated paint that is or may be lead-based paint; and (2) to identify visible dust, paint chips; or paint-related debris. The clearance examiner should inspect painted surfaces and horizontal surfaces near such surfaces in both interior and exterior locations. Any deteriorated paint that is or may be lead-based must be repaired or stabilized and any visible dust, paint chips, or other paint-related debris must be removed before dust sampling can take place. A form for visual assessments can be found at the end of this chapter (see Form 15.1).

Determining that the lead hazard control work was actually performed as specified is an important initial step. This may be done by the owner, the owner's agent, or (except for work covered by the Lead Safe Housing Rule) the certified contractor/supervisor. This is usually the responsibility of the contractor and the owner, but the clearance examiner may be asked to make such a finding, such as through the clearance examiner's contract or work order. If so, the examiner must be informed in detail of the scope of the work before the work begins in order to be on the job site while the work is being performed. See Section VIII, below, for further guidance.

For a dwelling unit, the visual assessment of interior spaces and exterior surfaces should be exhaustive, covering the entire clearance area, before any sampling of rooms or other spaces or exterior surfaces is considered. If dwelling units and common areas are sampled in a multi-family property, however, the visual assessment need cover only the sampled units and common areas, but may include more or all units and areas.

A. Visual Assessment for Deteriorated Paint

The clearance examiner should identify all deteriorated paint in the clearance area, whether interior, exterior, or both. Deteriorated paint is defined by EPA as any interior or exterior paint or other coating that is peeling, chipping, chalking or cracking, or any paint or coating located on an interior or exterior surface or fixture that is otherwise damaged or separated from the substrate (40 CFR

745.63). Nail holes and hairline cracks are not considered deteriorated paint. Paint that is separated from other layers of paint or from the substrate may appear to be loose, peeling, chipping, flaking, bubbling, blistering, alligatoring, or seriously cracking. See Section II.D.3 of Chapter 5 for an illustrated discussion of various forms of paint deterioration.

EPA and HUD regulations include chalking as a form of paint deterioration. Therefore, clearance examiners must identify chalking paint. Chalking paint (usually found only on exterior paints) has been of concern because chalking may contaminate the ground and building surfaces below if the layer of paint that is chalking is lead-based. Chalking is usually manifested by discoloration of the wall or ground below the painted surface and by a chalk-like substance that comes off on the hand after lightly rubbing the paint surface.

All deteriorated paint should be recorded on a form, such as Form 15.1, the Visual Assessment – Lead Hazard Clearance Examination form (at the end of this chapter). Results should be written down as the assessment proceeds, and the report should be precise about amounts and locations. If deteriorated paint is found, the clearance examiner should ask the client why the paint is deteriorated. If the deteriorated paint is known not to be lead-based, the examiner should record that information, identify the document that is the basis for the determination, and proceed. If the client states that he or she is not required to repair that paint, the examiner may record that and proceed. It is not expected that the clearance examiner should be a compliance official, but the clearance record should show the client's explanations, if any, for the existence of deteriorated paint.

One example of a possible explanation for the existence of deteriorated paint might be that the property has undergone rehabilitation with Federal assistance of $5,000 or less per dwelling unit. For such properties, HUD regulations (at 24 CFR 35.930(b)) do not require stabilization of deteriorated paint if that painted surface is not being addressed as part of the rehabilitation. Thus, for example, if the rehabilitation work is only window repair or replacement, deteriorated paint may remain on the walls near the windows – walls that are in the clearance area. A similar situation might occur in an unregulated renovation job of just part of a dwelling unit.

If the client does not know whether the deteriorated paint is or is not lead-based and has no other reasonable explanation for the presence of deteriorated paint, the paint surface should be made intact and the work area cleaned before completion of clearance. If the clearance area is an interior space, the paint must be repaired and the work area cleaned before collection of clearance dust samples because the paint repair might contaminate the area. Therefore, if there is any unexplained deteriorated paint, the clearance examiner should provide the client with a copy of the visual assessment form so it is clear exactly what paint should be repaired.

Tracking leaded dust from one area to another is a big problem on lead hazard control jobs. Leaded dust can be tracked on shoes from the work area to non-work areas or to the outside. Sometimes leaded dust from the outside soil is tracked into the work area. Leaded dust from a porch or non-work area can be tracked into a cleaned area. When this happens, the whole area must be cleaned. Accordingly, the clearance examiner and others visiting the worksite are advised to wear **disposable booties to minimize any cross contamination from one work area to another, or dust migration from outside the worksite into the worksite.**

B. Visual Assessment for Settled Dust and Debris

1. Interior

For an interior clearance area, there should be no evidence of settled dust or paint chips or paint-related debris following a cleanup effort. If dust, paint chips, or paint-related debris are observed, the clearance examiner should record his or her observations on a form, such as Form 15.1, and provide the form to the client. Remember to observe window troughs, as well as window sills and floors. These surfaces should all be clean because dust samples are collected from them. The client should have the relevant areas recleaned *before* clearance dust samples are collected to avoid conducting dust sampling twice. Visible settled dust provides sufficient evidence that cleanup was not adequate (see Figures 15.3 and 15.4). If recleaning is necessary, the clearance examiner should provide the client with a copy of the visual assessment form so it is clear exactly what areas should be recleaned.

There are conflicting reports regarding the use of the so-called "white-glove test," named for the concept of running one's hand in a white cotton glove along a surface to see how dusty or dirty it is, as part of the visual assessment. Some housing agencies have indicated that they find this to be a useful preliminary examination tool, while others indicate that this test almost always shows some discoloration of the glove, even if surfaces have been cleaned well. Until it has been demonstrated to effectively predict leaded dust levels, use of the "white glove test" is left to the discretion of the examiner and is not recommended by HUD. The "white glove test" is *not* a substitute for laboratory analysis of dust samples. Remember that the EPA has a cleaning verification method for projects covered by its RRP Rule (see Appendix 6) that are not covered by HUD's Lead Safe Housing Rule.

FIGURE 15.3 Visible Dust Indicates Recleaning is Needed

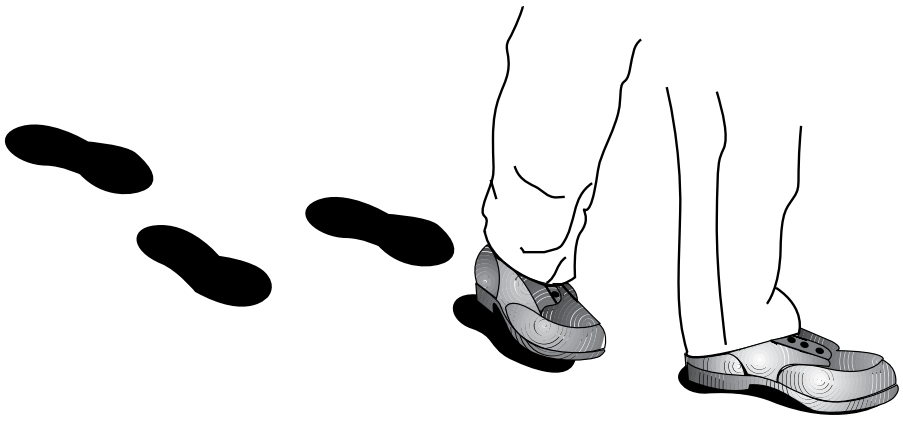


FIGURE 15.4 Tracking of Dust that may Contain Lead

2. Exterior

For an exterior clearance area, the clearance examiner, in addition to looking for deteriorated paint, should visually examine the ground, vegetation, and horizontal building surfaces (including exterior window sills) near the exterior work surfaces to determine that paint chips and other paint-related debris have been removed. Also, it is especially important that outdoor, hard-surfaced living areas such as porches, decks, and balconies that are within the clearance area and are frequented by children of less than six years of age be free of visible dust and debris. (See Section IV.A.2, above, for guidance on determining the area to be included in exterior clearance.) A visual examination of the surface for surface dust, debris and residue is usually adequate. It is not necessary to turn over or rake soil to look for paint chips unless the clearance examiner has reason to believe workers or the client may have covered up paint chips or other lead-contaminated debris with loose soil.

If exterior cleanup is necessary, the clearance examiner should provide the client with a visual assessment form explaining exactly what areas and what material must be cleaned up. Clearance has not been achieved until such cleanup has been satisfactorily completed. However, it is usually not necessary to postpone interior dust testing until exterior cleanup has been completed, provided building openings are closed during the exterior cleanup to avoid possible contamination of interior spaces. The clearance examiner should tell the client it is necessary to close building openings within 10 to 20 feet of the exterior cleanup.

C. Completion of the Visual Assessment Form

The Form 15.1 for visual assessments should be completed, signed, and dated. If no unexplained deteriorated paint or visible dust, paint chips, or paint-related debris are observed, the clearance examiner can proceed to dust sampling and analysis. If, on the other hand, further paint treatment or cleanup is required, the examiner should provide the client with such observations on a dated and signed form; and it will be necessary for the clearance examiner to return after the repair and cleanup is done, conduct another visual assessment, and complete, sign, and date a second visual assessment form to document the presence or absence of unexplained deteriorated paint. Dust sampling should not be performed until the examiner observes that the paint repair and cleanup has been satisfactorily done.

VI. Clearance Dust Sampling

A visual assessment alone is not adequate for determining if a residence is safe for occupancy, because small dust particles are not visible to the naked eye. A person with normal eyesight cannot detect individual dust particles smaller than 50 µm in diameter (Olishifski, 1983). Data indicate that a significant percentage of the dust generated during lead hazard control work is smaller than 50 µm (Mamane, 1994; NIOSH 1993b). Because these smaller dust particles are associated with an increased risk of lead poisoning, clearance dust testing is required to determine quantitatively if a leaded dust hazard remains following lead hazard control work. The dust testing involves two steps: sampling the dust, and analyzing the dust for lead.

A. Sampling Methods

1. Wipe Sampling

Dust samples must be collected using wet wipes. The recommended protocol for sample collection is either Appendix 13.1 of these *Guidelines;* ASTM Standard Practice E 1728,

"Standard Practice for Field Collection of Settled Dust Samples Using Wipe Sampling Methods for Lead Determination by Atomic Spectrometry Techniques"; or the EPA report, "Residential Sampling for Lead: Protocols for Dust and Soil Sampling," March 1995 (EPA, 1995a).

