



# Assessing and Addressing Lead Exposure in New York City Community Gardens through a Community-Research Partnership

Henry Spliethoff, MS

Bureau of Toxic Assessment

Center for Environmental Health

PEPH Urban Gardening Webinar, May 26, 2016

# Urban community garden benefits

- Increasing consumption of fresh fruits and vegetables
- Exercise, contact with nature
- Social Interaction (inter-generational, cross-cultural)
- Neighborhood revitalization
- Urban green space, reduced urban heat island effect
- Less need to transport food from distant farms

US community gardening households  
1 million (2008) → 3 million (2013)  
(National Gardening Association)



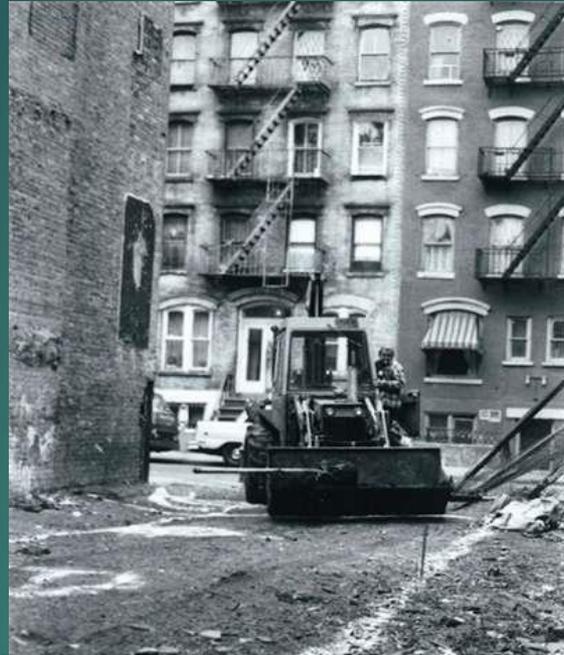
# NYC Community Garden History

- 1970s financial crisis, abandoned buildings, vacant lots
- Green Guerillas threw "seed bombs" (seeds & fertilizer) over fences into vacant lots



The screenshot shows the official website of the New York City Department of Parks & Recreation. The page is titled "History of the Community Garden Movement" and features a navigation menu with options like Parks, Facilities, Events, Programs, Kids, Permits, Trees, Opportunities, and About. A sidebar on the right lists various resources such as "About NYC Parks", "News", "People", "Rules & Regulations", "Connect with Parks", "History", "Email Newsletters", "Photo Gallery", "Parks TV", "NYC Parks Accessibility", "Partners", "Lost and Found", "NYC Parks FAQs", "Contact NYC Parks", "311 Online", and "Greenbook Online". The main content area includes a sub-header "Green Guerrillas Gain Ground" and a photograph of a woman in a headscarf looking out over a community garden.

# Genesis of a NYC Garden



# GreenThumb

## GreenThumb by the Numbers



An estimated **87,000** pounds of edible food is produced in GreenThumb gardens each year.



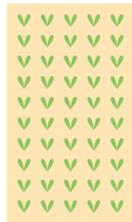
More than **150** workshops are given by GreenThumb each year.



More than **20,000** people are members of a GreenThumb garden.



Over **1,000** tons of soil and compost are delivered to gardens each year.



There are more than **2.8 million** square feet of garden space in the five boroughs.



More than **100** rain water systems are installed in GreenThumb gardens, collecting more than 1.1 million gallons of water each year.



More than **75** Greening Partners are affiliated with GreenThumb.

Oversees and provides services to 600 community gardens



# Urban soils & contamination

- Early community based organization testing
- Many gardeners aware of potential for soil contamination
- Common adoption of raised bed gardening



## RAISED BEDS

If soil tests indicate that the soil contains elevated contaminant levels, **building a raised bed will allow you to garden safely.** It is important that the soil being brought in is from a source known to be free of contamination. Raised beds are also beneficial because they lengthen the growing season by warming up sooner in the spring than a traditional garden. Do not build the beds using chemically treated lumber or railroad ties. See the publication “Raised Bed Gardens” listed in the resources section for more details on these gardens.



