

Report Back from the EPA Lead and Pyromorphite Lecture

lecture by Steve Calanog

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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 try to 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 and playing in the dirt) 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 it 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 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 them or grow root crops in imported soil (raised beds).

But 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 phosphare 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

Bay Area average 300-600

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 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

~ If you are still concerned, 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 (fruit trees & shrubs, cane berries, beans, tomatoes, pepper squash, eggplant etc.)

~ When planting leafy greens discard older outer leaves, wash thoroughly

~ Wash and peel root crops

~ Keep your soil acidity low. Bio-availability is higher in extremely acidic conditions.

Crop Recommendations for different ppm

Up to 500 ppm

Any crop, wash well. Peel root crops.

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. No root crops.
Keep soil out of house.