Neither EPA nor HUD currently recognizes a standard for collecting and evaluating vacuum samples of dust as a part of a lead-based paint hazard risk assessment or clearance examination. Wipe sampling yields a measure of dust-lead loading (in micrograms of lead per square foot or square meter), whereas vacuum sampling can provide a measure of the concentration of lead in the dust (in parts per million or micrograms per gram) as well as loading. Wipe sampling, however, is the required method of dust collection because it is simple, inexpensive, and has been used successfully for a number of years. Research has indicated that wipe sampling results correlate well with blood-lead levels in children (Lanphear, 1994; Farfel, 1992). The wipe sampling protocols in Appendix 13.1 and in ASTM E 1728 are equivalent to the method used in the Lanphear study.

Clearance wipe samples must be analyzed for lead by a laboratory recognized by the EPA under the National Lead Laboratory Accreditation Program (NLLAP) for analysis of lead in dust with one exception. The exception is for analyzing samples collected where States or Tribes operate an EPA-authorized lead-based paint inspection certification program that has paint testing requirements different from the EPA requirements, in which case the State or Tribal requirements must be followed. NLLAP-recognized laboratories are required to use the same analytical methods for analyzing the sample that they used to obtain NLLAP recognition.

- EPA established NLLAP to provide the public with laboratories that have a demonstrated capability for analyzing lead in paint-chip, dust, and/or soil samples at the levels of concern stated in these *Guidelines*. NLLAP monitors the analytical proficiency, management and quality control procedures of each laboratory participating in the program. NLLAP does not specify or recommend analytical methods.
- See Chapter VII, Section VI.I for further information of NLLAP procedures.
- Field-portable XRF analysis has been used for measurement of lead in dust (Sterling, 2000; Harper, 2002) or soil (EPA, 2004; Binstock, 2009) with varying degrees of success; these methods do involve collecting a sample of the medium, so samples collected from target housing or pre-1978 child-occupied facilities, must be analyzed by a laboratory recognized by NLLAP for analysis of lead in the particular medium. The laboratory may be a mobile laboratory, field sampling and measurement organization, or a fixed-site laboratory, as discussed in Section II.E.6, above.

Information on this program, including an up-to-date list of fixed-site and mobile laboratories recognized by NLLAP, can be obtained on the EPA web site at ***http://www.epa.gov/lead/pubs/nllap.htm***, or by calling the National Lead Information Center at 800-424-LEAD. (Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.)

2. Composite Sampling

Under EPA and HUD regulations, dust wipe samples may be either single surface or composite. Each single-surface sample is a separate wipe from a specific location. It is placed in a separate container and is analyzed separately. A composite sample can contain up to four wipes from four

different locations, but the locations must be from the same type of component, e.g., hard floors from four different rooms, or interior window sills from four different rooms. Wipe samples are composited in the field, not in the laboratory, by inserting up to four wipes from four surfaces into the same container. The laboratory analyzes all four wipes as one sample using a modified analytical procedure. The individual wipes in each composite are called "subsamples."

Acceptable recovery rates (i.e., within the range of 80 to 120 percent of the "true" value) have been found when no more than four wipes are analyzed as a single sample (EPA, 2001b; Jacobs, 1993c). Testing reported in 2011 among multiple NLLAP-recognized laboratories identified two sample preparation methods for four-wipe composite dust wipe samples that are capable of meeting NLLAP requirements for accuracy (recovery) and precision. (White, 2011)

In 2011, the American Industrial Hygiene Association Laboratory Accreditation Programs, LLC revised the "Specific Additional Requirements" in Policy Module 2C for its Environmental Lead Laboratory Accreditation Program (ELLAP). Laboratories accredited by ELLAP for lead analysis of dust wipes are recognized by NLLAP (and similarly for lead in paint chips and soil). As of the publication of these *Guidelines*, the ELLAP policy covers accreditation (and, hence NLLAP recognition) of laboratories analyzing composited wipes, for which "all requirements for wipes listed in Policy Module 2C apply, but with the additional requirement that each batch of samples and associated QC samples shall contain the same number of wipes, i.e. composited samples that contain two wipes are to be analyzed in a batch containing QC samples to which two wipes were added as matrix." (ELLAP policy 2C.4.12, which is linked from ***http://www.aihaaccreditedlabs.org/PolicyModules/Pages/2011%20Policy%20Modules.aspx***. Additional composite-specific requirements are found in the ELLAP application form linked from ***http://www.aihaaccreditedlabs.org/programfees-guidelines-forms/Pages/default.aspx***.)

While these *Guidelines* recognize the use of composite sampling of dust, they generally do not encourage it for the following reasons:

- Most laboratories that are recognized by EPA for lead analysis (i.e., NLLAP-recognized laboratories) discourage clients from submitting composite dust wipe samples.
- The lack of a inter-laboratory proficiency program for analysis of composited samples may make the data less convincing in case of a dispute.
- Compositing offers only limited amount of information. If one composite sample has dust lead levels exceeding applicable standards, all components represented by that composite sample will have to be recleaned, or each room will need to be resampled individually. In contrast, if one of the single-surface samples fails, recleaning is necessary only in the room in which the failed sample was taken plus all unsampled rooms (or each unsampled room could be sampled).
- The decision criterion for evaluating the results of composite clearance samples is more stringent than that for single-surface samples. In accordance with EPA regulations, the EPA standard for dust-lead hazards must be divided by one-half of the number of subsamples to determine the standard against which the results of a composite clearance sample must be evaluated (40 CFR 745.227(e)(8)(vii)). Thus, with the EPA dust-lead hazard level for floors being 40 µg/sq. ft. as of the publication of these *Guidelines,* the standard for a composite floor sample with four subsamples is 20 µg/sq. ft. Such a low composite standard increases the likelihood of failing clearance.

- Laboratories often separate composite samples and analyze each wipe separately because their equipment and sample preparation procedures are set up for individual wipes, rather than analyzing the composited samples together. As a result, the cost of the composite analysis may well be at least as high as for analyzing the wipes submitted as separate samples.
- The cost of single-surface sampling has declined since the 1990s, so the money spent in single-surface samples is more than made up by having good data.

Research has shown the benefit of composite dust wipe testing for the case of high-dust jobs involving lead-based paint. (Cox, 2011) For such jobs, lead in dust next to the walls was three times more difficult to clean than lead in dust nearer the center of the rooms; clearance using single-wipe samples collected next to the walls was much more likely to fail; and "four-wipe composite sampling within each room (two randomly selected from the perimeter and two randomly selected from the interior) provided a very reliable method for detecting clearance failure (99% or greater) versus a randomly selected single wipe sample per room (50% or less)."

The following recommendations should be observed if composite dust wipe sampling is conducted:

- Wipes used for composite dust wipe samples should meet the requirements of ASTM Standard E 1792.
- Whenever composite sampling is contemplated, clearance examiners should check with the analytical laboratory to determine whether it analyzes composite samples and, if so, whether special quality assurance practices are needed. For example, clearance examiners should confirm whether the laboratory is able to analyze composite samples with wipes that meet ASTM Standard E 1792 (Battelle, 2002).
- A single composite sample should not contain subsamples from different component types, e.g., floors and interior window sills, in the same composite sample.
- When composite samples are being taken, separate composite samples are required for each dwelling unit sampled.
- The surface areas of subsamples within a composite sample must be very similar in order to avoid oversampling a room.
- All the areas to be wiped for a composite sample should be identified before starting to perform the wiping for the subsamples. After preparing the container for a composite sample, put on the glove(s) and complete the wiping procedures for all subsamples.
- A new wipe should always be used for each spot sampled. Carefully insert each wipe subsample into the same container.
- No more than four different wipes should be inserted into a single container for a composite sample. As noted above, acceptable recovery rates (i.e., within the range of 80 to 120 percent of the "true" value) have been found when no more than four wipes are analyzed as a single sample (EPA, 2001b; Jacobs, 1993c).

- Composite samples should not be taken from rooms that have dramatically different conditions. For example, if the clearance examiner has some reason to believe that cleanup was not performed adequately in a room, a single-surface sample should be collected there. In some cases both single-surface samples and composite samples may be needed for the same component.

3. On-site Dust Testing

EPA and HUD allow on-site analysis of dust samples as long as the laboratory analyzing the samples is recognized for on-site ("mobile") analysis of lead in dust by EPA under the National Lead Laboratory Accreditation Program (NLLAP). Methods exist for reliably screening wipe samples on-site rather than in a fixed laboratory; note that this preliminary screening is not the same as clearance, but may be used by the owner, contractor or clearance examiner as part of determining whether to proceed to clearance testing. These include portable X-ray fluorescence (XRF) analysis and anodic stripping voltammetry (ASV) (Ashley 2001; EPA, 2002b; Clark, 2002). These methods may provide testing results much more quickly than fixed laboratory analysis, and so they may save time and money, reduce relocation difficulties, facilitate cooperation by both landlords and tenants, and accelerate environmental investigations in cases of children with elevated blood-lead levels.

In States and Tribal lands where EPA is operating a lead certification program, wipe samples for a clearance examination must be analyzed by a laboratory recognized by EPA under the National Lead Laboratory Accreditation Program (NLLAP) for analysis of lead in dust. If, in these States, an EPA-recognized laboratory wishes to perform on-site analyses of dust wipe samples, it may do so. In States or Tribal lands where the State or tribe is operating an EPA-authorized lead program, the same requirements generally apply, although there may be some differences (EPA, 2002a). While EPA clearance regulations and program procedures apply only to abatement activities (and the option for clearance in projects covered by the RRP Rule), HUD regulations and many State regulations apply the same procedures to non-abatement activities. On-site analysis (just like fixed-site laboratory analysis) of dust for lead for clearance testing (or for risk assessment or lead hazard screening) of target housing may only be done by an NLLAP-recognized laboratory. Thus a certified risk assessor, lead-based paint inspector, or sampling technician who wishes to conduct on-site dust testing as part of a clearance examination must conduct the analysis as part of working for an NLLAP-recognized laboratory, whether as an employee or a subcontractor of the laboratory.

Any person who is trained and otherwise qualified (e.g., holding a state radiation license) to operate the XRF instrument, or use the ASV or PSA method may use these methods to conduct dust testing in a preliminary screening to determine whether the clearance area is clean and ready for the clearance examination. A person conducting a preliminary screen does not have to be a certified lead-based paint inspector, certified risk assessor, or a certified dust sampling technician. To conduct a clearance examination or a risk assessment, however, one must be certified. Owners and contractors may wish to use appropriately certified individuals to conduct such screening tests to minimize the likelihood of clearance failure. State regulations on the use of devices with radioactive elements must be observed.

