A4089

Geoffrey Siemering and Doug Soldat

Lead in home garden soil

Home gardening is increasingly popular, especially in cities and towns, and is a great activity through which to connect with the outdoors, get kids interested in nature, and produce your own food. But lead in garden soil can pose health risks to gardeners and to those who eat the garden's produce.

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Guidelines for screening garden soil for lead

Screening **is recommended** if:

- Your home, garage, or outbuildings were built before 1979.
- Your garden site is an old fruit orchard.[1]
- Your garden is located near a busy thoroughfare.
- Your home is built on redeveloped industrial or commercial property.

Screening **is encouraged** if:

- You are already gardening.
- You are putting in a new garden.
- You are expanding a current garden.
- You are gardening in a yard that may have fill or soil added from an unknown source.

Where does the lead come from?

Prior to 1960, lead was used frequently in paints, primers, and varnishes. The amount of lead in these products declined until 1978 when the U.S. banned its use in coatings. Lead pigment was popular because it sped up drying, was durable, and maintained a fresh appearance. It's use peaked in the 1920s. Consequently, the older the house, the more likely lead is present in the soil around it.

Lead from house paint gets into yard or garden soil primarily in two ways. First, as paint weathers and becomes chalky with age, rain washes some of the lead pigment off the sides of the building and into the surrounding soil. Second, when a building is scraped or sanded prior to repainting, the dust of the lead-containing paint drops to the ground or is blown about the yard. Current regulations require painting contractors to capture lead dust, but past practices may have resulted in soil contamination.[2,3]

The second major source of lead in soil is automobile exhaust. Starting in the 1920s, lead was used as a gasoline additive in the U.S. to boost engine performance. Use of lead-containing gasoline peaked in the 1970s, was phased out beginning in the early 1980s, and in 1995 was banned for all vehicles except piston-driven airplanes. As a result, soils that in the past were exposed to large amounts of exhaust may now have elevated lead levels.

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Lead may also have been introduced into the soil from demolished buildings, soldered galvanized metal roofing or gutters, old burn pits, or insecticides used in fruit orchards before 1960.

Why is lead in garden soil a problem?

Once lead contaminates soil, that soil tends to remain contaminated. Years later, people exposed to the contaminated soil can experience increased lead in the bloodstream and this can cause health problems, especially in children. A surprising amount of soil is accidentally eaten or inhaled by people playing on bare soil, working in a dusty garden, eating or smoking with hands dirty from garden work, tracking dirt into the house, or eating garden produce that has not been thoroughly washed.

Plant uptake of soil lead

The most common way that lead travels from garden soil to the human bloodstream is through direct ingestion of soil. Breathing garden dust is another way, but far less common. Although considerably less hazardous even than dust inhalation, eating produce grown in lead-contaminated soil may not be completely hazard-free.[4,5]

Lead uptake by garden plants depends on many factors, including soil lead concentration, soil organic matter content, phosphorus levels, and pH. The amount of lead taken up by plants is small, but minimizing all sources of lead exposure is important. Fortunately, the techniques you use to improve your garden (such as adding compost, using fertilizer containing phosphate, maintaining correct soil pH) also help to lower the amount of lead being taken up by plants. Roots tend to take up and retain the most lead, leaves less, and fruits still less.

While it is most important to thoroughly wash all garden produce to reduce your exposure to lead, growing the right plants can also help decrease your exposure. In general, tall leafy plants (e.g., mustard, cabbage, Swiss chard, collard greens) and fruiting plants (e.g., tomatoes, eggplant, cucumber and zucchini) pose less risk than other plants grown in lead-contaminated soil. Root crops (particularly carrots) are more likely to contain lead above recommended levels.[1,2] The amount of lead ingested from eating root vegetables can be greatly decreased by peeling and washing them to remove all garden dirt.

Phytoremediation—the technique of using plants to remove contaminants from soil—is not a good option for home gardeners because plants normally won't take up enough lead to lower the amount of lead found in garden soil. Lead phytoremediation works only under certain soil conditions, often requires special chemicals, and requires a license for disposal of the harvested plant material.

How to minimize the amount of lead in garden soil

Placing your garden at least 20 feet away from painted structures and busy streets is the best way to make sure that the amount of lead in your garden soil is likely the lowest possible at your location. It is often tempting to put a garden next to a house or garage, but these are usually the yard areas with the highest soil lead concentrations.