# Gardener questions

Should I test my soil?  
*Location? Site history?*

How do I collect soil samples?  
*How many? From where?*

Where should I send the samples?  
*Analytical method? Cost? Certification?*

What do the results mean?  
*Standards? Background levels? Plant uptake? Human health?*

What should I do?  
*Best practices? Strategies to reduce exposure?*

## Other unknowns

- What is the extent of contamination?
- Is it a public health concern

# Healthy Soils, Healthy Communities

Goal: To help community gardeners and other community partners make informed decisions about soil contaminants



**Cornell University**  
College of Agriculture and Life Sciences  
Department of Crop and Soil Sciences



**Cornell University**  
Cooperative Extension  
New York City



## **GreenThumb / New York City Department of Parks and Recreation**

*Carlos Martinez, Bill LoSasso, Ijendu Obasi, Nancy Kohn, Edie Stone, and colleagues*

## **Cornell University Soil and Crop Sciences, and Cornell Waste Management Institute**

*Murray McBride, Hannah Shayler, Jonathan Russell-Anelli, and colleagues*

## **Cornell University Cooperative Extension-New York City**

*Gretchen Ferez and colleagues*

## **New York State Department of Health**

*Henry Spliethoff, Lydia Marquez-Bravo, Rebecca Mitchell, and colleagues*

# Additional Community Partners



# Lead study community gardens



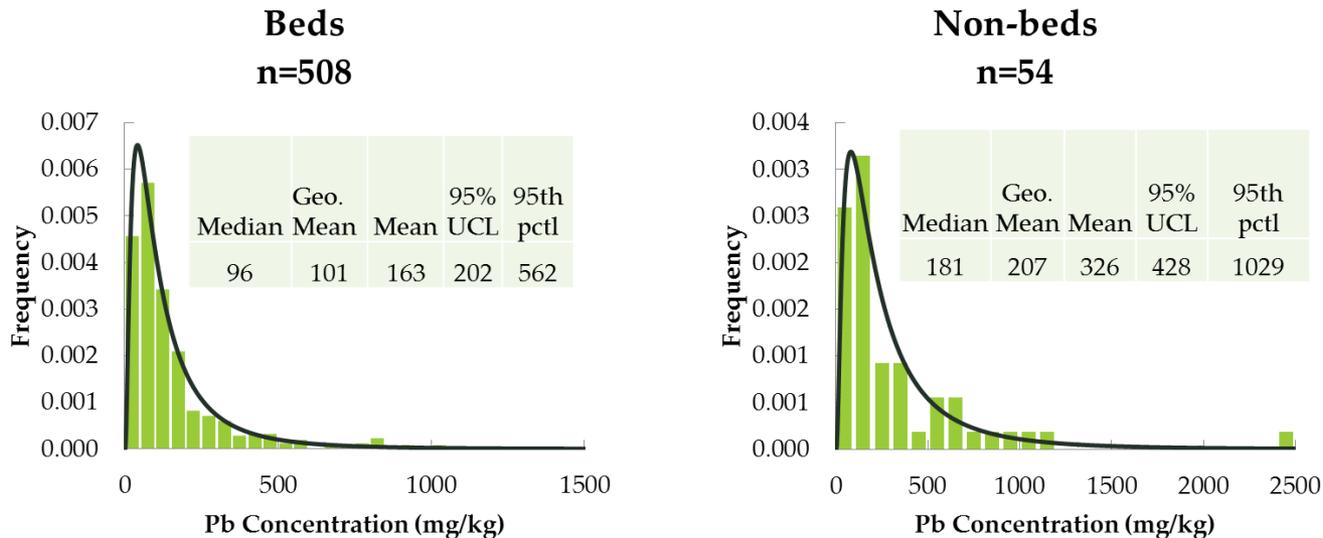
Community partners, gardeners and others provided invaluable help by providing access and/or collecting samples for contaminant analysis.