B. Clearance Dust Sampling and Sealant Application

Wipe samples should be collected after any application of a sealant on a rough, unfinished, horizontal surface, such as a floor or window sill, not before. In lead hazard control programs, and especially after paint removal, coating with a sealant is often one of the final measures completed. It is recommended for wood and concrete surfaces that are not coated with paint, varnish, polyurethane, or other coating. The purpose of sealing floors or sills is not to trap leaded-dust underneath the sealant, but to provide a surface that can be cleaned effectively by the resident. The type of surface determines the type of sealant. For example, wooden floors should either be painted with deck enamel or coated with polyurethane; concrete floors should be sealed with a concrete sealant; and tile floors should be sealed with appropriate wax or other coating. The lead-safe maintenance program should check the integrity of floor sealants at least yearly.

C. Location and Number of Clearance Dust Samples

Table 15.1 presents the minimum number and location of clearance dust samples to be taken in various circumstances. The number and location of samples depend on several factors: whether dust containment was used, the number of rooms in the clearance area, whether composite or single-surface samples are collected, and whether the clearance protocol must be a standard HUD-EPA protocol or can be a special worksite-only protocol that may acceptable in certain circumstances.

1. Clearance Categories

The four categories of clearance are shown in Table 15.1. Remember that clearance is not required following small work in which the amount of paint disturbed is less than the *de minimis* amounts defined in Section I.C, above.

Clearance Category 1 in the Table 15.1 is the standard HUD-EPA dust sampling protocol for clearance after interior work that has not used dust containment between work areas and non-work areas. Dust containment generally includes temporarily turning off HVAC systems, sealing vents, and installing plastic sheeting over doors to rooms in which work is being done. See Chapter 8 for guidance on containment to minimize dust migration. Also, clearance examiners should use Clearance Category 1 if information on the location and design of containment is not available.

Clearance Category 2 in Table 15.1 is the standard HUD-EPA dust sampling protocol for clearance after interior work that has used dust containment between work areas and non-work areas. Categories 1 and 2 constitute the recommended protocol for dust sampling in most clearance examinations. Categories 1 or 2 must be used if the work includes abatement of lead-based paint hazards, as defined and regulated by EPA and State or Tribal programs authorized by EPA. Categories 1 or 2 must also be used if the clearance is required by the HUD Lead Safe Housing Rule, except in certain cases in which worksite-only clearance is also permitted.

Clearance Category 3 in Table 15.1 is the recommended dust sampling protocol for worksite-only clearance following a small amount of interior work that was of short duration, generated little dust, and was contained. The HUD Lead Safe Housing Rule allows this worksite-only clearance procedure in housing receiving up to $5,000 per housing unit in Federal rehabilitation assistance and also in housing that is receiving certain other types of Federal assistance and is undergoing continuing lead-based paint maintenance. The EPA does not allow worksite-only

clearance after abatement work in States for which it operates the lead certification program. (See also sec. VI.C.5.) EPA does allow the option of clearance on work covered by the RRP Rule (40 CFR 745.85(c).); if there is no other requirement (such as from HUD's Lead Safe Housing Rule, or a State or tribal regulation) to clear the entire unit, worksite-only clearance is allowed.

Clearance Category 4 in Table 15.1 pertains to exterior paint-disturbing work. Dust sampling of exterior locations is not required. Dust testing of exterior living areas, such as porches and balconies, is optional. There is no EPA dust-lead hazard standard for exterior surfaces. Dust sampling of interior rooms is necessary, however, if building openings near the work surfaces are not sealed or tightly closed during the work to preclude the migration of work-generated dust into interior spaces. The clearance examiner must exercise professional judgment in selecting rooms that may have been contaminated during the work.

Each of these clearance categories has different dust sampling protocols, depending on whether the wipe samples being taken are single-surface or composite.

The recommended number and location of dust samples is the same for dwelling units, common areas, and child-occupied facilities. A child-occupied facility is defined by EPA as "a building or portion of a building, constructed prior to 1978, visited regularly by the same child, 6 years of age or under, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visit lasts at least 6 hours, and the combined annual visits last at least 60 hours (see Figure 15.5). Child-occupied facilities may include, but are not limited to, day-care centers, preschools and kindergarten classrooms" (40 CFR 745.223).

Once a clearance examiner has determined which clearance category(ies) apply to the job at hand, he or she then has the following decisions to make: (1) which rooms to sample; (2) which locations within rooms to sample; and (3) whether to use single-surface or composite samples. If the clearance examiner wishes to take samples above the minimum required, she or he must first ensure that the owner or owner's agent paying for the clearance examination agrees to the collection and analysis of the additional samples. These issues are discussed in the following paragraphs.

FIGURE 15.5 Indications that children are present.

Table 15.1 Minimum Number and Location of Dust Samples

Clearance Category	Number and Location of Single-Surface Wipe Samples	Number and Location of Composite Wipe Samples*
Category 1: Standard HUD-EPA clearance protocol following interior work with no dust containment.	The clearance area is the entire dwelling unit, common area, or child-care facility. If the clearance area contains four or fewer rooms, all rooms must be sampled. If there are more than four rooms, select at least four rooms for sampling. If the unit, common area, or facility being cleared consists of two or more rooms, collect two samples from each room selected for sampling: ✦ One from the floor. ✦ One from an interior window sill or window trough, if present, alternating from sill to trough between rooms. If the unit, common area, or facility being cleared consists of only one room, collect three samples: an interior window sill (if present), a window trough (if present), and the floor.	The clearance area, the number of rooms to be sampled, and room selection are the SAME as for Category 1 single-surface sampling. If the unit, common area, or facility being cleared consists of two or more rooms, collect three subsamples from each room to be sampled: ✦ One from the floor. ✦ One from an interior window sill, if present. ✦ One from a window trough, if present. If the unit, common area, or facility being cleared consists of only one room, sampling locations are the same as for Category 1 single-surface sampling locations; composite samples cannot be taken.
Category 2: Standard HUD-EPA clearance protocol for interior work with dust containment.	The minimum clearance area includes the rooms in which work was done, the area outside each containment area, and each passageway used by workers walking to and from the work area. Sampling locations are the same as for single-surface sampling Category 1, plus: ✦ One floor sample outside of, and within 10 feet of, each containment area. ✦ One floor sample along each passageway used by workers walking to and from the work area.	The minimum clearance area is the SAME as for single-surface sampling Category 2 single-surface sampling; If work was done in more than one room, collect: ✦ Three subsamples from each room to be sampled: ✦ One from the floor. ✦ One from an interior window sill, if present. ✦ One from a window trough, if present. ✦ One floor sample outside of, and within 10 feet of, each containment area.

Category 2: Standard HUD-EPA clearance protocol for interior work with dust containment.		✦ One floor sample along each passageway used by workers walking to and from the work area. If work was done in only one room, all samples must be Category 2 single-surface samples; composite samples cannot be taken.
Category 3: Worksite-only clearance for a small amount of interior work of short duration, with low dust generation and dust containment.	The minimum clearance area includes the rooms in which work was done. Room selection is the same as single-surface sampling Category 2. If the clearance area contains more than one room, collect three samples from each room to be sampled: ✦ One from the floor within 5 feet of a work surface. ✦ One from an interior window sill or window trough, if present, alternating between rooms. ✦ One from the floor near the main doorway used by workers to access the room. If work was done in only one room, collect four samples: two from the floor (in the same locations as above), one from a sill (if present), and one from a trough (if present).	The minimum clearance area, the number of rooms to be sampled, and room selection are the SAME as for Category 3 single-surface sampling. If the clearance area contains more than one room, collect four subsamples from each room to be sampled: ✦ One from the floor, within 5 feet of a work surface. ✦ One from an interior window sill, if present. ✦ One from a window trough, if present. ✦ One from the floor near the main doorway used by workers to access the room. If work was done in only one room, all samples must be Category 3 single-surface samples.
Category 4: Exterior paint-disturbing work.	Dust sampling is generally not required for exterior work if building openings near the work surfaces were tightly closed or sealed during the work. Optionally, collect one floor sample from each porch or balcony where children under age 6 play and paint-disturbing work was done. If building openings near the work surfaces were not sealed or tightly closed, conduct Category 1 interior dust sampling in rooms that may have been contaminated.	SAME as for Category 4 single-surface sampling.

** These* Guidelines *generally do not encourage collection of composite dust-wipe samples for the reasons stated above in Section VI.A.2, but they are permitted under Federal regulations.*

2. Selection of Rooms

For the purposes of clearance sampling, hallways, stairways, entry rooms/lobbies, and other significant definable spaces are considered "rooms" in addition to bedrooms, bathrooms, living rooms, kitchens, dining rooms, and family rooms. Closets are not considered to be separate rooms unless they are unusually large. Most closets are considered to be part of the room to which they are attached.

If the clearance area includes one to four rooms, all rooms must be sampled. If the clearance area includes more than four rooms in a dwelling unit, the clearance examiner may select just four rooms to sample, and those rooms will represent all rooms within the clearance area. Clearance examiners and their clients may, if they wish, choose to collect dust samples in more than the minimum number of four rooms. If the clearance area contains more than four rooms, sampling all rooms in the clearance area with single-surface samples, although more expensive, gives the most information and permits targeted recleaning if any of the samples fail. Time and labor costs saved in recleaning might justify the added cost of dust sampling. An alternative to sampling in all rooms is to sample in those rooms in which high-dust paint-disturbing work has been done.

If the clearance area contains more than four rooms, the selection of four rooms for clearance dust sampling requires judgment. Two questions should guide the clearance examiner in selecting rooms to be sampled:

(1) Where was the work done?

(2) Where do young children spend their time?

Of the two, the first is the more important for clearance dust sampling. The first priority is to sample rooms where most of the dust-generating work was done. If that criterion is not sufficient, however, the clearance examiner should select rooms where children less than six years old spend the most time. If no information on children's activity patterns is available or no young children are currently living in a dwelling unit, the following rooms can be considered as having frequent child contact: the bedroom that the youngest child would be likely to occupy (usually the smallest), the family room or play room, the kitchen, the living room, and the dining room.

Thus, if, for example, there are more than four rooms in the clearance area and paint-disturbing work was done in all the rooms, the clearance examiner should select rooms according to where, in his or her judgment, the most dust-generating work was done. If the work done in the various rooms did not vary much in dust generation, or if there is inadequate information on which to judge likely dust generation, the selection of rooms should be based on where children spend the most time. If only one, two or three rooms in the clearance area were work areas, those rooms should be selected, and then additional rooms should be selected according to where young children spend time. If exactly four rooms in the clearance area were worksites, those four should be selected.

Although the same general principles apply for common areas as for dwelling units, it is recommended that all rooms in the clearance area of common areas be selected if the rooms vary widely in size, construction, age, configuration, or use.

