SOIL TESTING DATA

Understanding Your Heavy Metal Numbers

Joshua (Zhongqi) Cheng, PhD
Director, Environmental Sciences Analytical Center

Our Analytical Service

You probably have noticed that our fees are significantly lower than most providers on the market. This affordable service is part of Brooklyn College's commitment to public service for the community. We are not an EPA certified laboratory therefore the data can only be used for screen purposes, not for legal proceedings. Despite of the low fees, we strive to make available high quality data through stringent quality control procedures. The heavy metal analysis follows EPA standard methods 3051A and 6020A.

NYS DEC Soil Cleanup Objectives

Before comparing your numbers to various regulation, guideline or recommendation levels, one should always bear in mind the intended use for this soil. The following table provides a starting point to compare your numbers with.

Contaminant	NYS Soil Background	NYS DEC Soil Cleanup Objectives		US EPA Soil Screening Levels
		Unrestricted	Residential (Health)	
Pb	19	**63**	400	400
As	5	**13**	16	0.4
Cd	0.5	**2.5**	2.5	70
Cr	14	**30**	36	120,000

The New York State Soil Background levels are based on soils collected from central and western New York. In urban environments higher values are very common. It should be noted that there is currently no specific regulation or guideline values that exist for garden soils. The New York State Department of Environmental Conservation (NYS DEC) developed the Soil Cleanup Objectives (SCO) to guide Brownfield remediation, and these are probably the closest values to compare with.

The University of Connecticut Soil Nutrient Analysis Laboratory suggested different actions for four different ranges of soil Pb levels. Based on this and the NYS SCO, we recommend that (1) for Pb levels below ~100 ppm, no precautions are necessary; (2) for Pb levels between 100 and 400 ppm, follow best management practices for garden soils containing lead, don't grow green leafy vegetables or root crops, kids shouldn't play in areas of bare soil, further investigation is suggested about lead distribution, and that children blood lead levels be tested; (3) for Pb levels above 400 ppm, the soil should not be used for growing food plants, and that remedial actions be taken for residential use.

For As, Cd and Cr, the NYS DEC's "unrestricted" and "Residential (Health)" values are similar to each other. We recommend that food plants not grown in soils containing As, Cd and Cr levels above the "Residential (Health)" values, where further investigation and remedial actions should be taken. Otherwise, follow best management practices.

It should be noted that heterogeneities are prevalent in soils. Since your submitted soil sample represents an average of soils from several sites and different depths, a low average doesn't mean that at every site or depth the contaminant levels are below the respective levels for unrestricted use. Commonly, surface soils (1-2 inches at the surface) and soils closer to a building or a high traffic road are likely to be more contaminated. There are also possibly "hotspots" due to historical burial or dumping activities. If your soil sample contains high levels of heavy metals, or the levels are marginally below the thresholds, further testing and investigation is highly recommended.

What to do when you've found high levels of contaminants?

Don't panic! You are not alone. In New York City there are many gardens like yours that had been contaminated due to historical reasons: paint chips in old houses, gasoline emission prior to 1980's, arsenic-bearing pesticides for lawns or from pressure-treated wood, or industrial activities at the site or nearby. Contaminants can enter human body through many different pathways, therefore what you do with the soil, and the extent to which you work with the soil controls the risk posed by these contaminants. Ingestion and inhalation are probably the two main forms of major risk in urban gardens. Most heavy metals don't pose health risk with dermal exposure – therefore touching soils are usually not a great risk, but washing hands is particularly important. Children are at much higher risk than adults to contaminants not only because that their systems are weaker, but also their tendency to ingest soil.

Follow the Best Management Practices (BMP) for Garden Soils Containing Lead (taken from SOIL LEAD INTERPRETATION SHEET by Dawn Pettinelli, Manager, Soil Nutrient Analysis Laboratory at the University of Connecticut)

- Gardens should be located away from older, painted structures and heavily traveled roads.
- Give planting preference to fruiting crops like tomatoes, squash and peppers on soils with elevated lead levels.
- Remove outside leaves of green leafy vegetables, peel root crops, and wash all vegetables thoroughly to remove soil particles.
- Maintain the soil pH at 6.5 to 7.0 by applying limestone at recommended rates to reduce the availability of lead uptake by plants.
- Maintain soil organic matter levels between 5 and 10 percent. Organic particles will bind with lead making it less available for plant uptake.
- Maintain soil phosphorus levels by applying the recommended amounts of fertilizer to garden plots. Phosphorus can reduce lead uptake by plants.
- Minimize dust and exposure to bare soil through use of mulches.
- Wash hands thoroughly after contact with lead contaminated soil.
- Do not bring food or drinks into areas of contaminated soil.
- Soil on tools, gloves and shoes will have elevated levels of lead also. Clean before storing or bringing indoors.
- Consider raised beds or containerized plantings in soils with elevated lead levels.

Where to find more information?

1. The Cornell Waste Management Institute maintains a great educational program for soil quality and testing. Their website is http://cwmi.css.cornell.edu/soilquality.htm. The fact sheets near the bottom of the

page provides lots of useful information on contaminants, how to interpret the data, as well as best practices in a garden.

2. Brooklyn Botanic Garden (www.bbg.org) recently published a book "Healthy Soils for Sustainable Gardens," in which there is a chapter dedicated to contaminants. It is worthy of a read for beginners.
3. For these who are more interested in the details of New York State Department of Environmental Conservation Soil Cleanup Objectives, please visit http://www.dec.ny.gov/regs/15507.html. Go to subpart 375-6: Remedial Program Soil Cleanup Objectives.
4. For those who are interested to know more about US EPA's Soil Screen Levels, please visit http://www.epa.gov/superfund/health/conmedia/soil/