



PHILADELPHIA
FOOD POLICY
ADVISORY COUNCIL

Soil Safety and Urban Gardening in Philadelphia

Process Report and Recommendations
to the City of Philadelphia

ABOUT

The Philadelphia Food Policy Advisory Council (FPAC) facilitates the development of responsible policies that improve access for Philadelphia residents to culturally appropriate, nutritionally sound, and affordable food that is grown locally through environmentally sustainable practices. Mayor Michael Nutter established FPAC in 2008 to help the City be a better partner in the regional food system. FPAC members serve three-year volunteer terms as individuals and together represent various facets of the food system, and reflect Philadelphia's diverse community.

FPAC operates programmatic subcommittees that develop policy recommendations and tackle projects that improve the city's food system. FPAC's Vacant Land Subcommittee, convened in 2011, guides the City of Philadelphia to develop and implement innovative laws and policies to support the conversion of Philadelphia's vacant and underutilized land into sustainable community assets that increase food security and sovereignty for all Philadelphia residents. The subcommittee engages diverse stakeholders to inform recommendations and make current policies more transparent.

The Vacant Land Subcommittee convened the Philadelphia Soil Safety Working Group in summer 2014. This report will guide readers through the process of creating the Philadelphia Soil Safety Working Group, the policy research, and the conclusions and recommendations to the City of Philadelphia for soil testing and evaluation for urban agriculture projects.



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EXECUTIVE SUMMARY

Philadelphia has a deep-rooted tradition of urban gardening. The city's more than ninety gardens and farms provide residents with access to healthy food and green space, as well as opportunities for place-making, community-building, and education. However, Philadelphia also has a long history of soil contamination, a legacy of the city's post-industrial past.

One barrier to the creation of new food growing projects is the question of health risks associated with food production in urban soils. Neither formal policies, nor clear soil safety guidelines exist in Philadelphia. The Philadelphia Food Policy Advisory Council (FPAC) convened the Philadelphia Soil Safety Working Group to address this policy gap.

Over the summer of 2014, participants from City, State, and Federal agencies, local academic institutions, non-profit organizations, community gardens, and market farms met in a series of three Working Group meetings. This report, *Soil Safety and Urban Gardening in Philadelphia*, summarizes the Working Group's policy research, conclusions, and recommendations to inform a responsible and effective soil safety policy for the City of Philadelphia.

Over the course of the three Working Group meetings, participants made clear that the benefits of urban agriculture far outweigh the potential risks presented by possible soil contamination, and that healthy gardening practices and behaviors can substantially mitigate these risks.

FPAC recommends that the City of Philadelphia acknowledge soil safety as a critical component of healthy gardening by endorsing best growing practices and providing guidance and resources for urban gardeners on conducting site histories, submitting soil samples for testing, analyzing testing results, building out-of-ground growing structures, and importing safe and healthy soil.

INTRODUCTION

Greenworks Philadelphia, the City's comprehensive sustainability plan, sets the broad goal of delivering equitable access to healthy neighborhoods. One specific target set to help achieve that goal is providing walkable access to affordable, healthy food for all Philadelphians. Urban agriculture is an important tool to increase healthy food access, and successful food growing projects depend on access to land. Gardening on urban vacant lots provides benefits beyond food production. For instance, studies conducted in Philadelphia show that improving vacant lots reduce crime rates in the surrounding area, and additional research shows that people who move to an area with more green space may experience improved mental health.¹

As of 2014, more than 30,000 parcels of land sit vacant in Philadelphia, of which the City owns nearly 10,000.² Philadelphians interested in growing food on City-owned vacant land historically have had difficulty gaining legal access to these often untended spaces, due to a lack of supportive policies, staffing limitations, and bureaucratic and political barriers. Philadelphia gardeners have long struggled to navigate processes that are even difficult for the established housing and commercial developers for whom they are designed. Over the past several years, City agencies and elected officials have recognized that these processes should be streamlined, including creating new policies, procedures, and opportunities for urban agriculture projects. While amending of urban agriculture policies, City agencies and the FPAC identified soil safety concerns as a barrier to the creation of new food growing projects.