# Lead in Soil

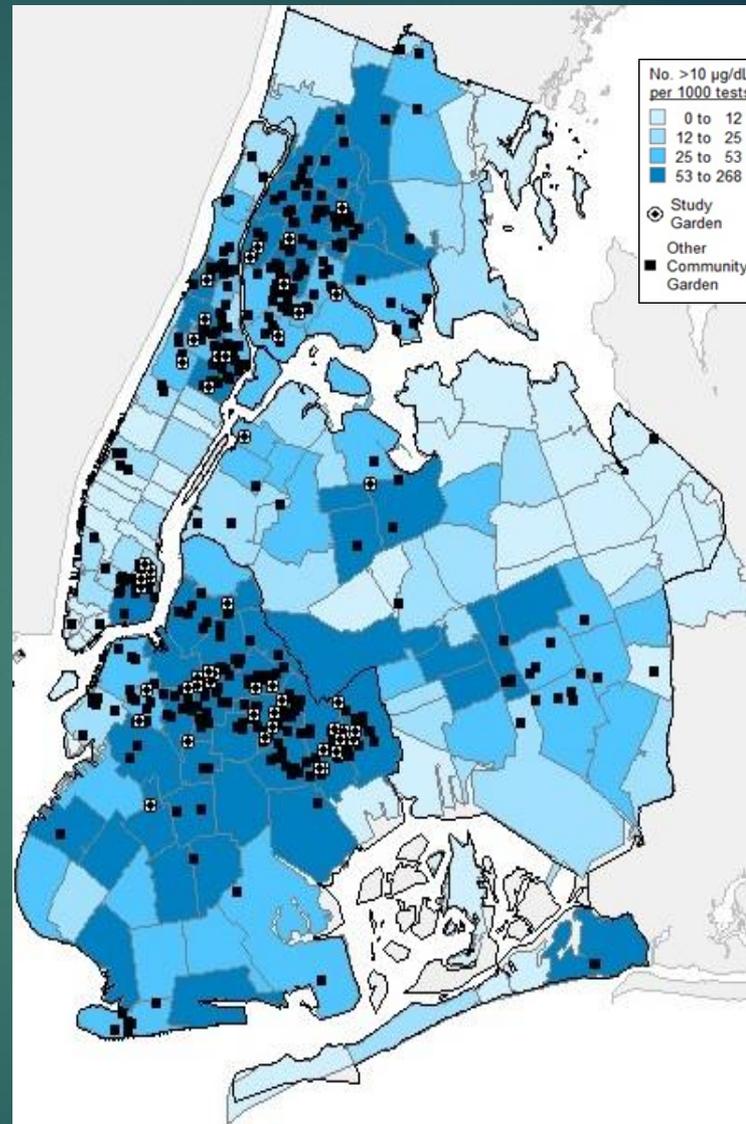
- 90% of bed samples <400 mg/kg (NYS residential Soil Cleanup Objective (SCO))
- 44% of gardens had at least one soil sample >400 mg/kg.
- Concentrations reached as high as 2450 mg/kg.

