

How to Read the Numbers
Heavy Metals in Garden Soil

How do your numbers compare to overall New York City levels and the New York State Department of Environmental Conservation’s Soil Cleanup Objectives?

The NYS Dept. of Environmental Conservation’s Soil Cleanup Objectives (SCOs) are the values aimed for in cleaning contaminated soils for residential purposes. The following table is a summary of data analyzed and compiled at our lab. Most of the samples were sent in from NYC’s five boroughs but some samples were also received from upstate NY and other states. In general, suburban or rural area samples have much lower toxic metal levels but the table provides a comparative starting point. The values will be updated as the analyses database grows.

	Average	Median	Range	NYS Baseline	NYSDEC Unrestricted SCO	NYSDEC Residential SCO	NYSDEC Restricted- residential SCO
Chromium (Cr)	62±38	54	9-248	13	30 (89%)	36	180 (3%)
Nickel (Ni)	38±28	29	3-178	17	30 (47%)	140	310
Arsenic (As)	20±16	15	2-79	5.0	13 (57%)	16	16 (46%)
Cadmium (Cd)	3.0±2.4	2.5	0.5- 22.5	0.5	2.5 (49%)	2.5	4.3 (25%)
Lead (Pb)	565±527	411	11- 2526	19	63 (87%)	400	400 (51%)

Note: units are ppm

The **Average**, **Median** and **Range** values are summaries of all currently collected data. The numbers in parentheses are the percentages of collected samples that exceed the listed limit.

The **NYS Baseline** levels are based on soils collected from central and western New York. In urban environments higher values are to be expected and are very common. It should be noted that there are currently no specific regulations or guideline values that exist specifically for garden soils. The New York State Department of Environmental Conservation (NYSDEC) developed the *Soil Cleanup Objectives (SCO)* with guidance from the NYS Department of Health to guide Brownfield remediation (industrial or commercial sites that may have contamination issues but can be used for redevelopment if cleaned up properly). These values are probably the most relevant and can be applied to garden soils.

The **NYSDEC Unrestricted SCOs** column represents the concentration of contaminant in soil that has no restrictions for use. This means both produce and livestock can be raised on the land for consumption. The values account for exposure to soil contaminants

through ingestion, inhalation or skin contact and also consumption of home-grown produce and home-grown animal products. These values are the most conservatively protective of human health, ecological resources and groundwater.

NYSDEC residential land use SCOs were developed as a standard for sites earmarked for residential housing, usually single family homes. The values account for exposure to soil contaminants via ingestion, inhalation, skin contact and eating home-grown produce. They do *not* take into account the consumption of animal products produced on the site. Growing and consuming of produce is allowed; home-grown animal products are not.

NYSDEC Restricted-residential land use values are intended for sites earmarked as multi-family housing. The values do not account for exposure through the consumption of home-grown produce or animal products. These activities should not be practiced on these sites. Under the SCO regulations, community vegetable gardens may be considered under this category with NYS DEC approval.

Recommendations regarding Fruits and Vegetables

The University of Connecticut Soil Nutrient Analysis Laboratory suggests different actions for different ranges of soil Pb levels. Based on this and the NYS SCO, our recommendation is:

- (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, i.e. don't grow green leafy vegetables or root crops, children should not play in areas of bare soil. Other suggestions would be to further investigate actual lead distribution in the area and to test the blood lead levels of children.
- (3) for Pb levels above 400 ppm, the soil should not be used for growing food plants, and remedial actions should be taken for residential use.

We also recommend that food plants not be grown in soils containing As, Cd, Ni and Cr levels above the **Restricted-residential** values. Further investigation and remedial actions should be taken. 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 (or high) average doesn't mean that at every site or depth the contaminant levels are below (or above) the respective levels for unrestricted use. 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 find high levels of contaminants in your garden soil?

Don't panic! In New York City it is not uncommon for many gardens to have contamination due to historical reasons: old paint chips, gasoline emissions prior to 1980's, arsenic-bearing pesticides from lawns or from pressure-treated wood and industrial activities at or near the site can all be contributing factors.

Contaminants can enter the human body through several different pathways - therefore *what you do with the soil, and the extent to which you work with the soil determines the risk posed by these contaminants.*

Ingestion and inhalation are probably the two main forms of exposure to contaminants in urban gardens. Most heavy metals do not pose a health risk with dermal exposure - touching soils is not a high risk activity, but *washing your hands, including under the nails, is very important.*

Children are at a higher risk for contaminants because their systems are still developing and susceptible. Ingestion of soil is a greater possibility with children so monitoring their activities and reminding them to wash their hands thoroughly is extremely important.

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. Cornell Waste Management Institute, <http://cwmi.css.cornell.edu/soilquality.htm>. The fact sheets near the bottom of the page provide useful information on contaminants, how to interpret the data and best practices in a garden.
2. Frank J. Peryea. Washington State University. Gardening on lead and arsenic contaminated soils. Available at <http://cru.cahe.wsu.edu/CEPublications/eb1884/eb1884.pdf>
3. Penn State College of Agricultural Sciences. Lead in Residential Soils: Sources, Testing, and Reducing Exposure. Available at <http://cropsoil.psu.edu/extension/facts/Lead%20in%20Soil.pdf>
4. Prevent Lead Poisoning From Soils Around Homes. <http://aginfo.psu.edu/news/1999/11/lead.html>
5. Oregon State University. Evaluating and Reducing Lead Hazard in Gardens and Landscapes. Available at <http://extension.oregonstate.edu/catalog/pdf/ec/ec1616-e.pdf>
6. Stephanie Hamel, Joseph Heckman, Stephanie Murphy. Rutgers University. Fact Sheet: Lead Contaminated Soil - Minimizing Health Risks. Available at <http://njaes.rutgers.edu/pubs/publication.asp?pid=FS336>
7. Ontario Ministry of the Environment programs and initiatives. Fact Sheet: Frequently asked questions about lead contamination. Available at <http://www.wdghu.org/tytler/docs/MOE%20Soil%20Pb%20Factsheet.pdf>
8. Heavy Metals in Soil. Available at http://www.dig-itmag.com/departments/print/274_0_14_0/
9. 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 worthwhile read for any gardener.
10. If you are interested in the details of the NYS Department of Environmental Conservation (NYSDEC) Soil Cleanup Objectives (SCO), please visit <http://www.dec.ny.gov/regs/15507.html>. Go to subpart 375-6: Remedial Program Soil Cleanup Objectives.
11. For more information about the US EPA's Soil Screen Levels (SSLs), please visit <http://www.epa.gov/superfund/health/conmedia/soil/>
12. **Residential heavy metals info**
<http://www.atsdr.cdc.gov/tfacts7.html>
13. **Info on blood lead levels**
<http://www.epa.gov/lead/pubs/leadrev.pdf>
14. **Soluble Salts:**
<http://www.agviselabs.com/inter3.php>
<http://www.aces.edu/pubs/docs/A/ANR-1158/>
<http://mining.state.co.us/TechnicalBulletins/SoilTestExplanation.pdf>
<http://www.ncagr.gov/AGRONOMI/pdffiles/stnote9.pdf>
15. **pH**
<http://www.ipm.iastate.edu/ipm/hortnews/1994/4-6-1994/ph.html>
16. **Nutrients:**
<http://www.soiltest.uconn.edu/faq.php>