Identifying the Policy Gap

In 2011, the United States Environmental Protection Agency (EPA) released a report entitled "Brownfields and Urban Agriculture: Interim Guidelines for Safe Garden Practices," which identified a series of policy gaps with respect to soil safety and urban agriculture. First, while EPA establishes soil screening levels for brownfields cleanup, there are no standards for establishing soil contaminant levels safe for food production reflective of soil site conditions and management practices at agricultural sites, nor that account for bioavailability or plant uptake.³ Second, the US Food and Drug Administration (USFDA) and US Department of Agriculture (USDA) regulate the safety of materials added to soil and organic practices, but do not regulate soil quality as a growing medium.⁴ Third, there are no common standards to guide site selection a gap in practice.⁵ Gardening and farming

¹ Branas, C. C., et al. "A Difference-in-Differences Analysis of Health, Safety, and Greening Vacant Urban Space." *American Journal of Epidemiology*, 2011, 1296-1306.

² "Land Bank Strategic Plan and Disposition Policies 2015, Executive Summary." October 30, 2014, available at http://www.philadelphialandbank.org/assets/ProposedLandBankStrategicPlan_ExecutiveSummary_103014.pdf.

³ "Brownfields and Urban Agriculture: Interim Guidelines for Safe Gardening Practices," 2, 2011, available at http://www.epa.gov/brownfields/urbanag/pdf/bf_urban_ag.pdf.

⁴ Id.

⁵ Id.

organizations often test for and monitor the nutrient quality of soil, and some also may also test for environmental contaminants such as lead and other heavy metals through testing offered by USDA extension agents. Yet there is no consensus on urban agriculture testing protocol and few municipalities have been engaged in soil testing, including with respect to food production on public land. Finally, there is no standard practice regarding the scope of testing relative to potential contaminants, and testing itself can be costly.⁶

State government has not stepped in to address the above policy gaps. Analogous to EPA's threshold screening levels, the PA Department of Environmental Protection (PA DEP) does have standards under the Act 2 Land Recycling Program to guide voluntary cleanup and reuse of contaminated commercial and industrial sites.⁷ PA DEP also regulates standards for "clean fill," uncontaminated, nonwater-soluble, nondecomposable inert solid material such as rock or concrete,⁸ but these regulations have not, yet, been intentionally applied to food production. On a municipal level, cities throughout the United States and Canada are beginning to address the question of soil safety for urban agriculture as they look for ways to better facilitate food production and confront their own versions of equity goals addressed above. However, the number of cities with soil safety policies, guidelines, or resources for urban growers is still limited.

Establishing the Philadelphia FPAC Soil Safety Working Group

Over the past three years, the Mayor's Office of Sustainability, Philadelphia Parks & Recreation (PPR), and the FPAC Vacant Land Subcommittee have been discussing with the City's various land holding agencies how to more effectively make city-owned land available for urban agriculture. One of the barriers identified during these conversations was the question of environmental health and liability associated with food production in urban soils. PPR, which recently launched a new urban agriculture program called Farm Philly,⁹ took the lead to research soil safety policies in Philadelphia and found no formal policies, nor clear guidelines or recommendations regarding this issue.

Farm Philly approached the FPAC Vacant Land Subcommittee to propose convening a working group in Philadelphia to address this policy gap, modeled after a similar interagency working group developed by the Wisconsin Department of Natural Resources to study long-term soil remediation.¹⁰ Under joint leadership from Farm Philly and FPAC's Vacant Land Subcommittee, the team convened a working group for Philadelphia.

⁶ Id.

⁷ Act 2 of 1995: The Land Recycling and Environmental Remediation Standards Act.

<http://www.palrb.us/pamphletlaws/19001999/1995/0/act/0002.pdf>

⁸ "Management of Fill." Pennsylvania Department of Environmental Protection. August 7, 2010.

<http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-81095/258-2182-773PO.pdf>

⁹Farm Philly supports the creation and maintenance of urban agriculture projects on PPR land, such as orchards, vegetable and fruit production, youth education gardens, intergenerational gardens, community gardens, and market farms. "Urban Agriculture." City of Philadelphia.

<http://www.phila.gov/ParksandRecreation/environment/Pages/UrbanAgriculture.aspx>

¹⁰ "Brownfields Study Group." Wisconsin Department of Natural Resources.

