



SOIL TEST NOTES

NOTE 17: *Managing Lead Contaminated Soils*

Lead in Soils

Lead is naturally present in all soils at low levels. Some soils, however, have become polluted with lead as a result of the past use of materials in the past which contained lead (e.g., leaded paint, leaded gasoline). Although lead has been reduced or eliminated from many of these materials since 1978, the lead contributed by these sources years ago remains in the soil where it persists until it is removed. Common locations of lead contaminated soils include areas adjacent to old homes or buildings where lead paint was used, areas along heavily traveled streets and highways, and former sites of fruit orchards where lead arsenate was used as an insecticide. In undisturbed soils, the lead concentration is usually highest in the top inch of soil. When soils have been highly disturbed (e.g., by construction, digging or rototilling), the lead may be dispersed throughout the upper 6 to 12 inches.

Direct contact with or exposure to soils that are contaminated with lead may pose a human health risk. Garden produce grown on lead-contaminated soils may also be a health hazard. In general, most plants do not take up or accumulate large amounts of lead from the soil. Some plants, however, may take up lead from contaminated soil, especially if the soil is acidic. In other cases, soil particles containing lead may cling to the outer leaves or to the surfaces of root vegetables and may pose a health risk if eaten.

Impact of Lead Exposure

Lead in soil may pose a significant human health risk, especially when present in high concentrations or when directly ingested in soil or breathed in as dust. Young children are at greatest risk from exposure to lead as they suffer lead poisoning at much lower levels of ingestion than do adults and are much more likely to engage in hand-to-mouth activities which introduce the lead-contaminated soil into their bodies. Exposure to low levels of lead has been linked to learning disabilities, impaired neurological development and reduced metabolic activity in the body. At high levels, exposure to lead can lead to acute lead poisoning which may result in kidney damage, coma, convulsions and even death. Additional information on lead contamination in soils can be found in *Soil Test Factsheet ST-06 -- Lead Contamination of Soils*.

Management Guidelines for Reducing Exposure to Lead in Soils:

Because removal of lead from a contaminated soil is not possible at this time and complete replacement of the topsoil is very expensive, and thus undesirable in all but the worst cases, the next best step is the adoption of management practices which minimize the exposure to lead in a contaminated soil. Management of lead contaminated soils consists of five key components:

1. *Determine the level of contamination present*
2. *Follow good hygiene practices*
3. *Select an appropriate use for the soil*
4. *Manage soil to reduce lead availability, and therefore, risk*
5. *Install and maintain barriers, if necessary, to prevent direct contact with contaminated soil.*

The specific guidelines for each component are designed to provide the information necessary to successfully use lead contaminated soils while minimizing exposure to the lead present. Further discussion of these components is given below:

1. Determine the level of contamination present.

If you suspect the soil may be contaminated with lead, have the soil tested. A soil test is the first step in determining if, and what type of precautions are necessary to reduce your exposure to lead in soil. A simple and inexpensive screening test for lead in soil is available from the University of Delaware Soil Testing Laboratory. Contact your local Cooperative Extension Office to obtain a soil lead test kit and Instruction sheet. More extensive testing is available from environmental consulting firms.

A generalized interpretation of the lead test results are given below in Table 1.

Table 1. General interpretation of the soil lead test.

Total Soil Lead Concentration (ppm)	Interpretation
100 or less	Soil lead is at background levels for urban areas. To minimize exposure, follow good hygiene practices during and after handling this soil.
101 -300	Soil lead is elevated relative to background levels for urban areas, but still less than the federal limit of 400 ppm. To minimize exposure, follow good hygiene practices during and after handling this soil.
> 300	Soil shows significant contamination with lead. Although less than the federal limit of 400 ppm, further testing and evaluation are recommended. To minimize exposure, follow good hygiene practices during and after handling this soil. Children should not play in bare soil.
> 400	Soil test is above the federal limit of 400 ppm total lead in soil. Further testing and/or evaluation are strongly recommended. <i>This soil should not be used for vegetable gardening.</i> To minimize exposure, follow good hygiene practices during and after handling this soil. Surface 6-8 inches may require treatment or replacement. <i>Children should not play in bare soil.</i> Children exposed to this soil may require a blood lead test. Contact your pediatrician or the Delaware Division of Public Health for further guidance.

