

LEAD IN SOIL

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Why Is Lead-Contaminated Soil a Health Hazard?

Lead poisoning can damage children's brains, make it hard for them to learn, and cause behavior problems. The effects can last a lifetime and cannot be reversed. Most children in America with harmful amounts of lead in their bodies come into contact with the lead in and around their homes:

- Soil can be contaminated by lead from many sources.
 - Homes or buildings built before 1950 with peeling, flaking, and/or chipping paint.
 - Paint chips and dust fall or blow into the soil.
 - Peeling paint on the outside of a building is more likely to contain lead than paint inside the home.
 - Painting projects that sand or scrape paint can release dust and paint chips that may contain lead.
 - Homes near industrial operations, particularly lead smelters or other plants with large lead emissions.
 - Homes near highways or truck routes where past emissions from lead in gasoline contaminated the soil.
 - Homes in neighborhoods with a lot of demolition or renovation of older buildings can spread lead dust and debris into soil.

- Lead in soil is only considered a health hazard if the soil is bare or uncovered.
 - People can bring lead-contaminated soil into the house on their shoes.
 - People touch soil with dangerous levels of lead and then put their hands in their mouths or touch food.
 - Lead in the soil can blow inside through a window or door.

- Federal standards for lead-contaminated soil only deal with “bare” or uncovered soil to focus attention on lead in soil that people can touch.

WHERE IS LEAD IN SOIL A PROBLEM?

Most lead in soil around homes and apartment buildings comes from peeling, chipping lead-based paint on the building, from nearby industrial emissions, or past uses of leaded in gasoline. More than $\frac{3}{4}$ of all housing units in the United States have some lead in the soil around their building. The older the property, the more likely it is to have high levels of lead in soil around it. Once there is lead in the soil it is likely to stay there unless the soil is removed.

- The highest amount of lead in soil is usually found in a few places around homes painted with lead-based paint. National data tell us that:
 - 38 million housing units or 40% of all homes and apartments have lead-based paint.
 - About 10% of homes have lead levels in soil that are higher than the Federal standards – making the soil “lead-contaminated soil”.
 - Homes and apartment buildings built before 1940 are 10 times more likely to have lead-contaminated soil than housing units built between 1960-78.

- The highest lead levels are found:
 - In soil around homes are along the dripline (the soil along the foundation and under roof edge) of a house, particularly at downspouts.
 - Near buildings or bridges that were repainted where lead-safe work practices were not used.
 - This includes work that was done using tools that spread lead dust and chips (power sanding, water blasting). Some states estimate that about $\frac{1}{3}$ or more of the lead poisoning cases happen when remodeling or repainting jobs create lead dust and debris.
 - Near roadways where leaded gasoline deposited lead into the soil.
 - Leaded gasoline is no longer used in cars, so leaded gas is no longer a pollutant of lead in the environment in the United States. That does not mean that lead from gasoline pollution deposited years ago is gone.

- Close to old factories, smelters, or repair facilities that used lead.
- Around waste disposal areas that took lead waste.

Reasons to Test for Lead in Soil

Federal regulations define lead-contaminated soil as a “lead hazard”. You can test for lead-contaminated soil to identify potentially harmful lead exposures to children and other family members.

There are a variety of reasons why you might want to test lead in soil.

- To determine if there is a lead hazard from lead in soil around a home.
- To describe soil lead levels in a neighborhood or community.
- To show patterns of lead in soil around a smelter, incinerator, or industrial facility.
- To put the property owner on notice about lead-contaminated soil, forcing the owner either to correct the problem or to tell future tenants or buyers about the lead hazard under the Federal lead disclosure law. (For more information go to www.epa.gov and search under lead.)
- To provide hard evidence to strengthen efforts to win needed policy changes or funding increases.

SUPPLIES:

The following supplies and equipment are needed to collect soil samples that you will send to a lab. You can buy them at a hardware or grocery store.

- Disposable gloves**
 - 1. How many?** One pair for each sample. Have extra pairs available since they may tear.
 - 2. How much?** Bag or box of 100 for \$5 - \$10.
 - 3. What features?** You can use the same kind of gloves you use to take a lead dust sample. Use gloves that are powder free and lead free. Some people are allergic to natural latex rubber. Hypoallergenic gloves cost more, but you may want to buy a box of hypoallergenic gloves to have available - just in case.
- Heavy duty, air tight sandwich size bags:** hold the soil samples collected. Some labs supply the bags or a sample container.