<http://dnr.wi.gov/topic/Brownfields/bsg.html>

The team identified and invited individuals to a series of three Soil Safety Working Group meetings over the summer of 2014. The participants came from City, State, and Federal agencies, local academic institutions, non-profit organizations, community gardens, and market farms.¹¹ The meetings achieved outstanding participation from the organizations and individuals invited, with about forty attendees at each meeting. The first two meetings began with policy research presentations followed by discussion, covering soil testing protocols and logistics, evaluation of risk levels, and how risk levels inform action steps. The last meeting focused on developing recommendations and next steps for approaching the gaps in policies, guidelines, and available resources to support soil safety. In the final meeting, participants refined soil safety policy recommendations and discussed next steps.¹²

¹¹ See Appendix A for full list of participants and their respective organizations.

¹² See Appendix C for Soil Safety Working Group meeting agendas and minutes.

RESEARCH

The Vacant Land Subcommittee conducted a policy research scan to inform the Working Group about other cities' policy approaches to soil safety for urban agriculture. The research team identified six cities with soil safety policies, guidelines, and/or recommendations as models. New York City, Boston, and Baltimore were selected because of industrial histories similar to Philadelphia, and likely similar soil contaminants. For geographical variety and because they have established urban agriculture sectors, the team also looked at Chicago and Seattle. The most robust guidance came from Toronto, Canada, where the public health department have spent considerable time and effort developing step-by-step protocols for urban agriculture soil testing.

FPAC presented the research at the Soil Safety Working Group meetings to give participants context on the soil safety policy climate in North America. Below is an overview of that research.

Site Histories and Testing Triggers

The Working Group sought to understand what kinds of information or conditions would prompt a grower to test. Research revealed that the cities identified take one of two approaches for soil testing: (1) testing based on a site history and (2) mandatory testing regardless of site history.

Toronto Public Health's guide, entitled "From the Ground Up: Guide for Soil Testing in Urban Gardens," takes the first approach. The guide outlines a detailed process for conducting a site history, including a list of online and archival resources.¹³ Toronto Public Health also assists growers with conducting a site history through the city's 311 hotline. The guide instructs growers to categorize their garden site into low, medium, and high concern based on the site history results, using a chart provided in the guide (see *Figure 1*).

¹³ "From the Ground Up: Guide for Soil Testing in Urban Gardens." Toronto Public Health, City of Toronto. October 1, 2013.
http://www1.toronto.ca/City%20of%20Toronto/Toronto%20Public%20Health/Healthy%20Public%20Policy/Environmental%20Pollutants/Files/PDF/guide_for_soil_testing_2013.pdf.

level of concern	definition	next steps
low concern	<ul style="list-style-type: none"> Garden site has always been residential, parkland, farmland, child care centre or school 	Take Action Level 1 (see Page 20)
medium concern	<ul style="list-style-type: none"> Garden site is or has once been a risk managed park, orchard, hydro corridor, infill area, commercial land uses (excluding gas station, dry cleaner, printing and auto body shop) Garden site is located within: a former landfill; former lead reduction zone; or 30 m from a rail line or a major arterial road Industrial land that has been remediated 	Test the soil (see step 2)
high concern	<ul style="list-style-type: none"> Garden site is or has once been a gas station, dry cleaner, print shop, auto body shop, rail line or rail yard Is or has once been industrial land Garden site reveals indications of dumping or burning, smells or staining in the soil 	Take Action Level 3 (see Page 20)

Figure 1

According to the Toronto guide, testing is only recommended when a lot is categorized as medium concern because the quality of soil is uncertain. The guide allows growers to assume that low concern lots are safe enough to grow in-ground, and that high concern lots will certainly be contaminated so there is no reason to test.

In contrast, Boston and Chicago have adopted a mandatory testing approach, regardless of site history. Boston recently adapted its zoning code to include urban farms, and requires farmers to hire environmental professionals to test soil.¹⁴ This requirement does not extend to urban gardens, however. Chicago's garden land trust, NeighborSpace, conducts site visits, histories, and soil testing for all gardens that apply to enter the land trust.¹⁵

Testing Logistics

Once a grower decides to test, there are testing logistics that can be carried out in several ways. The researchers sought to understand who conducts and pays for soil sampling and soil testing, and who analyzes the test results.