3. Selection of Locations Within Rooms

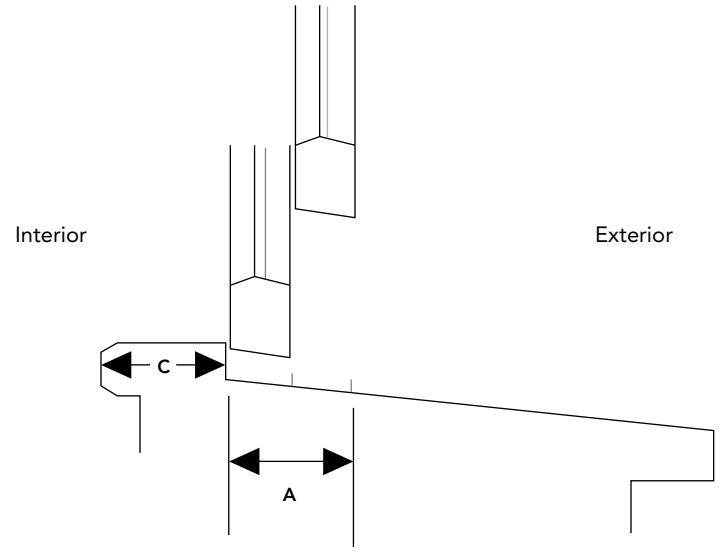
Within rooms, clearance dust samples must be taken from floors (see figure 15.6), interior window sills (if present, see Figure 15.7) and window troughs (if present). One floor sample or subsample must be collected in each sampled room. In multi-room clearance examinations using single-surface sampling, the clearance examiner should alternate sampling sills and troughs, i.e., collect a sill sample in one room, a trough sample in the next, and so forth. Where rooms have more than one window, the window to be sampled should be alternated from room to room to avoid bias in sampling. There are several ways to choose which window(s) to sample. For example, sample the rightmost window in the first room, the next one to the left in the next room, and so on, starting over when the leftmost window is reached. Similarly, sampling can start with the leftmost window and move rightward. The windows can also be randomly sampled using a random number generated by coin-flips, a die, a calculator or a computer spreadsheet. Thus, in multi-room clearance areas, a minimum of two single-surface wipe samples must be taken in each sampled room if the room has a window that can be sampled: one floor sample and one sample from either the sill or the trough.

If composite sampling is used, alternating between the sill and trough is not recommended; subsamples of each composite sample should be collected from the same component type in each sampled room. In single-room clearance areas, both the sill and the trough should be sampled, so three wipe samples must be taken in the room.

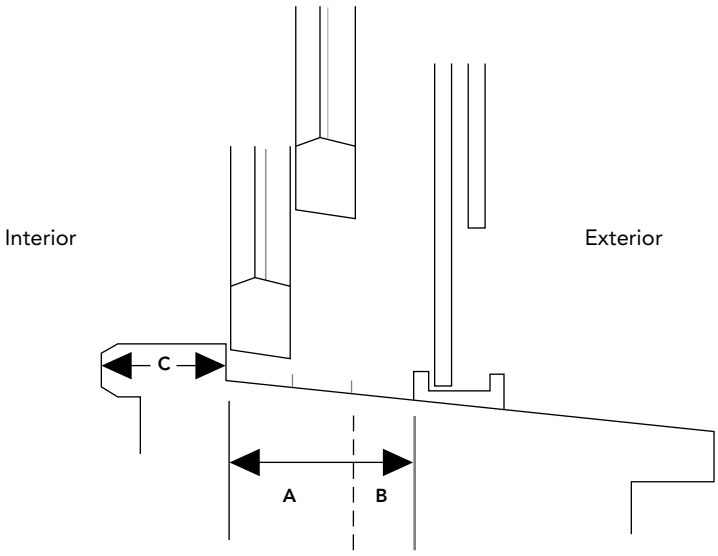
An interior window sill (sometimes called the stool) is the window ledge in front of the bottom of the closed window sash as seen while looking out the window(see Figure 15.7 for an illustration). A double-hung window has two parts that move up and down in the window frame. A window trough is the part of the window sill in which both sashes of a double-hung sash sit when lowered or, for a casement window, where the bottom of the casement sash is when it is closed, commonly called the well. If there is a frame for a storm window or a screen, the trough extends out to such a frame (see Figure 15.8). Do not sample the exterior window sill outside

FIGURE 15.6 A floor that may be tested.

FIGURE 15.7 A window sill and trough that may be tested.



1. Sectional view of window (with no storm window) showing window trough area, A, to be tested. Trough is the surface where both window sashes can touch the sill when lowered. The interior window sill (Stool) is sown as area C. Interior window sills and window troughs should be sampled separately.



2. Sectional view of window (including storm window) showing window trough area, A and B, to be tested. Trough extends out to storm window frame. The interior window still (stool) is shown as area C. Interior window sills and window troughs should be sampled separately.

Courtesy: Warren Fredman

FIGURE 15.8 Window Locations for Dust Sampling.

of the trough. EPA has not established a dust-lead hazard standard for exterior window sills. They are usually washed by rain and do not have the same dust-lead loadings as troughs.

Clearance examiners must exercise judgment in selecting the exact locations in a room from which to collect wipe samples on the floor, interior window sill, or window trough. Generally, samples should be taken either from locations near the area where the work was done, from nearby high-traffic areas (around doorways, for example), or from areas with which young children are likely to be in contact. Floor dust samples may be taken from either carpeted floors or hard-surfaced floors. The clearance examiner may determine which specific site is best based on the type of treatment, visual observation, and professional judgment.

Those performing the work must not know exactly where the clearance samples will be collected.

4. Sampling Outside the Containment Area

If dust containment is used (i.e., sealing vents and installing plastic sheeting on doors between work areas and non-work areas), one floor sample must be taken outside each containment area if the clearance area is defined as being within the containment. The floor sample should be taken within 10 feet of the containment to determine the effectiveness of the containment.

If dust containment is used, one floor sample must also be taken along each passageway used by workers walking to and from the work area, to determine the effectiveness of measures taken to control the tracking of leaded dust.

5. Worksite-Only Sampling

For small, low-dust non-abatement jobs, the certified renovator (or, for jobs not covered by the abatement or RRP rules, the project supervisor) is responsible for designing the containment system that will be used. In some cases, it may be acceptable for containment to consist of merely tape plastic sheeting on the floor extending at least 6 feet from the surface being worked on, and not install further containment. A low-dust job is defined generally as work that creates a small amount of dust that will not spread beyond 6 feet from the painted surfaces being disturbed. This set-up may be acceptable for such jobs as small repainting work that does not require scraping of large areas, or window replacement, if dust-limiting work practices are used. See Table 8.1 in Chapter 8 for guidance on work-site preparation. This set-up is not acceptable if an EPA-regulated abatement is performed, and it is not acceptable for high-dust jobs involving the scraping of large painted areas or the demolition of walls or ceilings or other large components.

The clearance examiner should take two floor dust samples in each room or space where work was done:

- One floor sample should be taken within 5 feet of the surface(s) that were worked on. This sample is to determine whether a significant amount of dust generated by the work remains nearby after the work and cleanup. If work was done on surfaces more than 10 feet apart, the sample should be taken near where the clearance examiner expects the greatest amount of dust to have been generated.

Another floor sample should be taken the near the door that workers usually used, if this is known or can be reasonably presumed based on the work location, the room layout, material storage and holding locations, etc. If the workers' entering and exiting pattern is not known or cannot be presumed, the sample should be taken the near the main door to the room or space. This sample is to determine whether workers tracked lead-contaminated dust into the unprotected part of the room or space.

- In addition, one should be taken from a window sill (if present) and one from a window trough (if present).

6. Composite Sampling: An Example

When the work is similar in a clearance area with multiple rooms in the same dwelling unit or child-occupied facility, or in multiple common areas of the same property, composite clearance dust samples may be collected.

An example of a composite sampling scheme is as follows: A house has undergone an abatement job involving extensive interior paint removal and has passed a visual examination. Before the work began, the owner and the clearance examiner have agreed to use composite clearance dust sampling to minimize initial laboratory expenses, based on the dust-lead analysis price schedule of the EPA-recognized laboratory being used. (Remember that the laboratory may charge based on the number of composite subsamples, which may eliminate any composite sample discount.) The house has eight rooms that were treated, four of which are carpeted, and all of which have windows. Two of the four rooms selected for sampling have carpets; two do not. At a minimum, the clearance examiner should collect the following samples:

- One composite carpeted-floor sample, with one subsample from each of the two carpeted rooms in the room sample.
- One composite hard-floor sample, with one subsample from each of the two uncarpeted rooms in the room sample.
- One composite interior window sill sample, with one subsample collected from each of the four selected rooms.
- One composite window trough sample, with one subsample collected from each of the four selected rooms.
- One field blank sample for quality assurance.

This results in a total of four composite samples, plus one field blank, for a total of five analyses. If single-surface sampling had been completed under the recommendations in Table 15.1, nine samples would be analyzed (four rooms x two samples/room, + one field blank = nine samples/dwelling).

D. Securing the Clearance Area

The clearance area should not be occupied until the results of the laboratory analysis of dust samples have been received and the clearance examiner has found that the area has dust-lead levels below the clearance standard(s). It is especially important that children not enter the area. In most cases, closing and preferably locking of doors to the area and the use of yellow construction-area hazard tape should

be sufficient. In circumstances where young children are likely not to be deterred by such methods and experience indicates that lead hazards may be present, it is recommended that components with a possibility of hazards be covered with a layer of plastic sheeting.

FIGURE 15.9 Soil debris.

VII. Clearance Soil Sampling (optional)

A. Considerations for Sampling Soil Before the Work

It may be necessary to collect samples from soil that is not bare to determine if contamination has occurred. While it is generally preferable to sample bare soil, sampling covered soil is acceptable because the purpose of such sampling is not to identify a "lead-based paint hazard," but rather to determine if dust containment practices were adequate.

If soil lead levels after the work are below applicable soil lead hazard limits, the pre-abatement samples need not be analyzed. The hazard levels for soil are 400 µg/g for play areas and 1200 µg/g for the rest of the yard. If soil lead clearance levels are greater than or equal to the applicable limits, the baseline samples should be analyzed to determine if soil lead levels were already high before the work began. The decision to conduct soil treatment may depend on applicable regulations and/or the goals of the owner, contractor, or public agency.

B. Considerations for Sampling Soil After the Work

Neither EPA nor HUD requires any soil sampling as part of a clearance examination. If work that disturbs exterior paint has been performed, it is sufficient to conduct a visual examination to assure that there are no visible paint chips and other paint-related debris on the ground or on horizontal building surfaces (including exterior window sills) near the work surfaces. Horizontal building surfaces in outdoor living areas close to the work areas, such as porches or balconies, should also be free of visible dust as well as paint chips and paint-related debris.

