

East Bay Soils: Lead, Testing & Remediation

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Here at the Institute of Urban Homesteading we get a lot of questions about the safety of food grown in urban gardens and whether soils should be tested prior to breaking ground. We hope this introduction and the following report-back on the EPA lecture on lead in the soil will address these concerns. We think results from soil testing can be interesting, however we do not think it is always necessary to test. If you live in a residential area, with no prior industrial use, there are some basic assumptions you can make about your soil and food grown in your urban garden.

Urban soils tend to be less toxic, than in areas of conventional agriculture where pesticides and herbicides are in regular use. Even if the gardener before you used some pesticides, it will be less than what is used agriculturally. Food grown in an urban environment, especially those close to a freeway, should be washed to remove both soil and particulate matter from the air.

If your building is in the East Bay, built prior to 1960 and it is the original building on the site, it is pretty much guaranteed there is some lead in your soil, but probably nothing else too worrisome. The lead in East Bay soils, which is typically 300-600 parts per million (ppm) comes from the lead paint which was used on houses prior to 1960. The paint flaked off into the soil due to normal weathering. As such, lead will be present in the highest amounts close to the building and lower the further away from the building you get.

The highest danger from this amount of lead is to small children who may ingest the actual dirt, so protecting them will be important. Uptake of lead by plants at this level is negligible (see report below) and regular amending with compost will completely neutralize the lead over time. If you have any qualms at all, you can garden in raised beds with imported soil.

Talk to your neighbors, especially older people about the history of the area. If your house is built more recently, or you have reason to believe your building was not the first thing on site, check with the county recorder to see what was there before. If there was prior industrial or automotive use, it is then a good idea to have your soil tested, or avoid the whole question by gardening in raised beds.

Cleaning up toxic waste is both intensive and expensive and what is usually recommended is completely digging out the old soil and bringing it to a toxic waste dump. People like the idea that you could remediate heavy metals in your soil by planting sunflowers, which supposedly take up lead and other heavy metals, but in reality this would take many seasons of planting sunflowers and transporting them to a toxic waste site, before any impact would be seen.

In terms of other information you might get from a soil test...we think may be fun and interesting to know how much nitrogen, potassium etc is in your soil, but don't recommend trying to adjust this balance in any fancy or technical manner. Our native East Bay soils are generally pretty rich in nutrients, as we are at the bottom of the Sierra watershed, where both small clay particles and nutrients wash down and collect (thus the East Bay clay). Soil health has more to do with soil structure and life, than it does with chemical make-up anyway and while adjusting for specific nutrients might make sense for growing specific crops on a large scale, for a kitchen garden it doesn't make much sense. Whether you have East Bay clay, or Alameda sand, and no matter what the deficiency we're going to recommend the same fix: when in doubt, just add compost. Adding finished compost increases the life in the soil and offers plants a balanced smorgasborg of nutrients, as well as binding to toxic lead to neutralize it. Once your soil is teeming with fungi and bacteria, they will adjust the pH* and work to balance and accumulate nutrients for your plants.

*The one exception to this rule might be trying to grow under oak or redwood trees, which create acid soils and inhibit growth of garden annuals. For these situations, growing in raised beds with imported soil is advised.

Should you wish to sample your soil and have it tested, the pace that we know that currently offers a reasonably priced, comprehensive test is here: <http://msusoiltest.com/>.

Report Back

EPA Workshop on Lead and Pyromorphite Remediation

I attended a lecture on lead in the soil and how to deal with it given by Steve Calanog of the EPA who is currently working on a massive clean-up in the Prescott neighborhood of West Oakland. The lecture was densely informative. I will summarize the most important bits here.

Lead (Pb) and lead poisoning have been around for a long time and lead is the most prevalent toxin in our Bay Area soil. There are a few other things to worry about (like arsenic) but the occurrence of these is relatively low in comparison to lead. Lead is a neuro-toxin which can cause blood and brain disorders and damage to the nervous system. It is most dangerous to children under 6, who have the highest risk of exposure (crawling on the ground, playing in the dirt, putting dirty hands in their mouths) as well as the largest capacity for uptake in this period of rapid growth and development. Adults are at relatively low risk from lead in the soil. There are various species of lead compounds in our soil, some naturally occurring, some man-made. Much of this lead is not toxic and/or can't be taken up by our bodies. Most of the toxic forms are man-made such as those from gasoline, paint, car filters, pesticides, leaded glass, aviation fuel and so forth. It is worthwhile to have your soil tested. However, the current tests measure for total lead, so do not tell you how much of the lead present is the toxic kind. On top of that there is the issue of "bio-availability" -- how much of this lead can actually be taken up by plants and animals, including humans.