Most labs offer Inductively Coupled Plasma (ICP) testing, in which the soil sample is digested in acid to unbind the contaminants from soil matter. The liquid sample is then analyzed to determine contaminant concentration levels.

¹⁴ "Article 89." Urban Agriculture. December, 2013.

<http://www.bostonredevelopmentauthority.org/getattachment/a573190c-9305-45a5-83b1-735c0801e73e>.

¹⁵ "NeighborSpace." NeighborSpace: Community-Managed Open Space. <http://neighbor-space.org/>.

The cities studied offered four different models for carrying out ICP soil testing. In Boston, farmers must hire an environmental professional to conduct soil sampling and testing, and the farmer bears the cost. The farmer must send the testing results to Boston's planning commission, who interprets the results. In Toronto, gardeners themselves conduct soil sampling, submit samples for testing to one of the laboratories listed in the "From the Ground Up Guide," and interpret the results of the test with assistance from the guide. The gardeners are responsible for paying for testing. For gardens on privately-owned land that wish to enter the land trust, Chicago's NeighborSpace hires environmental consultants to conduct soil sampling and bears the cost of testing. If a garden that applies to NeighborSpace is on publicly owned land, city employees will conduct the soil sampling and testing. In Seattle, City government will also conduct soil sampling, testing, and bear the cost where the City offers free testing for zip codes that have been most affected by the Tacoma Smelter Plume that contaminated the area with lead and arsenic.¹⁶ In each of these examples, test samples were sent to a lab for evaluation of a specific panel of contaminants.

A possibly more cost-effective alternative to ICP is the x-ray fluorescence (XRF) gun, which can test on site or in a central community location, mitigating the need to send samples to a lab. The XRF gun is a small handheld machine that analyzes soil samples in real time. Testers point the gun at a soil sample and receive a near instant reading of heavy metal contaminants in the sample. Gardeners using an XRF to test must still sample soil from many areas and depths of their site and allow soil to dry before using the XRF. XRF guns are convenient, but costly, although a number of Philadelphia-area universities possess them, as does EPA Region III. Another limitation is that XRF guns only for heavy metals. That said, as discussed elsewhere, many gardeners are currently only testing for heavy metals.

Contaminants

Some of the most difficult questions the Working Group confronted related to soil contaminants and contaminant concentration levels in the soil. The researchers tried to understand for which kinds of contaminants Philadelphia gardeners should test, and how to interpret the testing results.

The EPA offers guidance on what to test for in urban soil with a chart of common sources of contaminants in urban environments. This chart links likely contamination with past urban land uses (see *Figure 2*).¹⁷ A tool to determine contaminants for which a grower might test, the chart demonstrates the role site histories play in testing protocols. For example, an old residential building with paint from before 1978 has a high the likelihood of lead contamination, while a lot located on a former landfill might have PAHs or dioxins in its soil, depending on what types materials had been disposed of at the site.

¹⁶ Tacoma Smelter Plume Testing.

<http://www.kingcounty.gov/healthservices/health/ehs/toxic/TacomaSmelterPlume/testing.aspx>

¹⁷ "Reusing Potentially Contaminated Landscapes: Growing Gardens in Urban Soils," 2011, p. 3. https://clu-in.org/download/misc/urban_gardening_fact_sheet.pdf.

Table 1. Common Sources of Contamination¹

General Source	Examples of Previous Site Uses	Specific Contaminants
Paint (before 1978)	Old residential buildings; mining; leather tanning; landfill operations; aircraft component manufacturing	Lead
High traffic areas	Next to heavily trafficked roadways or highways; near roadways built before leaded fuel was phased out	Lead, zinc, polycyclic aromatic hydrocarbons (PAHs)
Treated lumber	Lumber treatment facilities	Arsenic, chromium, copper
Burning wastes	Landfill operations	PAHs, dioxins
Contaminated manure	Copper and zinc salts added to animal feed	Copper, zinc
Coal ash	Coal-fired power plants; landfills	Molybdenum, sulfur
Sewage sludge	Sewage treatment plants; agriculture	Cadmium, copper, zinc, lead, persistent bioaccumulative toxins (PBTs)
Petroleum spills	Gas stations; residential/commercial/industrial uses (anywhere an aboveground or underground storage tank is or has been located)	PAHs, benzene, toluene, xylene, ethyl benzene
Pesticides	Widespread pesticide use, such as in orchards; pesticide formulation, packaging and shipping	Lead, arsenic, mercury, chlordane and other chlorinated pesticides
Commercial/industrial site use		PAHs, petroleum products, solvents, lead, other heavy metals (such as arsenic, cadmium, chromium, lead, mercury and zinc)
Dry cleaners		Stoddard solvent and tetrachloroethene
Metal finishing operations		Metals and cyanides