## Garden Soil Pb Concentrations (from 54 gardens)



# Context of Potential Exposures to Lead in Community Gardens

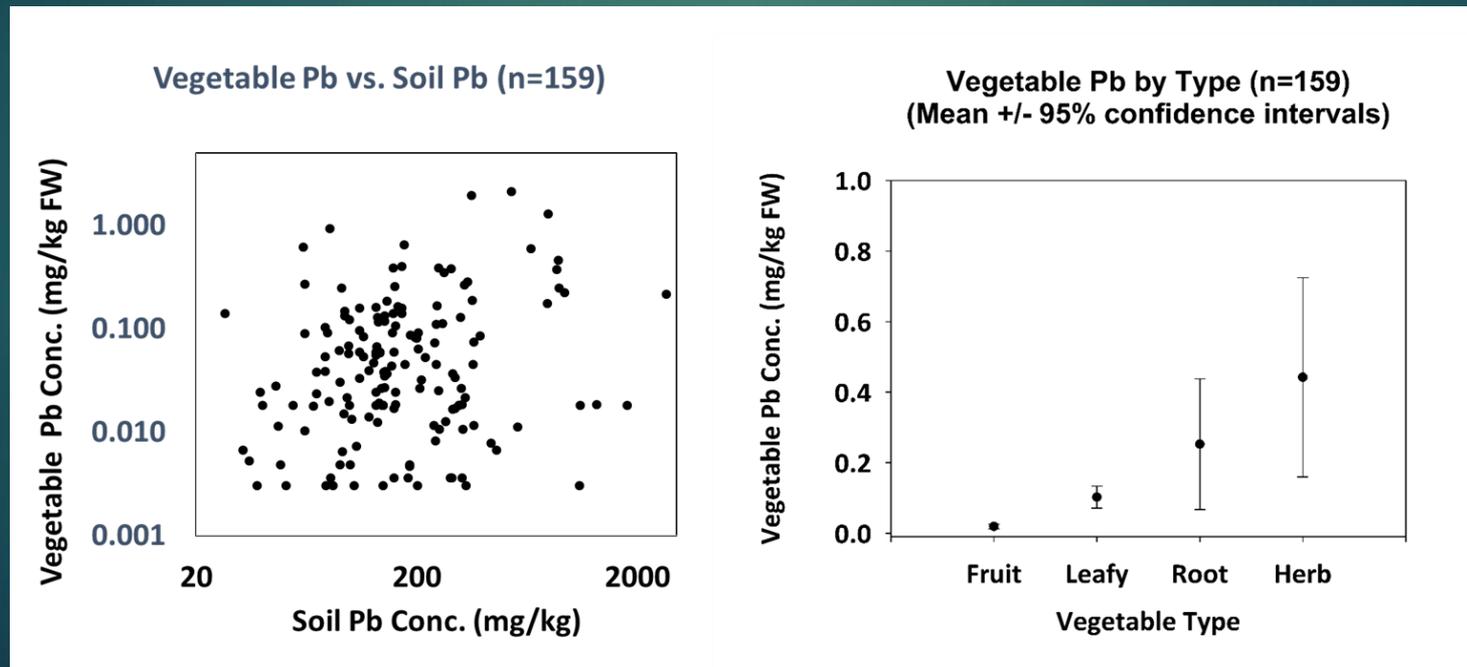
- Gardens located in neighborhoods historically burdened with elevated children's blood lead levels due to deteriorated housing, etc.
- Children visit many gardens