The EPA considers 400 ppm (parts per million) a time to "take action." The California number is 80 ppm. Soils in the Bay Area typically have 300-600 ppm. The bad news is that lead levels of this amount in the soil can be dangerous for children, especially if they have direct contact with the soil--getting it in their mouth, breathing it, etc. Lead paint in older homes also poses a risk for children in terms of lead dust, you can get information about that here:

http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_12460.pdf. The good news is that this same amount of lead (300-600 ppm) is low risk for gardeners and food grown in urban gardens, given implementation of "best practices" based on understanding where the actual risks lie. Steve said that you can safely eat food grown in soil with up to 3000 ppm lead, if you follow a few simple guidelines.

How can this be? Well, first of all, it is important to understand that not much of the lead present is bio- available to the plants. *Only 1% of the lead available can be taken up by plants.* So even if your soil tests at 300 ppm, the actual risk based on plant uptake is 3 ppm. Most of this will be found in roots and stems. The amount of lead found in fruits is fractional and close to zero, even in highly contaminated soils. The lead just doesn't make it there. So if you have lead in your soil, you should plant fruit trees, cane berries and plants with accessory fruits like tomatoes, peppers, squash etc. There is a much higher danger, especially to children, of lead poisoning from ingesting the actual dirt. In leafy greens the biggest danger is from dirt splashed onto the leaves--not so much from lead inside the plant. So wash your leafy greens well! Root crops pose the highest risk, as they will uptake some lead and the dirt is present on the skin of the root. So if lead is present in your native soil, always peel root crops or grow them in imported soil (raised beds).

What about getting rid of the lead all together? The traditional method is expensive and highly disruptive. It involves removing the top soil, bringing it to land-fill and importing clean fill (which may or may not be better than our native soil—mostly the latter IMHO) This can cost up to 30K for 1000 sq ft. Plus it is not viable if we are talking about an entire city. The EPA is now looking at ways to remediate the soil "in place" and to inform people of these "best management practices.'

The great news is that if you are gardening organically, you are already doing much to repair your soil! I have been telling people all along that adding compost will help neutralize toxins and metals in the soil. In the case of lead this has been shown to be true. Any time you add phosphate and phosphate compounds to your soil, it binds with the lead and forms pyromorphite crystals, a form of

lead which is non-toxic (not bio-available) to animals. If your soil is in really bad shape, you can amend it by adding up to 5% fish bone meal (calcium phosphate) or other concentrated phosphate. This is approximately 3 pounds per square feet, or 300 pounds for a 10 x 10 bed. That's a lot fish meal! But, this is not really necessary if you are a gardener who is adding compost and tilling in a couple times a year. There is plenty of phosphate available in well aged compost, chicken manure and other amendments and you will go far over time to reduce the lead in your soil this way.

Using this phosphate immobilization method does not change the amount of lead in your soil, it simply transforms it. So, if you re-test for lead, you will still get the same number. You are not removing lead, just changing it to a form that cannot hurt our bodies.

Here are some numbers

According to the EPA

0-500 ppm low risk

500-1000 ppm medium risk

1000-3000 ppm high risk

more than 3000 ppm very high risk

What do you do if there is lead in your soil?

1. Implement best management practices (see below)
2. Traditional: dig up and replace top soil. Expensive! up to 30K for 1000 sq ft
3. Treat soil in place through phosphate immobilization
 - binds with lead in soil to create pyromorphite
 - use various forms of phosphate up to 5% fish bone meal, TSP
4. Most importantly: If your soil falls in the 300-600 range there is very low risk for either adults or children in terms of eating food from this soil. For children 6 and under the risk is about direct contact with the soil, which should be minimized by covering the soil with lawn or playground mulch in the areas they are most likely to play.

If your result lands in the typical 300-600 range here are the **best practices** for minimizing risks:

- Cover children's play areas with mulch or grass.
- Plant away from older painted buildings
- Have children wash hands thoroughly after gardening.
- Implement "shoes off" in households where children are still crawling.
- Amend your garden beds regularly with compost and/or manure
- Create raised beds for leafy greens and root crops--you do not need to dig out the native soil, as the largest danger is from soil splash onto leafy greens and direct contact with the edible part of the root. Simply clear and loosen the native soil and put 8-24" of imported soil above.
- Plant fruiting crops. Lead will not be present in fruits. (fruit trees & shrubs, cane berries, beans, tomatoes, pepper squash, eggplant)
- When planting leafy greens discard older outer leaves, wash thoroughly
- Wash and peel root crops

Additionally, for higher results, or closer to buildings:

Up to 500 ppm

Any crop, wash well. Peel root crops. Amend with quality compost.

500-1500 ppm

Limit low growing leafy greens Limit root crops (except potatoes which will be fine as long as washed well) All other crops are fine.

More than 1500ppm

No leafy greens or root crops (grow these in raised beds). Keep soil out of house. Amend heavily with phosphate-rich compost or fish bone meal.