

Healthy Soils, Healthy Communities - Soil Metals Test Results
SAMPLE REPORT for “Example Garden”

November 20, 2010

Dear GreenThumb Gardener/Garden Coordinator,

You are receiving this information because your garden was part of a *Healthy Soils, Healthy Communities* (HSHC) project to test for metals in soil from food beds in 44 community gardens across New York City.

Project Information

Urban community gardens bring many benefits to gardeners and their communities, including the nutritious and affordable food they produce. However, urban soils may contain contaminants from years of human activity. In 2009, GreenThumb began partnering with Cornell University, Cornell University Cooperative Extension-NYC (CUCE-NYC), and the New York State Department of Health (NYSDOH) to test some garden soils and help provide information about soil metals levels in urban community gardens. Gardens were selected for testing based on factors such as size, a record of “food production” and recent GreenThumb soil/compost deliveries.

On November 20, 2009, a member of our team collected soil samples from ten randomly selected growing areas (“beds”) and a non-growing area in *Example Garden*. Cornell University tested the samples for levels of lead, a number of other metals, and other soil properties. Metals occur naturally in the environment, but some metals may occur at higher levels in soils affected by human activity. High levels of exposure to some metals can be associated with health effects (see **Resources** section at the end of this letter for more information). Gardening may increase your contact with these metals if you swallow soil particles or eat vegetables grown in the soil.

Results from Your Garden

There are no health-based standards specifically for community garden soils. To evaluate the testing results for your garden, we compared the results to typical “background” levels of the metals in rural soil and to health-based guidance values New York State uses for evaluating contaminated soils. Neither the background values nor the guidance values are fixed limits above which there is a concern. Rather, these values help identify levels that may call for additional steps to reduce potential exposures. The attached Table 1 shows levels of metals in soil samples taken from ten beds and a non-growing area of your garden compared with guidance values. Table 2 shows a summary of your garden results compared with typical rural soil levels, and a summary of the results from all other GreenThumb gardens sampled in this project. Also attached is a map showing sampling locations in your garden.

Some areas we tested in your garden are higher than guidance values for lead and barium. Other lead levels were above rural background levels, but below guidance values. Lead in soil may pose a health concern, especially for young children. A health risk associated with barium at these levels cannot be ruled out, but is likely to be low.

In *Example Garden*, results for these metals above the guidance values (*see next page for more information about these guidance values*) include:

- 5 beds had **lead** levels higher than the guidance value of 400 ppm (The maximum value was 1000 ppm)
 - 7 beds had **barium** levels higher than the guidance value of 350 ppm (The maximum value was 1100 ppm)
 - The non-growing area had a level of **lead** of 600 ppm
 - The non-growing area had a level of **barium** of 950 ppm
- (“ppm” = “parts per million”; *see note in Table 1*)

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Recommendations

Levels of soil metals measured in cities can be higher than guidance values, so these levels are not unexpected in an urban garden. For example, a study of 27 soil samples collected in Manhattan, NYC from ornamental gardens, cemetery lawns, grass covered vacant lots, and grass covered courtyards found that lead levels ranged from 48 to 891 ppm.¹ Nonetheless, lead in soil can pose a health concern, especially for young children. Lead can harm a young child's growth, behavior, and ability to learn. Here are some important considerations:

- Watch children while they are in the garden and remind them often to avoid touching their mouths after digging in the soil.
- NYS requires health care providers to test all children for lead in their blood when they are one and two years old.
- Parents can also ask their child's doctor or nurse if their child should get a lead test, and what the lead test results mean.

Barium can be found in rural soils at levels near or above the guidance value. If you would like more information about barium, see the Agency for Toxic Substances and Disease Registry frequently asked questions fact sheet ("ToxFAQ") for barium and barium compounds (available here: <http://www.atsdr.cdc.gov/tfacts24.pdf>).

We also encourage you to take some steps to reduce your contact with metals or other contaminants in your garden soil by following the Best Practices for Healthy Gardening listed below. We recommend these steps because they are generally good practices that reduce exposure to metals in soil in both growing areas and non-growing areas of your garden. **Some of the resources listed at the end of this letter give more information about soil chemicals and actions you can take.**

In addition to thoroughly washing and peeling your fruits and vegetables (especially those that grow in or close to the ground), you could consider growing only a variety of fruits or vegetable fruits if you are still concerned about contaminants in your soil. These include tomatoes, peppers, eggplants, squash, green beans, peas and many other crops that are least likely to have metals on or in their edible parts.