1. *How many?* 2 bags per sample.
 2. *How much?* A box of sandwich bags cost about \$3.
 3. *What features?* Use sandwich size. Use heavy-duty bags that won't rip. Use bags with a zip lock seal so they stay closed.
- Apple corer or sturdy tablespoon:** this is used to collect the soil sample.
1. *How many?* 2. In case you lose or break one.
 2. *How much?* An apple coring tool usually cost less than \$5 and can be purchased at the grocery store. You can use a heavy-duty spoon or shovel if you can't find an apple corer.
 3. *What features?* Make sure they don't bend easily. The bottom edge should be pointed to make it easier to get it into the dirt/soil.
- Small hand shovel:** this is another tool to collect soil.
1. *How many?* One.
 2. *How much?* You can buy a sturdy hand shovel for \$5-\$10.
 3. *What features?* Make sure the metal is tough and doesn't bend easily. You can use the hand shovel to pick up sandy soil that the apple corer isn't good at collecting. It can also help dig up soil if the ground is frozen.
- Disposable wet wipes:** wipes are used to clean off the corer or shovel.
1. *How many?* A package of individually wrapped wipes. It will last from job to job.
 2. *How much?* Less than \$5 for a box of wipes.
 3. *What features?* You can use the same wipes as those used to sample for lead dust, but are not required to use ASTM certified wipes. Baby wipes from the grocery store are fine. Make sure the wipes remain wet because they clean more effectively than dry wipes.
- Trash bags**
- Detergent and water**
- Permanent marker**
- Chain of Custody Form**
- Site Plan**
- Pen**
- Labels**

TRAINING AND QUALIFICATIONS:

1. There is no federal training required to do the type of sampling for lead in soil described in this guide. If you are sampling lead in soil as part of a Lead-Based Paint Inspection, you must be a certified lead inspector. The federal lead inspector course (3 days) teaches students to collect soil samples in addition to teaching them how to use an XRF device that measures lead in paint and collect paint chip samples.
2. States may have different requirements for qualifications. Always check your state standards and regulations before sampling.

LEAD BASED PAINT (LBP) DISCIPLINES*			
<i>Who Can Identify LBP Hazards?</i>			
	Lead Sampling Technician	Inspector	Risk Assessor
<i>Qualified to perform:</i>	Clearance after non-abatement work Other dust wipe sampling	Paint inspections Clearance Other lead sampling	Risk assessments Paint inspections Clearance Other lead sampling
<i>Not qualified to perform:</i>	Risk assessments Paint inspections Clearance after abatement Clearance using random sampling of units in multi-family properties	Risk assessments	
<i>Training/Certification required</i>	5 hours of training HUD requires states certification or risk assessor supervision Some states offer and require certification	3 days of training Certification by state or EPA	5 days of training (including Inspector training) Certification by state or EPA
<i>Methods</i>	Perform: Visual assessment Dust wipe sampling	Perform: Visual inspection Dust wipe sampling Soil sampling Paint chip sampling XRF testing of paint	Perform: Visual inspection Dust wipe sampling Soil sampling Paint chip sampling XRF testing
<i>Objectives</i>	Determine if dust hazards are present by taking a dust wipe and comparing the results to standards. To clear a unit after (non-abatement) work that disturbed lead-based paint.	Identify the existence, concentration and location of lead-based paint. To clear a unit after work that disturbed lead-based paint.	Assess a unit, identify hazards, and recommend methods for lead hazard reduction. To clear a unit after work that disturbed lead-based paint.

Reports/Forms

Site Plan

- This is filled out during the **Visual Survey**. It shows the layout of the house or apartment building and relation to the outside environment. You should have marked any play areas (swing sets, sandboxes, areas with toys or child activities) and other bare soil.

Sampling Results Report

FEDERAL AND STATE STANDARDS FOR LEAD SOIL HAZARDS:

Federal Standards:

The U.S. Environmental Protection Agency (EPA) has two standards for lead-contaminated soil – play areas and other bare soil. EPA defines lead-contaminated soil as bare (uncovered) soil that is on a residential property (yard, soil around an apartment building, etc.) that has equal to or more than the lead in the two standards shown below. Lead-contaminated soil is considered a lead hazard under Federal regulations.