Soil sampling, however, should be conducted if, contrary to the prohibitions of EPA and HUD regulations and the recommendations of these *Guidelines*, exterior paint was removed by abrasive blasting, power washing or large-scale power sanding without local HEPA exhaust and full containment.

There should be no visible paint chips, visible surface dust, debris or residue on the surface of the soil near the foundation before clearance soil samples are taken. Visible paint chips should be picked up with a vacuum or by hand before soil sampling. However, soil sampling near the foundations of dwellings is often complicated by the presence of paint chips embedded in or under the soil surface from previous repainting efforts. The hazard associated with these paint chips in the soil is difficult to assess since it is often not practical to sample all the different paint chips that may be present. Therefore, these paint chips should be considered a part of the soil. They should not be sampled preferentially or excluded when collecting or analyzing the soil. Laboratories should be instructed to disaggregate (force) paint chips through the soil sieve as part of the analytical process so that paint chips remain part of the soil matrix into which they are embedded.

Clearance soil sampling is typically conducted around the foundation of the house, although it is also important to collect samples in play areas that could have been contaminated as a result of the work. All soil samples should be composite samples. If only selected faces of the building were treated, the first composite sample's subsamples should come from the soil under those faces, with a second composite soil sample collected from any nearby play areas. In both cases, bare soil should be sampled preferentially. If the exterior work involved covering bare soil areas only, clearance soil samples are not needed; a visual examination is adequate. Protocols for soil sampling are provided in Appendix 13.3 of these *Guidelines*, or ASTM Standard E 1727-05, Standard Practice for Field Collection of Soil Samples for Lead Determination by Atomic Spectrometry Techniques (***www.astm.org/Standards/E1727.htm***), or the EPA report, *Residential Sampling for Lead: Protocols for Dust and Soil Sampling,* March 1995 (EPA 747R95001) (***www.ecy.wa.gov/programs/hwtr/demodebris/pages2/leadsample.html***).

Sampling replacement soil, mulch, and other similar material used to replace or cover soil-lead hazards is optional at clearance (see Figure 15.9). EPA soil abatement regulations require that the lead concentration in replacement soil must be no greater than 400 parts per million (ppm; µg/g). These *Guidelines* recommend a lead concentration of no greater than 200 ppm, if possible. This lower concentration is required after interim control work in housing covered by HUD's Lead Safe Housing regulation (24 CFR 35.1330(f)(3)(i)(C)), and is recommended by HUD for abatement work in housing covered by its regulation. In a soil abatement activity, the certified abatement supervisor or contractor is responsible for installing replacement soil with acceptable levels of lead. In non-abatement activities, the owner may wish to obtain assurance from the supplier or from the clearance examiner that lead levels are acceptable, but this is generally not necessary for mulch or bark that comes from trees or other vegetation. (Shredded wood from old houses is not recommended because it may be contaminated by lead-based paint.)

If exterior work on lead-based paint has been performed, the contractor, owner, or public agency may wish to document that the work did not contaminate soil surrounding the dwelling. If this optional testing is desired, baseline soil samples (i.e., samples taken before the work began) should have been collected but not necessarily analyzed until clearance soil samples have been collected, analyzed, and compared to clearance standards. Soil samples collected during risk assessments (if one was performed) can be used as baseline samples.

C. Multi-family Housing Properties with more than One Building

If a large multi-building complex (development) of multi-family housing has undergone similar lead hazard control work in several areas of the exterior or soil, random sampling of the soil around the buildings can be conducted using the sampling scheme for lead-based paint inspection (see Chapter 7). Soil should be sampled around each building that: (1) experienced exterior paint-disturbing work; and (2) contains a dwelling unit that would have been randomly selected under the procedure for unit sampling described in Chapter 7. The drawbacks of conducting random clearance sampling are the same for soil as for dust (see Section IV.B.2, above).

As with the single-building case, above, one composite soil sample should be collected around the perimeter of each building. If only selected faces of the building were treated, the samples should come from the soil under those faces. A second composite soil sample should be collected from any nearby play areas. In both cases, bare soil should be sampled preferentially.

VIII. Determining Specified Hazard Control Work was Done (optional)

If the client wishes, the report of the clearance examination may include a determination as to whether lead hazard control work on all interior and exterior surfaces to be treated was in fact done as specified. This option, which is one possible way for the owner to reduce liability, is not part of the standard clearance examination. It is normally the responsibility of the contractor performing the work or the construction manager. If desired by the client, it should be agreed to explicitly in advance. This function should be performed by a certified risk assessor or lead-based paint inspector. Sampling technicians are not trained to make this determination.

To do this, it is strongly recommended that, for most jobs, especially those involving abatement, the clearance examiner observe the work at critical phases, as well as at other times. In any event, it is essential that clearance examiners have full knowledge of the extent of the work, including the original scope and any change orders, and specifically which surfaces did not require treatment. The clearance examiner should have access to any risk assessment or paint inspection reports as well as the job scope of work or specifications and a report from the owner or contractor that the work has been completed. When paint removal and repainting or soil removal and covering are planned, verification of the removal of the lead hazards will be necessary prior to the completion of work.

Regulatory requirements:

- EPA requirements for abatement: When abatement of lead-based paint hazards is performed, EPA work practice standards require that a certified abatement supervisor be responsible for the job and that the supervisor prepare a report describing the abatement work that has been done and the results of the clearance tests. The owner may wish to ask a risk assessor or lead-based paint inspector to assist in monitoring the project and/or making a finding that the abatement was conducted in accordance with the specifications for the job as well as to perform the normal clearance examination.

- HUD requirements for interim controls in Federally-assisted housing: If the job is covered by HUD requirements for housing receiving Federal assistance or housing being sold by the Federal Government, HUD's Lead Safe Housing Rule requires that the owner or another designated party prepare a report that describes the hazard reduction or maintenance work that has been performed. In this case, the client may want the clearance examiner to assist in determining that the work is done as planned and to prepare the description of the work, or the client may prepare the description of the work. In either case, the clearance examiner must prepare the report on the results of the clearance examination.

- Lead-poisoning cases: In the case of a child with an elevated blood-lead level, local or State authorities may require that the treatment of all indicated surfaces be verified by a Government employee or certified third party, especially in cases where the abatement has been ordered by local authorities. In addition, for certain types of HUD housing assistance, HUD's Lead Safe Housing Rule requires environmental interventions when the children's blood lead level is sufficiently high. Clearance examiners should determine if the property they are evaluating has been treated as a result of a legal or regulatory proceeding. If so, the enforcement agency should be contacted to coordinate clearance procedures, prevent duplication of effort and, most important, ensure that the private clearance process is not inadvertently overstepping the bounds of the normal practices of the local health department or childhood lead-poisoning prevention program.

A report on work done should contain the following information:

- The address or location of the property or structures to which the report applies;
- The start and completion dates of the work;
- The name, address, and certification type and number of each firm or organization conducting the work, and the name(s) of supervisor(s) / certified renovator(s) assigned to the work;
- A detailed written description of the work, including the methods used, locations of exterior surfaces, interior rooms *and common areas*, and/*or* components where the work occurred, and (if applicable) any suggested monitoring of encapsulants or enclosures; and
- If soil hazards were controlled, a detailed description of the locations of the work and the methods used.

See Section X**,** below, for a list of information to be included in a report on the results of a clearance examination.

The following is guidance for determining completion of various types of lead hazard control work.

A. Paint Removal and Repainting

All surfaces where paint has been removed should be visually examined *prior to repainting*. If clearance is conducted after new paint is applied, it is often impossible to determine if the old paint was actually removed. Areas commonly overlooked during paint removal projects include the underside of interior window sills and handrails, backside of radiator ribs, the bottom edge of doors, the top of doorframes, and the back edge of shelving.

For both on-site and off-site paint removal, the clearance examiner or the owner should examine the bare surfaces to ensure that there is no visible residue (see Figure 15.10). If residue remains, the component should be cleaned prior to repainting or refinishing.

Wipe sampling and X-ray fluorescence (XRF) testing are not appropriate tools for determining the effectiveness of paint removal from a particular surface. Wipe sampling cannot dislodge any leaded-dust that may have been absorbed into the substrate during the removal process, nor can it remove paint that is still bonded to the substrate. Wipe sampling is appropriate for measurement of settled leaded-dust on floors, interior window sills, and window troughs. It is not appropriate to apply the settled leaded-dust clearance standard to stripped surfaces prior to repainting because the bare surface will be sealed with new paint, thus rendering the dust inaccessible. Appendix 1 describes how much lead-contaminated dust can remain on a surface (at least 35,000 µg/ft^2) before it would cause the newly applied paint to become lead-based paint (at 0.5 percent).

FIGURE 15.10 Surfaces that may have had paint stripped.

XRF testing of surfaces that have been stripped and repainted is not recommended. If the paint has been removed, removal should be assessed visually prior to repainting. Therefore the work specification should require the contractor to request visual clearance before paint or primer is applied. If for some reason it is not possible to visually determine that the paint has been removed, then XRF readings can be taken. The protocols described in Chapter 7 apply.

B. Building Component Removal and Replacement

If building components coated with lead-based paint were removed as a lead hazard control measure, the clearance examiner should have detailed knowledge of the scope of the activities so that actual removal can be verified. Each building component specified for replacement should also be examined to determine if it was overlooked during the lead hazard control work.

C. Enclosures

Complete installation of enclosure systems, such as new drywall, paneling, or siding, can be best evaluated by direct visual observation. The clearance examiner should determine that the mechanical fastening system used to hold the enclosure to the substrate is adequate. This is especially important for ceilings. All seams and edges in the enclosure should be sealed to provide a "dust-tight" (but not necessarily airtight) system (see Chapter 12 for further information on enclosures.)

D. Encapsulants

Another category of lead hazard control that can best be assessed visually is the application of encapsulants. Assuming that the encapsulant was properly selected for the surface undergoing treatment and that patch tests were conducted as recommended in Chapter 13, the clearance examiner can determine if the encapsulant is, in fact, present. Some States have requirements for the composition and/or application of encapsulants used in abatement.

E. Soil Treatments

Soil treatments, which typically consist of some form of covering or removal and/or replacement, can be assessed by visual observation to determine if the covering is present. For example, if sod or asphalt has been used as a soil covering, the clearance examiner should determine if all bare areas have been covered by sod or asphalt, as specified. See guidance on optional soil testing in Section VII, above.