2. Follow good hygiene practices during and after handling soil or products from the garden.

Always wash hands thoroughly after handling soil contaminated with lead. Do not eat while working in or around this soil. Keep dust to a minimum while working in the garden by keeping soil moist and using mulch where possible. Carefully wash childrens' hands and toys that come in contact with the soil. Avoid transporting lead contaminated soil and dust into the home by storing work gloves and tools outside the home living space. Remove shoes by the door or wipe them thoroughly on an abrasive fiber doormat before entering the home.

Remove outer / older leaves from vegetables grown in the garden. Carefully wash all vegetables to remove deposits of dust or soil. Peel root vegetables such as carrots and potatoes before eating.

3. Select appropriate uses for the soil.

When possible, locate vegetable gardens and play areas on soils that are low in lead. Flower/ornamental gardens can be located on soils that are higher in lead since the plants grown will not be eaten. Always use good hygiene practices to minimize exposure to any lead present.

If using a soil that is high in lead (**but less than 400 ppm**) for vegetable production, ***do not grow leafy greens*** (e.g., lettuce, swiss chard) as these plants tend to accumulate lead in their tissues. Instead, switch to fruiting vegetables such as tomatoes, beans, sweet corn, squash, eggplants or peppers. These types of plants do not readily accumulate lead from the soil. Always wash any vegetables grown on lead-contaminated soils and peel all root crops prior to eating.

If using a soil that is high in lead (**but less than 400 ppm**) for a children's play area, ***install a physical barrier between the children and the bare soil***. Appropriate barriers include turfgrass or sod, several inches of mulch or some type of plastic covered by mulch, sand or clean topsoil.

Soils that are very high in lead (400 ppm or higher) should not be used for vegetable gardens or childrens' play areas. If the total lead concentration is greater than 400 ppm, consider replacing the top 6-8 inches of soil with clean topsoil. ***If existing soil is not replaced, lime soil to maintain a soil pH of 6.5 or higher to reduce the availability of the lead.*** Plant container gardens using clean soil. Install physical barriers, ornamental plantings and/or sod to prevent direct contact with the soil.

4. Manage soil to reduce lead availability, and therefore, risk

Maintain soil fertility with adequate amounts of lime, fertilizer and/or organic amendments as recommended by a routine soil test. Optimizing fertility helps to minimize uptake of lead by garden plants. A soil pH of at least 6.5 reduces the availability of lead. The addition of large amounts of organic material such as compost, well-rotted manure and non-acid peat will also reduce the availability of lead as compounds in the organic matter bind with lead in the soil. Limit the use of acidic materials in the garden (e.g., some nitrogen fertilizers, pine needles, etc) as these materials can make soils acidic and increase the availability of soil lead.

Have the pH and nutrient levels of soils high in lead tested every 2-3 years. A soil testing service is available from the University of Delaware for a small fee. Contact your local Cooperative Extension office for additional information or to obtain a routine soil test kit. ***Specify high lead soil on the information sheet to ensure that a target pH of 6.5 is used in preparing your lime recommendation.***

5. Install and maintain barriers, if necessary, to prevent direct contact with contaminated soil

Prevent direct contact with soils high in lead by installing physical barriers between the bare soil and humans or pets (which may inadvertently carry contaminated soil or dust into homes). Typical barriers include turfgrass or sod, mulches, dense ground covers or shrubbery. To maximize the effectiveness of the barrier, on-going maintenance is a must. For plantings, monitor the soil fertility of the site to ensure optimum plant growth. For mulches or other artificial barriers, monitor the condition of the material and augment or replace as needed.

Lead exposure and lead poisoning are serious health risks facing many people, especially children, today. These guidelines are designed to help you reduce your risk of exposure to lead in your environment. For additional information on other aspects of lead exposure, contact your family doctor, your local public health clinic (*phone numbers can be found in the Guide to Human Services section of your local phone book*) or the Delaware Division of Public Health at (302) 995-8693 in New Castle County or (302) 856-5350 in Kent or Sussex Counties.

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