Remember that there are many health benefits to eating fresh fruits and vegetables from your garden!

In summary, levels of lead and barium in some areas of your garden were above guidance values. Lead is a particular concern. Risks posed by other metals with levels above SCOs cannot be ruled out, but are likely to be low. We sampled randomly chosen beds and the non-growing area to get some information about the possible range of levels of metals in your garden. However, we do not have information about the levels of metals in other areas of your garden.

¹ *Characterization of Soil Background PAH and Metal Concentrations in Manhattan, New York*, prepared by Consolidated Edison Company and submitted to NYSDEC on March 30, 2007.

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What Gardeners Can Do: Best Practices for Healthy Gardening

- Use **raised beds** filled with clean soil and compost. Incorporate new compost or other organic material often. Consider having the levels of metals in these materials tested by a NYS-certified laboratory (see link below);
- **Avoid use of pressure-treated wood or railroad ties** to build your beds;
- Maintain a **good soil nutrient balance** and a **pH near neutral**;
- **Cover (or mulch) soil in beds and in non-growing areas** such as play areas, gathering areas, or paths to reduce soil splash and dust. Different materials can be used such as stones or wood chips for paths, and compost or dried leaves for beds.
- Always **wash your hands** after gardening, and have children who play or work in the garden wash their hands;
- **Thoroughly wash** and/or **peel garden produce**. This can be especially important for leafy and root vegetables, which are more likely to have difficult to remove soil particles on their surfaces than fruiting vegetables such as tomatoes, peppers, eggplants, squash, green beans, peas and many others;
- **Avoid bringing soil into your home** after gardening by wiping off all of your garden tools while at the garden and changing your shoes before going indoors.

Next Steps

We will continue to analyze the results from this HSHC project and may reach out to some garden contacts in the future or hold additional workshops or meetings. As a leader/contact person in your garden, please share this information with other members of your garden. We hope the information in this letter helps you understand more about levels of metals in your garden soil and reminds you about healthy gardening practices. **Urban gardens bring many benefits to gardeners and their communities and we encourage you to continue healthy gardening!**

We look forward to learning more from gardeners and others who support gardening efforts.

- If you would like to share a “Garden Success Story” about how your garden has addressed soil contamination issues please send an email, with that heading, to VTL2@cornell.edu.
- You can also join our mailing list to receive the latest updates on *Healthy Soils, Healthy Communities* Project activities in NYC by sending an email to the same address.
- **Finally, if you have any questions or comments about your test results, please contact the HSHC team via Véronique Lambert, Extension Associate at CUCE-NYC, by phone at (212) 340-2983 or by email at VTL2@cornell.edu.**

Sincerely,

The *Healthy Soils, Healthy Communities* Project Team

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Resources:

- Cornell Waste Management Institute fact sheets and other *Resources for Healthy Soils*:
<http://cwmi.css.cornell.edu/soilquality.htm>
- NYSDOH brochure on Healthy Gardening:
<http://www.health.ny.gov/publications/1301/index.htm>
- NYSDOH information on lead:
<http://www.nyhealth.gov/environmental/lead/>
- NYSDOH Environmental Laboratory Approval Program (ELAP):
<http://www.wadsworth.org/labcert/elap/elap.html>
- U. S. Environmental Protection Agency information about Brownfields and Urban Agriculture:
<http://www.epa.gov/brownfields/urbanag/>
- Agency for Toxic Substances and Disease Registry ToxFAQs™ – Information about contaminants:
<http://www.atsdr.cdc.gov/toxfaqs/index.asp>
- Agro-One Services - Testing for soil pH and fertility:
http://www.dairyone.com/AgroOne/Form_H_Lawn_Garden_Landscape.pdf

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Table 1. Metals Levels in Sampled Beds and a Non-growing Area of Your Garden Compared with Guidance Values

