

3. Heavy Metal Contamination in New York City Garden Soils

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Abstract:

As we move toward a greener economy, urban agriculture has become a trend – not only that safer organic food can be produced to save cost for many low-income families, cultivating abandoned lands in backyards also brings a healthier lifestyle and sense of accomplishment. In many cases, school children are encouraged to participate. However, it has long been known that urban soils often contain high levels of contaminants, the extent of which in New York City has not previously been examined. In this study a total of 116 garden soil samples from XX residences and XX community gardens in New York City were analyzed for heavy metals. A summary of the results is shown in Table 1.

New York City soils are heavily contaminated with Cr, Ni, Cu, Zn, As, Cd, Pb. Their levels in urban soils are highly variable and 1-2 orders magnitude higher than New York State background. In particular, 51% of the samples contain more than 400 ppm of lead (the USEPA standard for playground) and 12% exceed 1200 ppm. All samples had As content over 0.4 ppm, USEPA's Soil Screen Level. Based on guideline values developed by the New York State Department of Environmental Conservation, few yards (<10%) are suitable for unrestricted use.

There are currently no established heavy metals guideline levels for soils that are suitable for gardening. Often people are concerned with elevated concentrations in vegetables and fruits grown in the contaminated soil, but the risk from inhalation and incidental ingestion of dusts and dirt have likely been underestimated. The finest fractions in soil, which can have 2-3 times higher Pb based on our data, are the easiest to be blown into air and provide a constant and dominant source for Pb contamination. With increased and extended exposure through gardening activities, the risk is even higher. Since children are often involved and they are the most susceptible, tougher standards should be recommended and Best Management Practices should be followed whenever possible.

It should be pointed out that while raised beds, increasing soil pH and organic content will reduce plant uptake of metals, risk from dusts and dirt remain. Phyto-remediation is not a viable option, because it is not as effective in normal soil pH conditions, takes a long time, and unnecessarily exposes gardeners to contaminants for extended period of time. Furthermore, there is no guideline on how and where to properly dispose the contaminated plants. Although costly, replacing contaminated soil or cover with 8 inches of new soil remain the best options – they have long terms benefits on land use and property values since contaminant source is permanently eliminated.

We call for greater public awareness campaign and expanded soil screening for urban soils, to minimize the health risk facing the increasing population participating in urban agriculture. Education is also needed on how to properly deal with and where to dispose the contaminant soils. There is potential for new “green” business and job opportunities to remediate the numerous contaminated yards in urban areas.

Table 1. Summary of heavy metal contents in New York City soils

| | Mean | Median | Range | NYS Baseline | NYSDEC Unrestricted | NYSDEC residential restricted | USEPA SSL |
|-----------|---------|--------|----------|-----------------|------------------------|-------------------------------------|--------------|
| Cr | 62±38 | 54 | 9-248 | 13 | 30 (89%) | 180 (3%) | 120000 |
| Ni | 38±28 | 29 | 3-178 | 17 | 30 (47%) | 310 | 1600 |
| Cu | 83±70 | 66 | 7-455 | 14 | 50 (63%) | 50 (63%) | - |
| Zn | 344±311 | 252 | 25-2206 | 65 | 109 (85%) | 109 (85%) | 23000 |
| As | 20±16 | 15 | 2-79 | 5.0 | 13 (57%) | 16 (46%) | 0.4 (100%) |
| Cd | 3.0±2.4 | 2.5 | 0.5-22.5 | 2.5 | 2.5 (49%) | 2.5 (49%) | 70 |
| Pb | 565±527 | 411 | 11-2526 | 19 | 63 (87%) | 400 (51%) | 400 (51%) |

Note: units are ppm; numbers in parentheses are percentages that exceed limits.

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