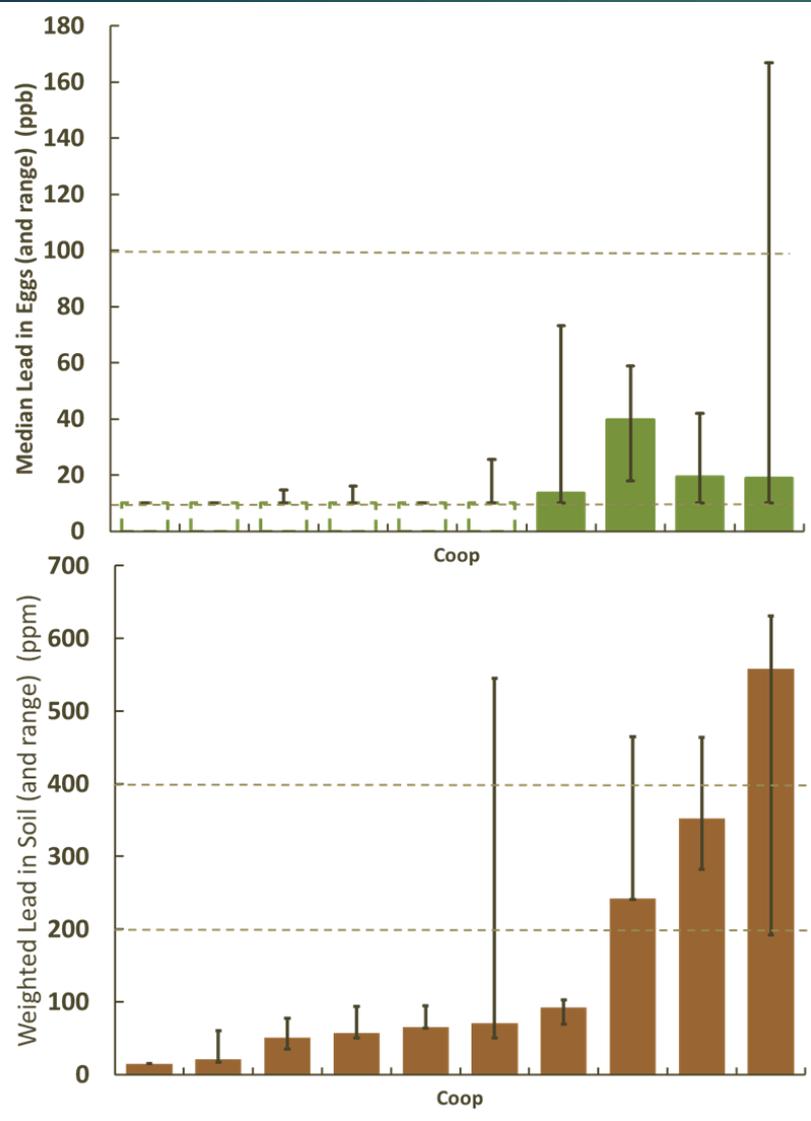
Most recent available (Year 2000) incidence of elevated blood Pb for ZIP codes and locations of community gardens, illustrating community vulnerability to potential additional Pb exposure from gardening.

# Lead in Vegetables

- Levels (83% > 0.01 mg/kg, n=159) higher than US FDA market basket vegetables (95% < 0.01 mg/kg, n=1,472). Some samples > European vegetable lead standards.
- Not related to soil lead levels, but a function of vegetable type



# Lead in Eggs



Nearly all  
< European  
lead  
standards



HOME PAGE | TODAY'S PAPER | VIDEO | MOST POPULAR | Subscribe

**The New York Times** Dining & Wine

WORLD U.S. N.Y. / REGIO. BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION  
FASHION & STYLE DINING & WINE HOME & GARDEN WEDDINGS/K

### High Lead Found in City-Sourced Eggs

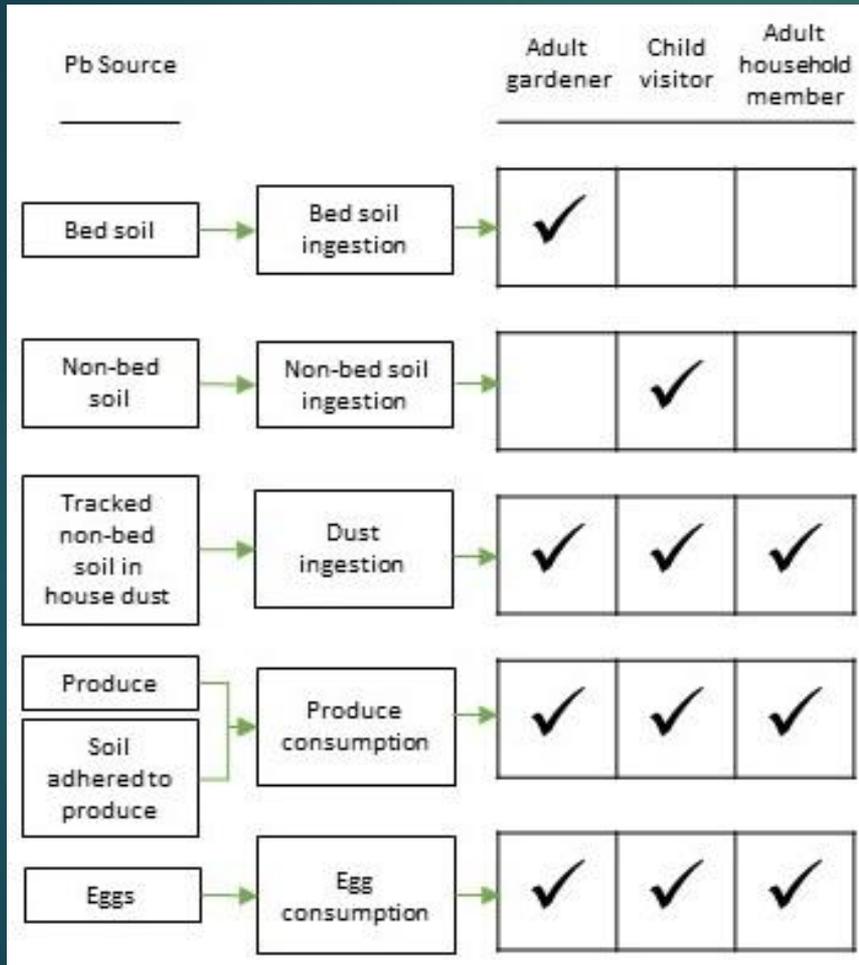
Homeowners who keep chickens in their backyards have little way of knowing whether their eggs might be contaminated unless they have them tested themselves.

