Urban Gardens and Soil Contaminants

A Gardener's Guide to Healthy Soil

The struggling economy and the growth of the organic and local food movements have led to an increase in the number of vegetable gardens being planted in urban settings. The nutritional, emotional, and environmental benefits of gardening have been well documented. However, in some cases past uses of the site may have contaminated the soil, requiring use of simple precautions to prevent exposure to harmful substances. While this factsheet will concentrate on vegetable gardens, the information is applicable to all types of gardens and urban lawns. It will look at contaminants of concern, soil testing, minimizing exposure risk, and resources for more information. The available resources listed focus on the cities of Minneapolis and St. Paul, MN.

SUMMARY

Lead (Pb), ***Cadmium*** (Cd), and ***Arsenic*** (As) are the main contaminants of concern because of their widespread occurrence in urban environments.

Other contaminants may be a concern if the site or nearby properties have a history of ***industrial or commercial use***.

Although ***soil tests*** for Pb, Cd and As are relatively inexpensive (less than $100 for all three), tests for other contaminants can be much more expensive.

If soil contamination is a concern, ***raised bed gardens*** are the most effective alternatives to using the native soil.

Ingestion of soil and dust is the main route of ***exposure*** to soil contaminants.

Reduce the risk of exposure by ***washing and peeling root crops***, and washing and removing the outer leaves or bottoms of leafy green crops.

Reduce children's exposure by covering bare soil with ***mulch or sod***.

Increasing the organic matter content and pH of the garden soil can limit the amount of contamination taken up by the crops.

>>> *Continue reading for more details about each of these topics*

POTENTIAL CONTAMINANTS

There are two types of contaminant that are potentially of concern to urban gardeners, those that are widespread throughout the urban environment and might be found anywhere, and those that are localized around specific commercial or industrial sites.

Contaminants that may be widespread in the ***urban environment*** include:

- Lead which has historically been used widely in paint formulations and as a gasoline additive
- Arsenic which was widely used in wood preservatives, fertilizers, pesticides, and weed-killers
- Cadmium, which has entered the environment through the uncontrolled burning of coal and garbage
- Polyaromatic hydrocarbons (PAHs), which are formed during the incomplete combustion of organic matter. They are found in vehicle emissions as well as soot and ash from wood burning stoves and backyard fires

Some of the contaminants that may be found near ***industrial or commercial*** sites include:

- Benzene, toluene, ethyl benzene and xylene associated with leaks and spills at gas stations
- Stoddard solvent and tetrachloroethene associated with dry cleaners
- Metals and cyanides associated with metal finishing operations

Lead, arsenic, cadmium and PAHs may also be found in higher than usual concentrations around industrial locations. For example, the arsenic contamination that the EPA has removed from residences in southeast Minneapolis may have originated at a site that historically used arsenic in the manufacture of pesticide. Past fertilizer and pesticide use may also have contributed to the arsenic contamination, as metals do not degrade.

SOIL TESTING

It is quite likely that the soil in any urban setting will contain detectable quantities of lead, arsenic, PAHs, and possibly cadmium. In most cases, especially in areas that have been residential for a long time, these contaminants will be at low concentrations that don't pose a health risk, unless pesticides or fertilizers that contain heavy metals were used. However, prior to establishing a vegetable garden, the history of the site and the surrounding area should be researched to see if there are any past uses that might be a concern.

A good place to start a historical review is the interactive Minnesota Pollution Control Agency (MPCA) website "What's in My Neighborhood"*. This website enables you to search your neighborhood for potentially contaminated sites. The librarians at your local public library may be able to help you find other useful resources, including fire insurance maps and city directories, which contain information on property uses at various times in the past. Local historical societies are an additional resource.

If the proposed garden site or adjacent properties formerly contained gas stations, dry cleaners, junk yards, metal finishers, body shops, other industrial operations, or railroad tracks, there is a possibility that there may be higher than normal concentrations of contaminants in the soil. If you are concerned that there may be unsafe concentrations of contaminants in your soil it is possible to have samples analyzed to determine what contaminants are present, and in what concentrations. However, depending on the tests that need to be performed, testing can be expensive. Single soil analyses for metals such as lead, arsenic, or cadmium cost roughly $20 per metal per sample. Analyses for PAHs or volatile organic compounds such as dry cleaning chemicals can cost several hundred dollars per sample and require special techniques for collecting the samples. It may be more economical to assume that the soil is contaminated and plan to bring in clean soil from elsewhere to construct raised beds for your garden, rather than pay for the testing. See the Raised Bed Gardens section for more information.

* http://www.pca.state.mn.us/wimn/index.cfm

SOIL TESTING continued...

If you decide to have your soil tested there are several labs in the Metro area that can perform the analyses, but first you have to tell the lab which contaminants you are concerned about. The MPCA site contact listed on the "Whats in My Neighborhood" listing for the site you are concerned about may be able to give you some advice, otherwise the lab can recommend an environmental consultant to help you for a fee. Soil test prices vary by the lab and by the test. See the table below for a list of some of the labs. The lab will send you the containers that you need to collect the samples, but be sure to ask if there are special handling procedures required for the samples.

The City of Minneapolis offers soil testing for lead at no charge to their residents. Their contact information is listed in the Resources section. For community gardens, funds are available to assist with testing. Contact Gardening Matters for more information, their information is listed in the Resources section as well.