Metal	Guidance Value ^{(a) (b)} (ppm)	Your Garden Levels in Parts per Million (ppm) ^(b)										
		Garden Bed Sample Number ^(d)										NG ^(f)
		1	2	3	4	5	6	7	8	9	10	
Arsenic	16 ^(c)	10	9	6	<5.3	7	12	15	12	8	10	10
Barium	350 ^(c)	400	200	600	500	900	300	700	1100	1000	300	950
Beryllium	14	0.2	0.1	0.2	0.2	0.3	0.5	0.2	0.2	0.3	0.2	0.3
Chromium	36 ^(e)	13	5	17	12	16	14	6	7	9	21	19
Copper	270	40	20	30	25	25	30	45	45	30	40	40
Lead	400	200	600	100	450	350	900	300	1000	150	400	600
Manganese	2000 ^(c)	200	100	150	250	200	200	300	100	350	200	350
Nickel	140	8	12	18	13	15	11	11	20	21	10	20
Zinc	2200	350	100	300	500	200	250	400	300	450	300	550

Notes:

Levels above guidance values are shown in bold.

- ^(a) There are a number of different sets of guidance values for soil developed by various agencies for various purposes. We are using NYS Department of Environmental Conservation (NYSDEC) Residential Soil Cleanup Objectives (SCOs) as guidance values - or a point of reference - to interpret your soil results. SCOs were developed as part of a regulation by NYSDEC and NYSDOH for specific State programs to clean up contaminated sites. While not developed specifically for community gardens, “Residential SCOs” can be used outside of these programs as guidance levels to help interpret levels of chemicals in soil when considering human health and the environment. Residential SCOs are more relevant to garden soils than SCOs for other land uses, because they were developed to consider residential exposures including gardening. However, the guidance values we used here assume that you live on the property with the soil that was tested – and that you are exposed in some ways every day and over a lifetime. Exposure to metals in soils for a community gardener may be less than this. Furthermore, the guidance values generally assume that the metal is in a more toxic and available form. This is not always the case with metals in soil.
- ^(b) Levels of metals in soil are often described in units of “parts per million” or “ppm.” A level of 1 ppm would mean that for every million “parts” of soil by dry weight, there would be 1 part of the metal being measured.
- ^(c) If the SCO calculated based on health risks was lower than rural soil background concentrations for a particular metal, the rural soil background concentration was used as the SCO for that metal (see also footnote (a) on the next page).
- ^(d) 6 to 8 sub-samples were combined into a “composite” for each bed location shown in the attached map.
- ^(e) Guidance value for “trivalent” chromium, a common form of chromium in soil.
- ^(f) Single sample taken from a non-growing (NG) area.

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Table 2. Results from Your Garden Compared with Typical Rural Soil Levels and All Other Gardens Sampled in this Project. Levels are shown for each category in parts per million (ppm).

Metal	Midpoint and Range of Levels in Beds in Your Garden (ppm)	Midpoint and Range of Levels in All Samples: 44 gardens, 414 beds (ppm)	Rural Soil Background Levels (ppm) ^(a)	Number of Beds with a Level Higher than a Guidance Value (of all 414 beds in 44 gardens) ^(b)
Arsenic	9.5 (<5.3-15)	5.9 (<5.3-27.3)	<0.2–69	11 beds from 5 gardens
Barium	550 (100-1100)	82 (13-1422)	4–743	50 beds from 14 gardens
Beryllium	0.2 (0.1-0.5)	0.2 (<0.1-1.0)	0.1–2.5	none
Chromium	12.5 (5-21)	13 (3-366)	1.0 – 36	6 beds from 3 gardens
Copper	30 (20-45)	35 (8-131)	2 – 98	none
Lead	375 (100-1000)	88 (11-1531)	3 – 110	34 beds from 13 gardens
Manganese	200 (100-350)	213 (56 -673)	13 – 4,550	none
Nickel	12.5 (8-21)	10 (<2.8-38)	0.3 – 49	none
Zinc	300 (150-500)	130 (21-2317)	10 – 454	1 bed

Notes:

^(a) These values are from the NYS DOH/DEC’s Rural Soil Background Survey that measured the range of levels for a number of chemicals in “source-distant” rural soils in NYS. Source-distant samples were obtained from areas that were reasonable points of human contact with soil, such as yards and trails, but at least five meters distant from potential pollution sources such as trash, roads, driveways or structures. (See http://www.dec.ny.gov/docs/remediation_hudson_pdf/appendixde.pdf)

^(b) See Table 1 for Guidance Values.

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Ⓝ Sampling location

Ⓜ Sampling location with lead above guidance value