By JULIE SCELFO  
Published: October 8, 2012 | 108 Comments

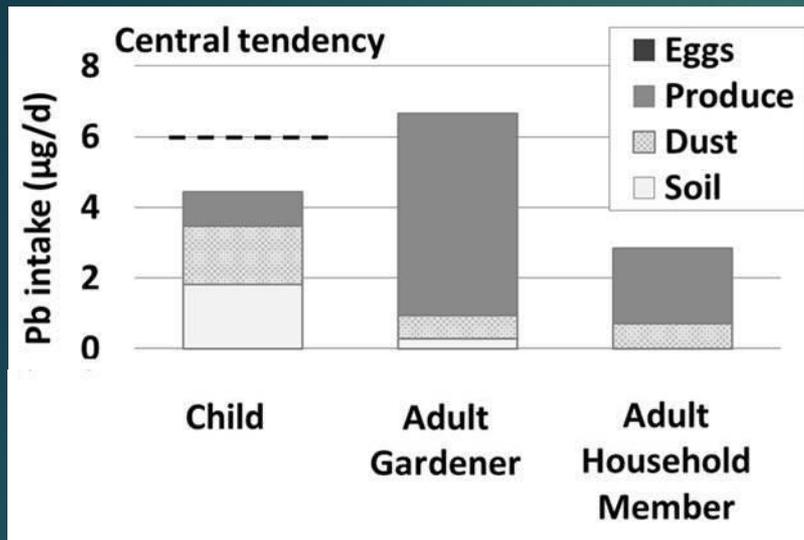
TO the long list of food conundrums, add this: research has found elevated levels of lead in eggs from chickens in New York City public neighborhood