Laboratory Name	City	County	Phone number
Braun Intertec Corporation	Minneapolis	Hennepin	952.995.2638
Era Laboratories, Inc.	Duluth	St. Louis	218.727.6380
Interpoll Laboratories, Inc.	Circle Pines	Anoka	763.786.6020
Legend Technical Services, Inc	St. Paul	Ramsey	651.642.1150
Minnesota Valley Testing Laboratories, Inc	New Ulm	Brown	507.354.8517
Northeast Technical Services, Inc	Virginia	St. Louis	218.741.4290
Northeast Technical Services - Duluth	Duluth	St. Louis	218.742.1038
Pace Analytical Services, Inc	Minneapolis	Hennepin	612.607.1700
Uc Laboratory	Janesville	Waseca	320.587.4271
Western Lake Superior Sanitary District	Duluth	St. Louis	218.722.3336
Xcel Energy, Inc, Minneapolis Testing Laboratory	Minneapolis	Hennepin	612.630.4439

Because the risk of exposure to contaminants from bare soil or dust is usually a greater concern than the risk of exposure from contaminants accumulated in vegetables, human health-based residential Soil Reference Values (residential SRVs) give an indication of when some risk reduction measures listed below should be considered. The SRVs for lead, cadmium and arsenic are 300 mg/kg, 25 mg/kg and 9 mg/kg, respectively.*

MINIMIZING THE RISK

It is important to realize that the principal route of exposure to contamination is usually not the uptake and accumulation of contaminants in the vegetables that you are growing, rather it is the soil and dust that you contact while gardening and that sticks to the outside of the plants. There are a number of steps that you can take that will minimize potential exposure to harmful contaminants.

- Locate your garden away from building foundations, especially if the building is old enough to have had lead-based paint used on it;
- Do not use railroad ties or chemically treated lumber that contains arsenic in your garden construction
- Use a fence or hedge as a barrier to block dust from potential sources of contamination such as highways or railroad tracks
- Mulch thickly (roughly 4 inches) or lay landscape fabric and mulch to minimize contact with the soil
- Teach young children not to eat dirt or unwashed vegetables
- Remove the outer leaves of leaf crops, especially the bottom
- Peel all root crops
- Clean produce thoroughly before storing or eating
- Wash your hands immediately after gardening and before meals

* A full list of SRVs can be found on the internet at http://www.pca.state.mn.us/publications/risk-tier2srv.xls. These values periodically change. The most recent values will be listed on this website.

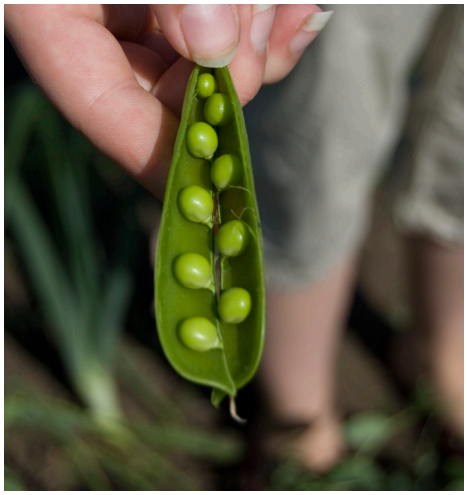
MINIMIZING THE RISK continued...

There are no specific threshold levels for exposure to contaminants from consumption of home-grown fruits and vegetables. This is partly because there are so many variables that affect the uptake of the contaminant by the plant. These include the species of plant, the part of the plant that is being eaten, the pH of the soil, the time during the season when the plant is harvested, and the organic content of the soil. Exposure to contaminants accumulated in plants can be minimized in a number of ways, including:

- Growing fruiting crops, such as tomatoes, peppers, beans, and okra, rather than root crops, leafy vegetables, or herbs, which tend to absorb more contaminants from the soil
- Adding organic matter to the soil through compost or use of cover crops. The organic matter makes metals less mobile in the soil and lessens the amount taken up by the plants
- Maintaining a pH of 6.5 or more makes metals less mobile in the soil and lessens the amount taken up by the plants. See "Modifying Soil pH" website in the resources section for details

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.



Resources For More Information

- **Gardening Information**

  Hennepin County Master Gardeners
  612.596.2118

  Ramsey County Master Gardeners
  651.704.2071

  Community Garden information:
  Gardening Matters
  612.492.8964
  www.gardeningmatters.org

- **Health Information**

  Minnesota Department of Health
  651.201.4897 or 800.657.3908
  press '4' and leave a message

  City of Minneapolis – Lead Hazard Control
  612.673.3000

- **Soil Contaminants Information**

  Minnesota Pollution Control Agency
  "What's in My Neighborhood"
  651.296.6300
  651.757.2593
  http://www.pca.state.mn.us/wimn/index.cfm

- **Publications**

  Lead in the Home Garden and Urban Soil Environment.
  Carl Rosen. 2002. Extension bulletin FO-02543.
  http://www.extension.umn.edu/distribution/horticulture/DG2543.html

  Raised Bed Gardens. Vince Fritz and Carl Rosen. 2009. Extension Bulletin M1254.
  http://www.extension.umn.edu/distribution/horticulture/M1254.html

  Modifying Soil pH website
  2006. Regents of the University of Minnesota
  http://www.sustland.umn.edu/implement/soil_ph.html

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