F. Interim Controls

Visual examination of the wide variety of interim control measures consists of a confirmation that all lead-based paint (either suspected or identified through testing) within the scope of work is stabilized, and that any friction, impact, and other surfaces marked for treatment in the risk assessment report or project specifications have all been properly treated. No known or suspected lead-based paint within the scope of work should be in a deteriorated condition in a cleared dwelling or on the building exterior.

IX. Interpretation of Clearance Results, Recleaning, and Resampling

A. Visual Assessment Results

The clearance examiner should follow the procedures for visual assessment recommended in Section V.A, above.

B. Dust Sampling Results

Clearance dust standards are shown in Table 15.2 for single-surface wipe samples. Levels from single-surface wipe samples must be less than these levels to pass clearance. Clearance standards are shown in micrograms per square foot (µg/ft^2, micrograms of lead per square foot of sampled area, the common measurement unit for dust-lead clearance in the U.S.), and their equivalents in milligrams per square meter (mg/m^2, commonly used outside the U.S.).

Levels from a composite sample must be less than the following: the levels in Table 15.2 divided by one-half of the number of subsamples in the composite. Composite samples with two, three or four subsamples may be collected; the single-sample standards are divided by 1, 1.5 or 2, respectively, to determine the composite-sample standards. Clearance dust standards are shown in Table 15.3 for composite samples, in both µg/ft^2 and mg/m^2.

C. Recleaning and Resampling

1. Single-Surface Clearance Sampling

If single-surface wipe sample leaded dust levels equal or exceed those shown in Table 15.2, cleaning and sampling must be repeated until compliance is achieved. The clearance examiner should explain to the client exactly what surfaces must be recleaned in what rooms. The recleaning should be focused on those types of surfaces where the sampling results indicate that the previous round of cleaning was inadequate. For example, if floor leaded dust levels are above the standard, but interior window sills and window troughs are below the standard, only the floors need to be recleaned. Similarly, if single-surface samples fail in one room, then only that room and any rooms not sampled need to be recleaned. If composite samples fail, then ***all*** the surfaces the composite represents need to be recleaned (or resampled individually to determine which ones require recleaning). For example, consider the two examples shown in Tables 15.4 and 15.5.

Table 15.2 Clearance Dust Standards (Single-Surface Wipe Samples).

Surface	Dust-Lead Loadings Must Be Less Than[1]:	
Bare and carpeted floors	40 µg/ft^2	0.43 mg/m^2
Interior window sills	250 µg/ft^2	2.70 mg/m^2
Window troughs	400 µg/ft^2	4.30 mg/m^2

[1]Dust-lead standards are expressed in micrograms per square foot (µg/ft^2). To convert from µg/ft^2 to mg/m^2, multiply by 0.01076.

In Table 15.4 only the floors in rooms 1 and 2 require recleaning, assuming it is a four-room clearance area. The entire floor of each of these two rooms must be cleaned, not just the sampled spot. If there are unsampled rooms, the entire floors in those rooms would have to be recleaned also, or the floors in those rooms would have to be independently sampled, with any floor recleaning confined to rooms failing clearance. In either case, new floor dust samples would have to be taken to represent the rooms that were recleaned (if more than four rooms are recleaned, samples can be taken in a sample of rooms, as described in Section VI.C, above), and the samples must be analyzed and the results interpreted to determine whether the rooms pass clearance.

2. Composite Clearance Sampling

In Table 15.5, which is based on composite sampling with four subsamples in each composite, the clearance standard is one-half the standard for single-surface sampling; because one-half of 4 is 2, the single-surface sampling standard is divided by 2. Thus the standards applicable to this case are 20 µg/ft^2 for floors, 125 µg/ft^2 for interior window sills, and 200 µg/ft^2 for window troughs. This is shown in Table 15.3.

The floors and window sills are below their respective composite clearance standards, so they pass clearance. The window troughs, with dust-lead levels at 3695 µg/ft^2, is at or above the 200 µg/ft^2 composite clearance standard for four window trough subsamples (specifically, it exceeds the standard). Therefore all the window troughs should be recleaned in all four sampled rooms and any rooms not sampled. While the window troughs could conceivably be sampled individually to determine which ones require recleaning, it is likely to be more cost effective to simply reclean all of them. When cleaning troughs, the interior sills should also be cleaned, even if they were not originally contaminated, to minimize contamination of the sills during cleaning of the troughs.

Recleaning, if necessary, should be performed as soon as possible after receiving dust sampling results because dust lead on failed surfaces can migrate to other surfaces that successfully cleared.

Repeated sampling of the recleaned surfaces should be completed to ensure that the recleaning was sufficiently effective. (The clearance examiner and work supervisor may also want to recheck the completeness of the work.) In the second round of sampling, the clearance examiner should take wipe samples from specific floor, sill, or trough locations that are different from the specific wipe locations used in the initial round of sampling because the initial wipe cleaned the wiped surface. Also, the clearance examiner should consider taking one or more of the second wipe samples in unsampled rooms, if any, unless no work was done in those rooms.

If a surface fails clearance twice, the property owner should consider additional hazard control measures and/or further sealing of the surface prior to a second recleaning and a third round of clearance dust sampling.

Table 15.3 Clearance Dust Standards (Composite Wipe Samples)[1].

Surface / Number of subsamples	Dust-Lead Loadings Must Be Less Than[2]:	
Bare and carpeted floors		
2	40 µg/ft^2	0.43 mg/m^2
3	27 µg/ft^2	0.29 mg/m^2
4	20 µg/ft^2	0.22 mg/m^2
Interior window sills		
2	250 µg/ft^2	2.70 mg/m^2
3	167 µg/ft^2	1.79 mg/m^2
4	125 µg/ft^2	1.35 mg/m^2
Window troughs		
2	400 µg/ft^2	4.30 mg/m^2
3	267 µg/ft^2	2.87 mg/m^2
4	200 µg/ft^2	2.15 mg/m^2

[1] *The standard for a composite clearance dust sample is determined by dividing the single-surface standards, above, by one-half the number of subsamples in the composite sample. Thus, for a three-subsample composite, half of 3 equals 1.5, so the floor standard is 40 µg/ft^2 divided by 1.5, which equals 27 µg/ft^2.*

[2] *Dust-lead standards are expressed in micrograms per square foot (µg/ft^2). To convert from µg/ft^2 to mg/m^2, multiply by 0.01076.*

Table 15.4 Hypothetical Example of Single-Surface Clearance Dust Sampling Data.

Room	Floors (µg/ft^2)	Interior Sills (µg/ft^2)	Window Troughs (µg/ft^2)
1	230	50	190
2	375	65	285
3	28	70	214
4	31	40	305

Table 15.5 Hypothetical Example of Composite Clearance Dust Sampling Data.

Surface	Rooms Included in Composite	Leaded Dust (µg/ft^2)
Floors	1,2,3,4	18
Interior window sills	1,2,3,4	120
Window troughs	1,2,3,4	3695

X. Report Preparation

It is essential that the clearance examiner provide the client with a report documenting the results of the clearance. EPA specifies the required contents for an abatement *report* at 40 CFR 745.227(e)(10). HUD specifies the required report contents for *non-abatement projects in* units covered by the Lead Safe Housing Rule at 24 CFR *35.*1340(c). A checklist-based worksheet (Form 15.4) covers both requirements.

A. Summary Report

The report should include a one-page summary at the beginning of the report that is suitable for communication with residents, as well as a complete file of the visual assessment(s) form(s) and the dust sampling results form(s). Form 15.3, at the end of this chapter, provides a format for the summary report. The summary should contain the following information:

1. The address of the property where the clearance area is located.

2. A description of the area(s) covered by the clearance examination, including, as applicable, the specific dwelling units or common areas covered by the clearance and the specific rooms and exterior spaces.

3. The name and address of the client.

6. A summary of the results of the visual assessment. (The clearance examination should be stopped if the visual assessment fails.)

7. A summary of the results of the dust testing, which should include either:

   (a) A statement that no dust-lead hazards, as defined by the relevant EPA, State, Tribal or local standards, were found in the clearance area, and the date of the dust sampling; or

   (b) A statement that dust-lead hazards were found in the initial examination, identifying the date of the initial examination, the rooms and surfaces where dust-lead hazards were found, including any unsampled rooms and surfaces represented by the samples, and stating the dust-lead levels found.

8. If dust-lead hazards were found in a second or later round of dust sampling, a similar summary of the results of the dust testing should be provided for each round separately.

9. If the initial or later round of sampling found no dust-lead hazards, the report of a successful clearance examination should contain a statement that, based on visual assessment and dust sampling on the specific sampling date, no dust-lead hazards, as defined by the relevant EPA or State, Tribal or local standards, were found.

10. Identification of the clearance examiner(s), including the name of the clearance examiner, the name of the examiner's firm or organization, business address and telephone number, and the examiner's license or certification number.

11. Identification of the laboratory, including the name, address, telephone number, and NLLAP number.

12. The signature of the clearance examiner, with date.

The owner should use the summary of the report for, among other purposes: (1) promptly notifying current residents of the clearance results, as required by the HUD Lead Safe Housing Rule (if the property is covered by that rule), and (2) disclosing clearance dust-lead testing results and other lead reports, records and knowledge to prospective lessees (tenants) and purchasers of the property before they become obligated under a lease or sales contract, as required by Federal law under the HUD-EPA Lead-Based Paint Disclosure Rule (24 CFR 35, subpart A and 40 CFR 745, subpart F). The disclosure rule applies to almost all pre-1978 housing. See Appendix 6 for more information.

B. Regulatory Report Requirements

When abatement is performed, a certified supervisor or project designer must provide an abatement report that follows 40 CFR 745.227(e)(10) if EPA is operating the State or Tribal lead abatement certification program. In a State or Tribal area that has an EPA-authorized lead abatement certification program, the abatement report must follow that program's regulation.

When a non-abatement hazard reduction or maintenance activity requiring a clearance report is performed in housing covered by HUD's Lead Safe Housing Rule, the report must follow 24 CFR 35.1340(c) of that regulation.

Because HUD's report requirements were based on EPA's, the two reports are similar. The common and individual-agency requirements are outlined below; see the regulations for the exact wording of the requirements:

1. (Both) Start and completion dates of the abatement, lead hazard reduction or maintenance work.
2. (Both) The name and address of each certified firm conducting the work, and the name of each supervisor assigned to the project.
3. (HUD) The address of the residential property where the work was done, and, if only part of a multi-family property is affected, the specific dwelling units and common areas affected.
4. (EPA) The occupant protection plan.
5. (Both) The name, address, and signature of the clearance examiner.
6. (Both) The date(s) of clearance examination and testing.
7. (HUD) The results of the visual assessment for the presence of deteriorated paint and visible dust, debris, residue or paint chips.
8. (Both) The results of clearance testing, including the results of the analysis of dust samples, in µg/sq. ft., by location of sample.
9. (EPA) The results of all soil analyses (if applicable), in parts per million (µg/g), by location of sample.
10. (Both) The name of each NLLAP-recognized laboratory that conducted the analyses.
11. (HUD) The address and NLLAP identification number for each laboratory.
12. (Both) A detailed written description of the work, including the methods used, locations of exterior surfaces, interior rooms, common areas, and/or components where the hazard reduction activity occurred, and any suggested monitoring of encapsulants or enclosures.