Bare Soil Location	Standard (in parts per million of lead - ppm)
Play area	> = 400 ppm
All other locations (including Dripline)	> = 1200 ppm

State Standards:

Some states have different standards for lead-contaminated soil. If the state standard is stricter, compare results to the state standards. Contact your state health department for the state standard.

What do the Results Mean?

The Results Will Tell You:

- 1. The amount of lead in the soil you sampled.** The lab will tell you the amount of lead in each sample. The results will be a number in parts per million (ppm). This number is the average soil lead concentration of all the soil you put in one bag.
- 2. If the soil you collected has enough lead in it to be considered “lead-contaminated soil”.**

Play Areas

- The federal standards say that a result greater than or equal to 400 ppm of lead in soil is lead-contaminated soil.
- “Play areas” are parts of the yard where children often play. Examples include the soil around sandboxes, swing sets, sliding boards, and areas with toys or other things children play with. It may be helpful to ask people living in the house or apartment building where children play.

Soil Around House or Apartment Buildings

The federal standard is 1200 ppm of lead in soil. If you collected 2 soil samples (one from the soil along the building “dripline” and one in the middle of the yard), you should average the 2 lab results to figure out the overall yard average. Then, compare the overall yard average to the 1200 ppm standard. You can also compare sample results from the dripline or rest of the yard to the standard of 1200 ppm to figure out which parts of the yard have the biggest soil problem.

Calculating sample results to figure out if the soil is lead-contaminated

Step 1: Write down results	Dripline Other Bare Soil	5,000 ppm lead 600 ppm lead
Step 2: Add up results		5,000 ppm lead + 600 ppm lead ----- 5,600 ppm lead
Step 3: Average Results		5,600 ppm/2 samples=2,800 ppm lead
Step 4: Compare to Federal standard	Is the bare soil around the house "lead-contaminated soil"?	Yes, 2,800 ppm is higher than the standard of 1200 ppm The highest levels are along the dripline.

Explaining the Results to Residents

Finding Lead-Contaminated Soil

If the results show that there is lead-contaminated soil (soil lead in play areas \geq 400 ppm or in other bare soil \geq 1200 ppm), the soil poses an immediate health risk, particularly to children.

- Within one week of receiving the results from the lab, tell residents the results and what they mean. Give them the lab report and **Sampling Results Report**.
- Telling other people (such as the landlord) or organizations (such as the health department or code enforcement agency) depends upon two things:
 - The residents' agreement, and
 - The advocacy strategy of your organization.
- Provide residents with information about their legal rights and steps the property owner can take to fix the lead hazards.
 - While families can avoid having children play in soil with lead contamination, it is the property owner's legal duty to control lead hazards.
 - Under federal disclosure requirements, landlords of residences built before 1978 who are told about the presence of lead hazards (including lead-contaminated soil) must tell future tenants or buyers. Landlords are exempt from federal disclosure if they can prove that there is no lead-based paint on the building. For more information on the disclosure requirements go to www.epa.gov — search under lead disclosure.
 - Covering lead-contaminated soil with mulch, grass, gravel, or other materials creates a barrier to stop contact with the lead. The protection is only as good as the barrier and will only last as long as the cover lasts. This is not a permanent solution.
 - Information on how to minimize lead soil hazards.
- If the source of the lead in soil is deteriorated paint, it is important both to repair the paint and fix the cause of the paint problem. The property owner is the person to fix the problem as they can deal with both the paint repair and the problem causing the paint failure (e.g., water leaks, moisture).

Getting a Result Below Federal Standards

If the results show that there is lead in the soil but the level is below the federal or state standards, it is still important to communicate to residents and owners that there is a potential hazard.

- Explain to residents that even though the soil doesn't have enough lead in it to be considered an immediate lead hazard there are still potential risks. Give them the basic fact sheets on lead in soil.
- If sampling was done for lead dust or lead paint chips, provide all the lead results together in the **Sampling Results Report**.

LEAD IN SOIL: Sampling Checklist

PREPARE THE SAMPLE AREA:

1. Review site plan.
2. Decide where to collect samples.
 - Play areas with bare soil
 - Dripline with bare soil (within 3' of building)
 - Other bare soil area (optional)
3. Take photos of sample locations.
 - Mark sample locations on site plan
4. Prepare labels & bags.

COLLECT THE SAMPLE:

5. Put on gloves.
6. Collect bare soil samples.
 - Play areas
 - Dripline
 - Other bare soil area (optional)
7. Clean up between samples.
8. Take samples from other sample locations repeating steps 5, 6, and 7.

