Soil Lead: Testing, Interpretation, & Recommendations

Soil Lead Contamination Lead is naturally present in all soils. It occurs generally in the range of 15 to 40 parts lead per million parts of soil (ppm), or 15 to 40 milligrams lead per kilogram of soil (mg/kg). Pollution can increase soil lead levels to several thousand ppm; the major cause of soil lead contamination in populated areas is the weathering, chipping, scraping, sanding, and sand-blasting of structures bearing lead-based paint.

In the past, significant causes of soil contamination by lead included the use of tetraethyl lead as an anti-knock ingredient in gasoline and lead arsenate as an insecticide in fruit orchards. Automotive lead emissions have effectively ceased with the phasing out of leaded fuels, and with the development of more effective pesticides and Integrated Pest Management (IPM), lead arsenate is no longer in use. Unfortunately, lead persists in soil for many hundreds of years and past use of these products continues to present problems in some areas.

Soil lead becomes a health risk when directly ingested or inhaled as dust. Garden produce, which has accumulated lead in its tissue or has soil particles adhering to it, can also be a hazard if eaten. Lead poisoning is a particular concern for young children (under 6) because their rapidly developing bodies are very sensitive to the effects of lead, and their play habits tend to increase exposure.

Soil Lead Levels, Distribution, and Sampling Procedures used by the UMass Soil Testing Lab to screen soils for lead contamination are the same ones used for routine measurement of plant nutrients. The Modified Morgan extracting solution, dilute glacial acetic acid and ammonium hydroxide, removes a reproducible fraction of the total soil lead. The “extractable” lead is a measure of the reactive lead in the soil. A correlation between extractable lead and ESTIMATED TOTAL LEAD has been determined by testing a large number of soils (>300) using both the routine extraction procedure and a more rigorous total soil digestion. Test results report an ESTIMATED TOTAL LEAD level based on this relationship. Information derived from a variety of sources has resulted in classifying soil lead levels as follows:

<table>
<thead>
<tr>
<th>Lead Level</th>
<th>Extracted Lead mg/kg or ppm</th>
<th>*Estimated Total Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>less than 22</td>
<td>less than 299</td>
</tr>
<tr>
<td>Medium</td>
<td>22 to 126</td>
<td>300 to 999</td>
</tr>
<tr>
<td>High</td>
<td>127 to 293</td>
<td>1000 to 2000</td>
</tr>
<tr>
<td>Very High</td>
<td>greater than 293</td>
<td>greater than 2000</td>
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</table>

The listed categories are those of the UMass Soil Testing Lab. They are meant to correspond to the recommendations listed below. *If Estimated Total Lead levels are above 300 ppm, young children and pregnant women should avoid contact with the soil. Estimated Total Lead Levels above 2000 ppm are considered a concern for all users and may represent a hazardous waste situation.* Contact your state’s Department of Environmental Protection or your local health department for more information.

The screening test offered by the UMass Soil Testing Lab is only meant to identify areas where lead contamination may be a concern. Soils that are known to be contaminated with higher levels of lead, should be tested for Total Sorbed Lead (using EPA method 3050 or 3051) with appropriate actions taken. There are a number of public and
Due to the nature of the contamination process, lead in soil may be very unevenly distributed. The lead in paint removed from a structure will generally be concentrated near the source, but levels may vary greatly over small distances (e.g., one foot). Lead arsenate residues in old orchards closely reflect the locations of sprayed trees. Consider these facts carefully when sampling. If the purpose of testing is to establish the extent of play area contamination, combine several, small, randomly taken samples from the surface 1- to 2-inches to create one sample for testing. If the concern is for lead uptake by garden vegetables, combine several vertical slices from the top 6- to 8-inches of soil to create a sample.

**Good Gardening Practices to Reduce Lead Exposure**
1. Locate gardens away from old painted structures and heavily travelled roads.
2. Give planting preferences to fruiting crops (tomatoes, squash, peas, sunflowers, corn, etc.).
3. Incorporate organic materials such as high quality compost, humus, and peat moss.
4. Lime soil as recommended by soil test (a soil pH of 6.5 to 7.0 will minimize lead availability).
5. Wash hands immediately after gardening and prior to eating.
6. Discard outer leaves before eating leafy vegetables. Peel root crops. Wash all produce thoroughly.
7. Protect garden from airborne particulates using a fence or hedge (fine dust has the highest lead concentration).
8. Keep dust in the garden to a minimum by maintaining a well-mulched, vegetated, and/or moist soil surface.

**Recommendations**
- **Low** - Follow the good gardening practices listed above.
- **Medium** - In addition to following good gardening practices:
  - Restrict access of children to these soils by maintaining dense cover.
  - Do not grow leafy green vegetables or root crops in this soil; instead, grow them in raised beds built with non-contaminated soil and organic amendments.
- **High** - In addition to following good gardening practices:
  - Do not grow food crops in this soil and do not allow children access to it.
  - Keep soil covered and take steps described above to reduce lead availability.
  - Grow food crops in containers filled with growing media or clean topsoil; or create lined, raised beds filled with non-contaminated soil and organic amendments.
- **Very High**
  - Contact your local Health Department, Cooperative Extension, or the Department of Environmental Protection office for advice on lead abatement measures that should be taken.

**Additional Resources**

Prepared by Tracy Allen, Lab Supervisor, UMass Soil and Plant Tissue Testing Laboratory; John Spargo, Assistant Extension Professor of Soil and Nutrient Management and Director, UMass Soil and Plant Tissue Testing Laboratory; and Baoshan Xing, Professor of Soil Chemistry. January 2012.

This factsheet is a revision of a previous UMass Soil and Plant Tissue Testing Laboratory document.