13. (HUD) If soil hazards were reduced, a detailed description of the location(s) of the hazard reduction activity and the method(s) used.

Some States, Tribes or localities may have specific requirements or forms pertaining to clearance reports. Clearance examiners must comply with those requirements if they are more stringent or protective than the applicable federal requirements.

XI. Recordkeeping

A. Recordkeeping Responsibilities

Three parties should maintain records of all abatement, interim control, risk assessment, inspection, and clearance results, and resident notifications and disclosure forms, with which they have been involved:

- Property owner.
- Contractor.
- Clearance examiner.

See Section X.A, above, regarding the owner's responsibility for clearance report record retention and disclosure / notification under the Lead Disclosure Rule and, if applicable, the Lead Safe Housing Rule. (See Appendix 6 for more information on record retention, disclosure, and notification.) Some jurisdictions may also require submission of such records to an enforcement agency or a lead-safe housing registry.

B. Record Content

The records should include all laboratory results, quality control/quality assurance procedures, dates of both visual examination and environmental sampling, completed forms, and appropriate identifiers for the property – the owner, inspector, contractor, and resident(s).

C. Length of Retention

Records of all clearance testing should be kept for no less than 3 years but preferably for the duration of the life of the building, since it is to the benefit of the owners to retain this information. See Appendix 6 for more information. Some states require a longer period of record retention of (e.g., New Jersey requires that lead records for multi-family target housing be retained for at least 5 years).

Form 15.1 Visual Assessment – Lead Hazard Clearance Examination.

Property address: _____ Page _____ of _____

Name of client: _____

Name of clearance examiner: _____ Certification No.: _____ Exp. date: _____

Date of visual assessment: ____ / ____ / ____ Repeat visual assessment? ❑ Yes ❑ No

This form covers: ❑ Dwelling units. (Specifiy which units) _____

❑ Common areas. (Specify which areas) _____

❑ Exterior areas/outbuildings. (Specify) _____

Any deteriorated paint, visible dust, paint chips, or paint-related debris observed? ❑ Yes ❑ No

If "Yes," record observations in the table below:

Room, Area, or Side of Building (if exterior)	Building Component, or Other Surface (such as ground or vegetation)	Additional Notes on Specific Location	Description of Problem (i.e., deteriorated paint, visible dust, paint chips, or paint-related debris)

Notes (include any explanations by the client of why deteriorated paint has not been repiared; also include any instructions to client regarding further cleaning):

_____

_____

_____

_____

_____

_____

Signature of clearance examiner: _____

Form 15.2 Field Sampling Form for Dust-Lead Hazard Clearance Examination (single-surface sampling).

Property address: _____ Apt. no. or common area: _____ Page _____ of _____

Name of property owner: _____ Name of clearance examiner: _____

Certification #: _____ Exp. date: _____

Sample Number	Room (if possible, use room names used by the owner or resident)	Surface Type (hard floor, carpeted floor, interior window sill, or window trough)	Exact Location of Wipe Sample	Dimensions of Sample Area (inches x inches)[1]	Area of Sample (sq. ft.[2])	Results of Lab Analysis		Pass[3] (less than standard) or Fail (equal or greater than st'd.)
						µg of Pb in Sample	µg/ft[2]	
				____ x ____				
				____ x ____				
				____ x ____				
				____ x ____				
				____ x ____				
				____ x ____				
				____ x ____				
				____ x ____				
				____ x ____				
				____ x ____				
				____ x ____				
				____ x ____				

[1] Measure to the nearest 1/8th or 1/10th of an inch. [1/8 = 0.125; 2/8 = 0.25; 3/8 = 0.375; 4/8 = 0.5; 5/8 = 0.625; 6/8 = 0.75; 7/8 = 0.875]

[2] Calculate area in square feet as follows: Calculate square inches, then divide by 144.

[3] EPA standard: 40 µg/sq. ft. for floors; 250 µg/sq. ft. for interior window sills; and 400 µg/sq. ft. for window troughs.

Total number of samples on this page: _____ Date of sample collection: _____/_____/_____ Date shipped to lab: _____/_____ / ____

Shipped by: _____ (signature) Received by: _____ (signature and date) Reviewed by: _____ (signature and date)

Date results reported by lab: _____/_____/_____ Reviewed by: _____

Form 15.3 Lead Hazard Clearance Report – Completed Example

The following report is a made-up example of a clearance report from a small , non-abatement, rehabilitation job (less than $5,000) that involved window replacements in the small bedroom and kitchen of a single-family home that is available for rent. The clearance report covers clearance of the worksite.

Home Environmental Inspection Services, Inc.

345 Hammond Road
East Chicago, IN 12345
123-123-1235
345-789-5678 (fax)

Firm certification number: IN 78787

Clearance Report

General Information

Date of clearance examination:	8/5/2010
Clearance Examiner:	Joe Smith
Certification Category:	Risk Assessor
Certification Number:	IN 77777
Property address:	78 East Main St., Apt. A Hammond, IN 89898
Client name:	Sally Jones
Client address:	80 East Main St. Hammond, IN 89898
Laboratory:	Analysis Services, Inc.
Address:	990 45th St., Suite 500 Gary, IN 44444
Telephone number:	222-222-2222
NLLAP number:	IN 999999

Summary of Clearance Results

Dust above Federal standards was found in the following areas:

Location	Surface	Fg lead/ft^2
Small bedroom	Side facing window (C-1) – windowsill	600
Small bedroom	Floor	200
Kitchen	Window above sink (A-1) – windowsill	525

Signature: Joe Smith

Date: 8/6/2010

Summary of Hazard Reduction Activities

Name of firm	ABC Renovations
Address of Firm	123 Main Street East Chicago, IN 12345
Abatement or RRP Firm Certification Number	IN45789
Name of Certified Abatement Supervisor / Certified Renovator	John Brown #1634
Supervisor / Renovator Certification Number	IN1634
Start and completion date of hazard reduction or abatement activity.	8/1/2010 to 8/5/2010

Description of Hazard Reduction Activities and Areas Addressed:

Location	Activity
Kitchen	Replaced A-1 window with new, vinyl-clad window
2nd Floor Small Bedroom	Replaced C-1 and C-2 windows with new, vinyl-clad windows
Description of Work	The certified renovator was present on the job site when work was being performed. Workers used lead-safe work practices. Plastic sheeting covered a 8-foot area on the ground outside under the windows being replaced and on the floor inside. Signs were posted at the doors to the bedroom and kitchen. Occupants were not allowed in the kitchen and bedroom and the outside work area during this activity. The window frame was misted prior to tear-out. After removal, workers wrapped the old windows in plastic sheeting and picked up debris on the plastic immediately and bagged it. The plastic sheeting was carefully gathered up and bagged for disposal. Workers replaced their disposable booties when leaving the work area for lunch and breaks. Respirators were not necessary. The new windows were installed and, in accordance with the contract, a clearance examination was requested.

On-Going Lead-Based Paint Monitoring Requirements:

HOME rental assistance is not provided to this unit, so ongoing LBP maintenance is not required.

VISUAL EVALUATION RESULTS FORM

Date of clearance:	8/5/2010
Clearance Technician:	Joe Smith
Client:	Sally Jones
Property address:	78 East Main St., Apt. A Hammond, IN 89898

Visual Assessment of the Work Area

Work Area	Deteriorated Paint	Debris	Visible Dust	Notes	Pass/Fail
Small bedroom					Pass
Kitchen					Pass
First floor hallway					Pass
Staircase					Pass
Second floor hallway					Pass
Exterior soil under kitchen window					Pass
Exterior soil under bedroom window					Pass

DUST SAMPLING RESULTS FORM

Date of clearance:	8/5/2010
Clearance Technician:	Joe Smith
Client:	Sally Jones
Property address:	78 East Main St., Apt. A Hammond, IN 89898

Sample #	Location	Surface	Dimensions of sample area	µg Lead/ ft^2	Pass/Fail
1-2	Upstairs small bedroom	Front facing window (C-2)- windowsill	4″ x 18″	17	Pass
1-3	Upstairs small bedroom	Floor under C-1 window	12″ x 12″	200	Fail
1-4	Upstairs small bedroom	Side facing window (C-1)- windowsill	4″ x 18″	600	Fail
2-1	Second floor	Floor	12″ x 12″	35	Pass
3-1	Staircase	Floor	12″ x 12″	30	Pass
4-1	Kitchen	Floor under A-1 window	12″ x 12″	12	Pass
4-2	Kitchen	Window above sink (A-1)- windowsill	4″ x 18″	525	Fail
5-1	First floor	Floor	12″ x 12″	30	Pass

Understanding Your Report

1. The Summary Results section lists all of the areas that failed the clearance examination. The areas represented by the sample needs to be re-cleaned and re-tested to see if the cleaning removed the contaminated dust. Deteriorated painted surfaces should be repaired using interim controls or abatement techniques.

   For written information on how to address lead hazards, call the National Lead Information Center Clearinghouse at 1-800-424-Lead (1-800-424-5323). You may consider hiring a risk assessor to evaluate lead hazards in your home and recommend a lead hazard control plan. Risk assessors may be found from the EPA Regional Lead Coordinator, if the property is in a State for which EPA operates the lead certification program, through ***www.epa.gov/lead/pubs/leadoff1.htm***, or if the property is in a State or Tribal Area which does operate the lead certification program, through ***www.epa.gov/lead/pubs/traincert.htm***.

2. The laboratory result forms attached to the report list all of the areas sampled inside and outside the dwelling and the laboratory analysis results for each sample.

3. The dust sampling results are expressed in micrograms per square foot (µg/ft^2); soil samples are expressed in micrograms per gram (µg/g).

4. Areas that failed the clearance examination showed lead levels in dust at or above Federal or state standards. The standards that were used for during this clearance examination are:

HUD/EPA Clearance Standards for Lead in Dust

Carpeted and Uncarpeted Floors: 40 µg/ft^2
Interior window sill (stool): 250 µg/ft^2
Window trough: 400 µg/ft^2

Form 15.4 Clearance Report Review Worksheet

You may use the worksheet for a project that requires clearance, or when the owner chooses to have clearance, to document clearance was achieved and the clearance report is complete.