FACEBOOK | TWITTER | GOOGLE+

# Multipathway Lead Exposure Assessment

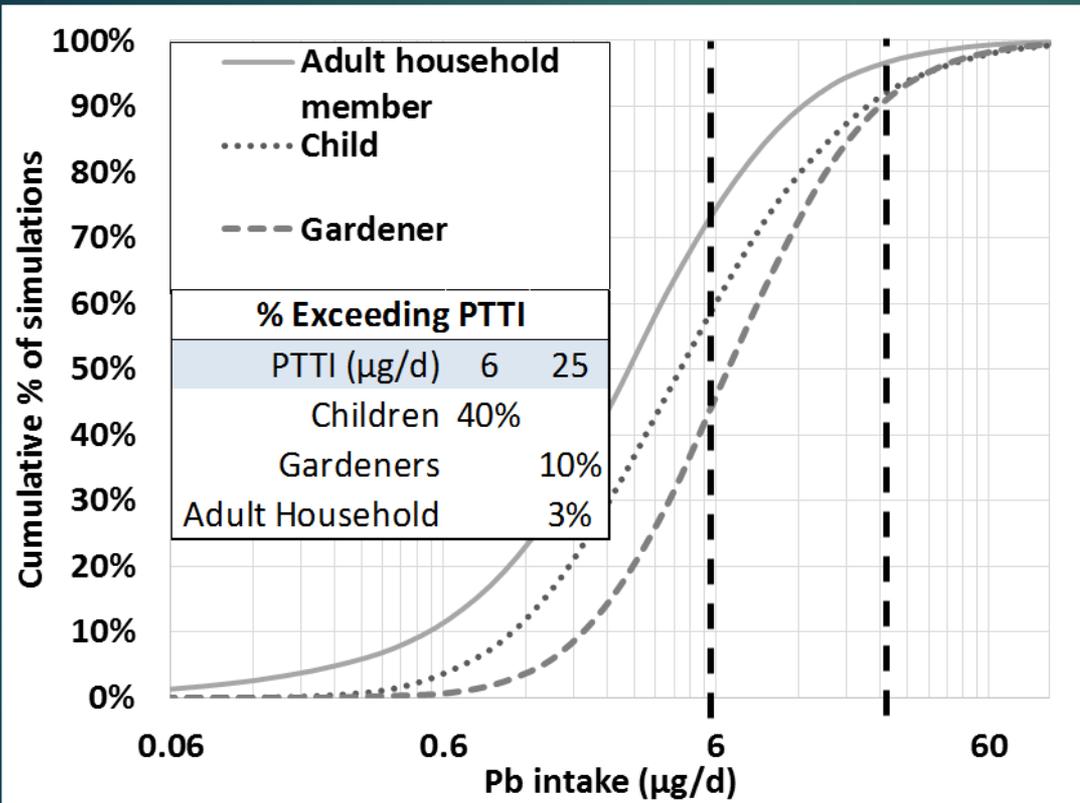


# Multipathway Lead Intake



- All central tendency intakes below USFDA's Provisional Tolerable Total Intake (PTTI)
  - Exposure from eggs very small
  - Most children's exposure from ingestion of soil & dust
  - Most adults' exposure from consuming vegetables (~45% from adhered particles)
- Putting clean soil in beds - e.g., raised beds - may not reduce most significant exposures.

# Multipathway Lead Intake



A percentage of children and gardeners exceed PTTI

# Implications for Exposure Reduction Strategies

Continued efforts to reduce exposure are warranted

Adding clean soil and amendments to beds is important, but

- Children's exposure may be most effectively reduced by minimizing soil direct contact and tracking (e.g., between beds and other places children play).
- For pregnant women, focus should be on growing/ eating fruiting vegetables over leafy and root vegetables.

# Actions

- Education, outreach and community engagement
- Ongoing clean soil distribution to gardens
- Ongoing collaboration



## What Gardeners Can Do: 10 Best Practices for Healthy Gardening

1. **Use clean soil and compost.**  
If you are concerned about contamination in your garden soil, consider having it tested by a New York State-certified laboratory.
2. **Use raised beds.**  
Build beds deep enough for the roots of your crops, and maintain them by adding compost often.
3. **Avoid treated wood.**  
Railroad ties, telephone poles, pressure-treated wood and some painted wood contain chemicals that can get into soil.
4. **Maintain soil nutrients and pH.**  
Healthy garden soils have a good nutrient balance and a pH near neutral (6.5 – 7).
5. **Cover (or mulch) soil.**  
Use compost, straw or bark mulch in garden beds, and stones or wood chips in paths and non-growing areas. This helps reduce soil splash, dust and tracking of soil home.
6. **Keep an eye on children.**  
Make sure children do not eat soil or put dirty toys or other objects in their mouths. Young children can be more sensitive to certain chemicals in soil, such as lead.
7. **Leave the soil in the garden.**  
Avoid bringing garden soil into your home. Remove soil from garden tools and harvested vegetables while at the garden, and change your shoes before going indoors.
8. **Wash your hands.**  
Wash up after gardening, and have children who play or work in the garden do the same. Consider wearing gloves, and remember to remove them when leaving the garden.
9. **Wash and/or peel produce.**  
Wash vegetables thoroughly – especially leafy and root crops, which are more likely to have soil on them. Consider peeling if appropriate.
10. **Put a barrier under play areas.**  
Separate children's play areas from underlying soil with landscape fabric or other durable material. Put clean play materials such as sand or wood chips on top. Check the barrier over time to be sure underlying soil isn't mixing with play materials.