It is also prudent to avoid establishing your garden in an area where painted and demolished structures (such as garages or backyard housing units) were previously located. If you are a new homeowner, your city permit department or older neighbors may be able to tell you if there were previously structures in your backyard, or you may find this information in old aerial photographs available in a local library, in city archives, or online. Lead will not easily spread through soil from the place where it was first deposited, so avoiding previous building sites is the safest course.

When screening for lead, how many samples do I need?

In established gardens, use a clean trowel or shovel to collect one cup of soil from the upper 5 to 7 inches of soil at each of 3 or 4 random spots. Thoroughly mix these samples together in a clean plastic container to create a single sample. Make sure your sample contains only soil and not any overlying mulch (you want to test the soil, not the mulch). Put one cup of your sample into a plastic bag for analysis. Label the bag with your name and contact information, then send the sample to a soil analytical lab. This type of mixed (or composite) sample is appropriate for existing gardens only.

To find the best spot to establish a new garden you will need to collect a number of samples to be sure to avoid areas of greatest lead contamination. For more detailed sampling information, see UW-Extension publication, *Sampling Lawn and Garden Soils for Analysis* (A2166).

Where can I get my samples analyzed?

The University of Wisconsin and the Milwaukee Health Department can perform lead and soil nutrient analyses. County extension offices can provide contact information for private soil testing laboratories. (Outside of Wisconsin, contact your state extension office for a list of soil testing labs.)

- Milwaukee Health Department Laboratory
  milwaukee.gov/healthlab
  414-286-3526
  Samples sent to the Milwaukee Health Department will be analyzed for soil nutrients and lead using the Mehlich 3 method.
- The University of Wisconsin Soil and Forage Analysis lab
  uwlab.soils.wisc.edu
  715-387-2523
  Samples sent to the UW lab will be analyzed for soil nutrients. Lead analysis is available at additional cost.

What do the results mean and what resources are available?

Lead occurs naturally in all soils and in Wisconsin is not considered a gardening hazard at levels of 52 milligrams of lead (or less) per kilogram of soil (52 parts per million or less). Based on "blood lead level of concern" guidelines from the U.S. Centers for Disease Control and Prevention, exposure to any soil containing 200 parts per million of lead is potentially hazardous.[6,7] The U.S. Environmental Protection Agency recommends that soil with more than 1200 parts per million of lead not be used for gardening at all.[8]

The results of your soil analysis may indicate no need for corrective action, a need for minor modifications, or a need for extensive modifications to lower risk. More detailed information about what your soil lead levels indicate, and what actions you might take to reduce risk can be found in the UW-Extension publication, *Reducing Exposure to Lead in Your Garden Soil* (A4088).

University or county extension staff, as well as public health department staff, can help you interpret the results of your soil analysis and plan any future steps.

References

1. Lead and Arsenic in Soil at Old Fruit Orchards. **http://datcp.wi.gov/uploads/Environment/pdf/ArmPub99.pdf**
2. Simple Steps to Protect Your Family From Lead Hazards. **www.hud.gov/offices/lead/library/enforcement/pyf_eng.pdf**
3. Renovation, Repair, and Painting Program: Do-It-Yourselfers. **www2.epa.gov/lead/renovation-repair-and-painting-program-do-it-yourselfers**
4. Attanayake, Chammi P., et al. "Field Evaluations on Soil Plant Transfer of Lead from an Urban Garden Soil." *Journal of Environmental Quality* 43(2014): 475-487.
5. FAO/WHO-CODEX. 1995. Codex general standard for contaminants and toxins in food and feed: Codex standard. Revised 1995, 2006, 2008, 2009, amended 2010. **www.fao.org/fileadmin/user_upload/agns/pdf/CXS_193e.pdf** (accessed Aug. 2, 2015).
6. United States Centers for Disease Control and Prevention. "Lead" Accessed June 26, 2015. **www.cdc.gov/nceh/lead**
7. Zharan, S., et al. "Nonlinear association between blood lead in children, age of child, and quantity of soil lead in metropolitan New Orleans." *Science of the Total Environment* 409 (2011): 1211-1218.
8. United States Environmental Protection Agency. "Brownfields and Urban Agriculture: Interim Guidelines for Safe Gardening Practices" (accessed June 29, 2015). **www.epa.gov/brownfields/urbanag/pdf/bf_urban_ag.pdf**

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Authors: Doug Soldat, associate professor; Geoff Siemering, outreach specialist; with the Department of Soil Science, College of Agriculture and Life Sciences, University of Wisconsin–Madison. Soldat holds a joint appointment with University of Wisconsin-Extension, Cooperative Extension. Cooperative Extension publications are subject to peer review.

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