Property Address:_____ Date:_____

Name of Reviewer:_____ Title:_____

Question	Yes	No	Notes
The clearance examiner's report must include the information in items number 1 though 6, and 13a. See below on instructions for Items 7-12. Item 12 may be required.			
1. Property address and specific unit or common areas identified.			
2. Name, address, signature and certification number of each person involved in the clearance examinations.			
3. Name and NLLAP identification number of each laboratory conducting an analysis.			
4. Dates of clearance examination.			
5. Results of visual assessment for the presence of deteriorated paint and visible dust, debris, residue or paint chips.			
6. Results of all analyses (dust wipes in micrograms per square feet (μg/ft²); soil in parts per million) by location of sample, as well as information about the laboratory.			
The clearance report must also include information on lead hazard reduction (Items 7-11). Indicate the source of the information (the designated party or contractor may have to provide this information) if the clearance examiner was not responsible for the information. ***Item 12 is required for abatement and optional for other projects****.*			
7. Name and address of each firm and supervisor involved in the lead hazard reduction activity.			
8. Start and completion dates of lead hazard reduction activity.			
9. Detailed *written* description of the lead hazard reduction activity, including the methods used.			
10. Locations of exterior surfaces, interior rooms, common areas and/or components where the hazard reduction activity occurred.			
11. Any suggested monitoring requirements. (If none, enter "N/A".)			
12. Occupant protection plan (*required* for **abatement** project, optional otherwise; if not required or done, enter "N/A").			
Evaluate the results of the report.			
13. Did each unit *or common area* pass clearance?			

Other Notes:

_____

_____

Form 15.5 Example of Filled-In Clearance Report Review Worksheet

Property Address: 78 East Main St., Apt. A, Hammond, IN 89898 Date: 8/8/2010

Name of Reviewer: John Jones Title: Construction Specialist, City of Hammond, IN

Question	Yes	No	Notes
The clearance examiner's report must include the information in items number 1 though 6, and 13a. See below on instructions for Items 7-12. Item 12 may be required.			
1. Property address and specific unit or common areas identified.	***x***		
2. Name, address, signature and certification number of each person involved in the clearance examinations.	***x***		
3. Name and identification number of each laboratory conducting an analysis.	***x***		
4. Dates of clearance examination.	***x***		
5. Results of visual assessment for the presence of deteriorated paint and visible dust, debris, residue or paint chips.	***x***		
6. Results of all analyses (dust wipes in micrograms per square feet (μg/ft²); soil in parts per million) by location of sample, as well as information about the laboratory.	***x***		
The clearance report must also include information on lead hazard reduction (Items 7-11). Indicate the source of the information (the designated party or contractor may have to provide this information) if the clearance examiner was not responsible for the information. ***Item 12 is required for abatement and optional for other projects****.*			
7. Name and address of each firm and supervisor involved in the lead hazard reduction activity.	***x***		
8. Start and completion dates of lead hazard reduction activity.	***x***		
9. Detailed *written* description of the lead hazard reduction activity, including the methods used.	***x***		
10. Locations of exterior surfaces, interior rooms, common areas and/or components where the hazard reduction activity occurred.	***x***		
11. Any suggested monitoring requirements. (If none, enter "N/A".)	***N/A***		
12. Occupant protection plan (*required* for **abatement** project, optional otherwise; if not required or done, enter "N/A").	***N/A***		
Evaluate the results of the report.			
13. Did each unit *or common area* pass clearance?	***x***		

Other Notes:

HOME rental assistance is not provided to this unit, so ongoing LBP maintenance is not required.

References

Ashley, 2001. Ashley, K., Wise, T.J., Mercado, W., Parry D.B., Ultrasonic extraction and field-portable anodic stripping voltammetric measurement of lead in dust wipe sample. *Journal of Hazardous Materials*, 83: 41-50, 2001.

ATSDR, 1988. Agency for Toxic Substances and Disease Registry, U.S. Department of *Health and Human Services, The Nature and Extent of Lead Poisoning in Children in the United States: A Report to Congress,* Atlanta, Georgia.

Battelle, 2002. Battelle Memorial Institute, "A Field Study Comparing the Use of Individual and Composite Dust-Wipe Samples for Risk Assessment and Clearance Testing," report prepared for the U.S. Department of Housing and Urban Development, Office of Healthy Homes and Lead Hazard Control.

Binstock, 2009. Binstock, D.A.; Gutknecht, W.F. McWilliams, A.C. "Lead in Soil - An Examination of Paired XRF Analysis Performed in the Field and Laboratory ICP-AES Results," International Journal of Soil, Sediment and Water. 2:2(1), 2009. ***http://scholarworks.umass.edu/intljssw/vol2/iss2/***

Choe, 2000. Choe K.T., Trunov, M., Grinshpun, S.A., Willeke, K., Harney, J., Trakumas, S., Mainelis, G., Bornschein, R., Clark, S., and Friedman, W., "Particle Settling After Lead-Based Paint Abatement Work and Clearance Waiting Period," *American Industrial Hygiene Association Journal*. 61:798-807.

Clark, 2002. Clark, C.S., "Development of a Rapid On-Site Method for the Analysis of Dust Wipes Using Field Portable X-Ray Fluorescence," prepared for the U.S. Department of Housing and Urban Development, January 2002.

Cox, 2011. Cox, D.C., F.G. Dewalt, K.T. White, R. Schmehl, W. Friedman, and E.A. Pinzer. "Improving the Confidence Level in Lead Clearance Examination Results through Modifications to Dust Sampling Protocols." ASTM International. Special Technical Publication STP1533-EB, January 2011. ***http://www.astm.org/digital_library/stp/pages/STP49746S.htm***. DOI: 10.1520/STP49746S. ***http://www.astm.org/digital_library/journals/JAI/pages/JAI103469.htm***.

EPA, 1995a. U.S. Environmental Protection Agency, *Residential Sampling for Lead: Protocols for Dust and Soil Sampling,* March 1995 (EPA 747-R-95-001).

EPA, 2001b. U.S. Environmental Protection Agency, *Analysis of Lead Clearance Testing,* (EPA 747-R-01-005). Office of Pollution Prevention and Toxics, EPA, Washington, DC.

EPA, 2001. U.S. Environmental Protection Agency, Analysis of Lead Clearance Testing. EPA 747-R-01-005. Office of Pollution Prevention and Toxics, EPA, Washington, DC.

EPA, 2002a. U.S. Environmental Protection Agency, "Questions & Answers About ETV Reports on Portable Technologies for Measuring Lead in Dust," Office of Pollution Prevention and Toxics, EPA, Washington, DC. December 2002.

EPA, 2002b. U.S. Environmental Protection Agency, The Environmental Technology Verification Program (ETV), Verification Statements EPA-VS-SCM-50, 51, 52, 53, and 54. Prepared by Oak Ridge National Laboratory, Tennessee, August 2002.

EPA, 2004. U.S. Environmental Protection Agency, X-ray Fluorescence (XRF) Instruments. Frequently Asked

Questions (FAQ). ***http://epa.gov/superfund/lead/products/xrffaqs.pdf***

Harper, 2002. Harper M, Hallmark TS, Bartolucci AA. A comparison of methods and materials for the analysis of leaded wipes. J. Environmental Monitoring, 4(6):1025-33, December 2002. ***http://pubs.rsc.org/en/Content/ArticleLanding/2002/EM/b208456m***

Farfel, 1992. Farfel, M., Paper presented at Centers for Disease Control Conference, December 8, 1992 (unpublished).

HUD, 1991. U.S. Department of Housing and Urban Development, *The HUD Lead-Based Paint Abatement Demonstration (Federal Housing Administration),* prepared by Dewberry & Davis, HC–5831, Washington, DC.

Jacobs, 1993a. Jacobs, D.E., "Lead-Based Paint Abatement in Murphy Homes," Georgia Institute of Technology Report for the Macon Housing Authority, Macon, Georgia, (unpublished data).

Jacobs, 1993c. Jacobs, D.E., "Analysis of Recovery Rates for Spiked Composite Wipe Samples by the Wisconsin Occupational Health Laboratory and Azimuth Laboratory," National Center for Lead-Safe Housing, Columbia, Maryland (unpublished data).

Lanphear, 1994. Lanphear, B., et al., *The Relation of Lead Contaminated House Dust and Blood Lead Level Among Urban Children,* Final Report to the National Center for Lead-Safe Housing.

Mamane, 1994. Mamane, Y., R. Willis, R. Stevens, R. Miller, and K. Blume, "Scanning Electron Microscopy/X-Ray Fluorescence Characterization of Post Abatement Dust," *Lead in Paint, Soil and Dust: Health Risks, Exposure Studies, Control Measures, Measurement Methods, and Quality Assurance,* ASTM STP 1226, eds.

NCHH, 2002. National Center for Healthy Housing, "An Evaluation of the Efficacy of the Lead-Hazard Reduction Treatments Prescribed in Maryland Environmental Article 6-8," report submitted to Baltimore City Healthy Start, Inc., and Baltimore City Health Department, Lead Abatement Action Program, January 24, 2002.

NCHH, 2004. National Center for Healthy Housing, and University of Cincinnati Department of Environmental Health, *Evaluation of the HUD Lead-Based Paint Hazard Control Grant Program: Final Report,* prepared for the U.S. Department of Housing and Urban Development, Washington, DC, May 1, 2004.

NIOSH, 1993b. National Institute for Occupational Safety and Health, and Ashley, K., J.D. Travis, M. Milson, P.M. Eller, and A.L. Sussell, *Evaluation of Field Methods for Lead Screening and Analysis,* Paper presented at American Industrial Hygiene Association Conference, New Orleans, Louisiana, May 17, 1993.

Olishifsky, 1983. Olishifsky, J. *Fundamentals of Industrial Hygiene,* National Safety Council, Chicago, Illinois.

Sterling, 2000. Sterling DA, Lewis RD, Luke DA, Shadel BN. A portable x-ray fluorescence instrument for analyzing dust wipe samples for lead: evaluation with field samples. Environmental Research, 83(2):174-9, June 2000. ***http://www.sciencedirect.com/science/article/pii/S0013935100940581***

White, 2011. White K.T., F.G. Dewalt, D.C. Cox, R. Schmehl, W. Friedman, and E.A. Pinzer. "Development of Two Sample Preparation Methods for Determination of Lead in Composite Dust Wipe Samples." Journal of ASTM International, Vol. 8, No. 3, ***http://www.astm.org/DIGITAL_LIBRARY/JOURNALS/JAI/PAGES/JAI103466.htm***. DOI: 10.1520/JAI103466.