FINISH THE JOB:

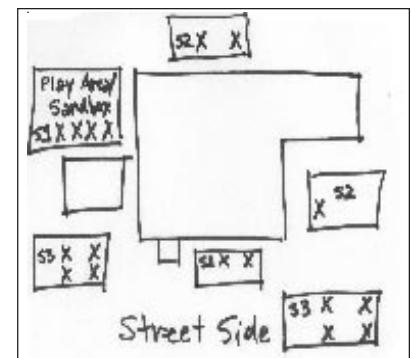
9. Complete forms.
 10. Do final clean-up.
 11. Send samples to the lab.
- Remember:** never throw away trash at the resident's home - take it with you.

FOLLOW-UP

Prepare **Sampling Results Report**, attach the lab results and deliver to the resident.

Supplies:

- Labels
- Pen
- Camera
- Sampling Results Report
- Site Plan
- Disposable gloves
- Permanent marker
- Trash bags
- Detergent and water
- Chain of Custody Forms
- Apple corer, sturdy large spoon or small hand trowel
- Heavy duty, zip lock sandwich size freezer bags
- Heavy duty ziplock bags
- Disposable wet wipes



Sample Locations Marked on Site Plan.

LEAD IN SOIL

Sampling Instructions

I. Supplies

The following supplies and equipment are used for sampling lead in soil.

- Disposable gloves
- Trash bags
- Pen
- Permanent marker
- Detergent and water
- Camera
- Chain of Custody Form
- Site Plan
- Apple corer or sturdy tablespoon or trowel
(small hand shovel)

II.

- Heavy duty, air tight sandwich size bags
- Disposable wet wipes
- Labels
- Shipping package or envelope

Avoid Common Mistakes

Only sample “bare” or uncovered soil. If the soil has grass or mulch on it, don't collect the sample from this spot. Federal standards on lead-contaminated soil only apply to “bare” soil.

Keep soil from the play area separate from soil from the dripline. The standard for play areas is stricter, so it is important not to mix soil from driplines with the play areas.

Wipe off the spoon, apple corer or trowel as you finish each sample location (play area; driplines). This prevents mixing soil between sample locations. You may get inaccurate results if the supplies are dirty.

III. Sampling Instructions

PREPARE THE SAMPLE AREA

I. Review the Site Plan completed during the Visual Survey.

- Look for areas of bare soil.
 - a.** "Bare soil" is soil that is not covered by grass, mulch, wood shavings, pavement, sandboxes, etc.
 - b. If there is no bare soil, there is no need to sample.**
 - c.** Look for labeled areas of bare soil on the site plan. Make sure the plan matches the yard - if not, you should fix it now.

2. Decide where to collect soil samples.

- Look at the yard and the site plan. If there is bare soil in play areas or along the dripline, plan on collecting a sample from that spot. You may also choose to collect samples from other areas with bare soil.

Note: You should not necessarily climb under shrubs, low trees, etc. to collect your sample. If a child can't reach it, it is not relevant.

- Mark 8 spots in each sample location where you will collect soil.
 - a.** These are called sub-samples.
 - b.** Each sub-sample is about one tablespoon of soil.
 - c.** Space sub-samples at least a few inches apart.
 - d.** Pick spots with paint chips, if there are any.
 - e.** You will put all 8 sub-samples for one location into the same bag; that bag holds the entire sample for the play area, dripline, or other area with bare soil (if you sampled these 3 areas of the backyard, you would have 3 bags, each containing 8 sub-samples).

LEAD IN SOIL

Sampling Instructions

3. Take photographs of each sampling location (play area, dripline) and mark site plan.

- Take 2 photos of each sample location in the same order the samples were taken. For the dripline, take one picture for each side of the building (up to 4 pictures total).
- Include a part of the building, a person, or a common object in the picture to help show the scale and size of the bare soil area.
- Write the photo number on the **Chain of Custody Form**.
- Mark the **Site Plan** with the sample location.

Special Instructions: **Dripline with Bare Soil**

If there is no bare soil on 1, 2 or 3 sides, take extra sub-samples from the side(s) with bare soil to get 8 scoops of soil. Pick the side(s) with the most deteriorated paint.