See reverse for more about the **Healthy Soils, Healthy Communities** project, or visit us at <http://cwmi.css.cornell.edu/healthysoilshh>



## What Gardeners Can Do: Tips for Urban Chickens

There are many benefits to gardening and to raising chickens. However, some urban soils may lead – from years of human activity, and some of those chemicals can get into chicken eggs if the following suggestions may help reduce chickens' exposure to lead and other contaminants in soil.

- Use clean soil** when constructing new chicken runs. Consider having the soil tested by a NYS-certified laboratory.
- Add clean cover** material to existing chicken runs. A layer of clean soil, mulch or straw may help keep chickens from being exposed to underlying soil.
- Don't scatter feed** on bare ground. This may help reduce the amount of soil chickens ingest.
- Look for possible sources** of lead, such as old paint, and avoid areas painted with lead-keep chickens away.
- Limit foraging activity** to areas where soil is not suspected to have higher concentrations of lead or other chemicals.
- Remove chickens** from areas where soil has higher concentrations of lead or other chemicals, and some may also be a source of lead or other chemicals.
- Don't feed chickens unwashed plant material** from areas of your garden where soil has higher concentrations of lead or other chemicals.
- Provide a calcium supplement.** An adequate calcium supply is important for laying hens, and it may help reduce the amount of lead that gets into their eggs.



See reverse for more about the **Healthy Soils, Healthy Communities** project, or visit us at <http://cwmi.css.cornell.edu/healthysoilshh>

## Healthy Soils, Healthy Communities Metals in Urban Garden Soils

Metals are naturally present in rock, soil, and other materials. They are also used in manufactured (anthropogenic) materials, and human activity can increase the levels of metals in soil. Urban soils often have higher levels of metals than rural soils because they have been affected more by human activity. Gardening in urban soils may increase your exposure to metals if you swallow or breathe in soil particles or eat food raised in or on the soil.

What metals can be found in urban gardens?

The table on this page lists several metals commonly found in urban garden soils, along with guidance values developed to protect human health, and ranges of "background" levels typically found in rural and urban soils in New York State (NYS) and New York City (NYC).

The following pages provide some basic information for gardeners about each of these metals: where they come from (both natural and anthropogenic sources), how they behave in soil, considerations for human and plant health, and what gardeners can do to help reduce exposure to metals in garden soils.

Metals commonly found in urban garden soils: Guidance values; and background levels.\*

Metal	Guidance Value Protective of Public Health	Level in soil (parts per million [ppm])	
		NYS Rural Background Level	NYC Urban Background Level
Arsenic	16	< 0.2 - 12	4.1 - 26
Barium	350	4 - 170	46 - 200
Cadmium	2.5	< 0.05 - 2.4	0.27 - 1.0
Chromium	36	1 - 20	15 - 53
Copper <sup>†</sup>	270	2 - 32	23 - 110
Lead	400	3 - 72	48 - 690
Mercury	0.81	0.01 - 0.20	0.14 - 1.9

A woman wearing a blue hat and glasses is smiling while holding a large head of green lettuce and a tomato. She is standing in a lush garden with various plants, including a large green leafy vegetable in the foreground. In the background, there is a wooden gazebo and a brick building.

# Thank you

**We greatly appreciate the support of gardeners and our other collaborators.**

Analytical laboratory support: NYS Ag & Markets Division of Food Lab, Cornell Nutrient Analysis Laboratory, NYSDOH Wadsworth Center, Pace Analytical & H2M.

*The project described is supported by Award Number R21ES017921 from the National Institute of Environmental Health Sciences (NIEHS). The content is solely the responsibility of the authors and does not necessarily represent the official views of NIEHS or the National Institutes of Health.*