4. Prepare labels and bag.

- Write sample numbers on 2 sets of labels: one for **Chain of Custody Form** and one for bags.
- Give each sample a number and an "S" for soil. Start with S1=play area, S2=dripline, S3 (optional). Don't skip numbers.
- Add the property address to each label.
- Add the location to the label (play area, dripline).
- Put the labels on the **Chain of Custody Form** and bag.
- Place a second bag inside the bag with the label to "double bag" it.
- Put bags near sampling locations.

Special Instructions: **Play areas with Bare Soil**

If there is more than one play area with bare soil, you can collect a second sample of 8 sub-samples from the second play area. Or economize by sampling the play area closest to the home.



- c. Put the soil you collected in to the bag for that sample.
- If the soil is loose and sandy, use a trowel or spoon to collect the sample, instead of the apple corer.
- Put each of the 8 sub-samples into the bag.

7. Clean up between samples:

- Use wet wipes to clean the spoon, corer or trowel before moving to the next location (play area, bare soil, dripline). **You don't need to clean the corer or trowel after each sub-sample in a location.**
- Throw away wipes in a trash bag.
- Change your gloves.

Never use the resident's trashcan. Take your trash bag with you when you leave.

8. Take samples from other sample location repeating steps 5, 6 and 7.

FINISH THE JOB

9. Complete the form:

- Fill in and review the **Chain of Custody Form**. Make sure you have filled out all the sections and ~~that the sample numbers are the same on the~~ bags, the forms, and site plan.

II. Send samples to the lab:

- Send your samples to lab with the **Chain of Custody Form**.

- Keep a copy of all forms.

FOLLOW-UP

When you receive the results from the lab, usually within one week of mailing

the samples to the lab, write the result of the test on the **Sampling Results Report**,

attach the lab results and deliver to the resident.

LEAD IN SOIL

Decision Guide

This guide is for program managers who are trying to decide if they want to measure soil lead levels in the communities they serve and which homes to target for sampling. The **Sampling Instructions** provide the step-by-step instructions the Hazard Investigator needs. CEHRC's **Lead in Soil Background Materials** offer added reference information.

- Why is lead in soil important?** Lead in soil can be an immediate health hazard for children who play in the soil. Young children can get lead-contaminated soil in their mouth, hands, and lungs. People can also bring lead from soil into the house on their shoes or the wind may blow it in. Contact with lead in soil can cause learning difficulties, behavior problems, and damage to the nervous system or other organs.
- Which homes should be checked?** Sample soil near homes with a high risk of lead in soil.
 - a. Homes built before 1950** with peeling or flaking paint on the outside of the building. These older buildings are most likely to have lead paint. Any home built before 1978 may have lead-based paint.
 - b. Homes in neighborhoods with a lot of demolition or renovation of older buildings.** These activities produce dust and debris that could be contaminated with lead.
 - c. Homes near industrial operations**, particularly lead smelters or other plants with large lead emissions.
 - d. Homes near highways or truck routes** where past emissions from leaded gasoline created lead-contaminated soil.
- What training is required?** No training is required under federal rules. The procedure is easy to learn - anyone can do it. Hazard Investigators need training to learn how to follow CEHRC's soil-sampling procedures.
- How much does it cost?** The cost of supplies and laboratory fees is \$35 - \$50 per home. This includes \$5 to \$10 of laboratory fees to analyze each of the samples (between 1 and 3 samples).
- Any limits on scheduling of visits?** The testing can be done at any time of the year. It is easier to collect soil in the daylight and when the ground is not frozen.
- Any special supplies needed?** No. The supplies should be available at any hardware or grocery store.

- Are there recognized/established standards?** There are federal standards for lead-contaminated soil. Some states have stricter standards; see the **Lead in Soil Background Materials** for more information on these standards.

Federal Lead-Contaminated Soil Standards

Part of the Yard	Standard (parts per million of lead - ppm)
Bare soil in play area	≥ 400 ppm
Bare soil in rest of yard (including "dripline.")	≥ 1200 ppm

- How useful are the results?** The lab will give you a number as your result; it is the amount lead in parts per million. You can compare to lab result to federal (and/or state) standards. A result that is equal to or greater than the standards is a lead hazard. Give written results to residents along with general information on how to control lead hazards in soil.

The results should also be given to the property owner with the residents' consent. The owner is required under federal regulations to disclose the information to future tenants and buyers. It is the property owner's responsibility, not the tenants, to control soil lead hazards. Until a property owner fixes a soil problem, occupants can take steps to avoid the lead-contaminated soil.

- Are there any safety concerns to Hazard Investigators?** No.