EPA's Toxic Release Inventory (TRI) can provide information to communities about sites where contaminants were released into the environment. The Envirofacts database allows users to enter location information, such as zip code, address or county location, to get information about releases in their area. The database is available online at: www.epa.gov/enviro.

Figure 2

Toronto Public Health adapted a narrowed, but still comprehensive, list of likely contaminants in the province of Ontario for a shorter, more affordable testing panel of twelve heavy metals and fifteen polycyclic aromatic hydrocarbons (PAHs). The guide recommends that gardeners test for all twenty-seven contaminants on this list. The guide also includes a chart of soil screening values (SSVs) for each contaminant. These SSVs indicate the concentration of contaminants in milligrams in one kilogram of soil. Toronto identified thresholds (SSV1 and SSV2) for each contaminant that help the gardener categorize each lot into low, medium, and high concern categories after testing (see *Figure 3*).¹⁸ Toronto Public Health developed these numbers using a soil screening values model

¹⁸ "From the Ground Up," p. 17.

adapted from the provincial government of Ontario to reflect urban gardening parameters in the City of Toronto.¹⁹

Table 2: Urban Gardening Soil Screening Values (SSVs) (mg/kg)



metals	ssv 1	ssv 2
Arsenic (As)	11	110
Cadmium (Cd)	1.0	10
Cobalt (Co)	23	170
Chromium, total (Cr)	390	630
Chromium, VI (CrVI)	5.0	5.0
Copper (Cu)	180	660
Mercury (Hg)	2.7	2.7
Molybdenum (Mo)	13	13
Nickel (Ni)	34	340
Lead (Pb)	34	340
Selenium (Se)	10	11
Zinc (Zn)	500	1800
pahs		
Acenaphthene	0.050	0.32
Acenaphthylene	0.093	0.47
Anthracene	0.58	0.58
Benz(a)anthracene	0.23	2.3
Benzo(a)pyrene	2.3	3
Benzo(b)fluoranthene	0.23	2.3
Benzo(g,h,i)perylene	0.10	1.0
Benzo(k)fluoranthene	0.23	2.3
Chrysene	0.099	0.99
Dibenz(a,h)anthracene	0.77	0.77
Fluoranthene	0.14	1.4
Fluorene	0.39	0.39
Indeno(1,2,3-c,d)pyrene	0.23	2.3
Phenanthrene	3.1	3.1
Pyrene	0.11	1.1

Figure 3

Working Group participants were particularly focused on how to identify the contamination concentration levels below which gardeners can grow food safely in-ground and above which gardeners should not grow at all. These concentration levels would be different for each contaminant. While Toronto has developed a geographically specific answer to this question, resources and research would be needed to develop urban

¹⁹ Toronto Public Health. "Assessing Urban Impacted Soil for Urban Gardening: Decision Support Tool and Technical Report and Rationale." City of Toronto. May, 2011.
http://www1.toronto.ca/city_of_toronto/toronto_public_health/healthy_public_policy/lead/files/pdf/urban_gardening_assessment.pdf.

agriculture soil screening levels specific to this region. In the meantime, the Working Group proposed looking to soil screening levels used in other contexts that might be applicable for urban agriculture. The Working Group has considered soil screening levels from the Pennsylvania Act 2 Land Recycling Program, the New York State Soil Cleanup Objectives from the Environmental Remediation Program, and the U.S. EPA's Soil Screening Levels for Superfund sites.²⁰

Levels of Concern and Action Steps

Building on Toronto's model, the Working Group discussed how to determine levels of concern that are associated with the soil contamination concentration numbers, and how to link those levels of concern to action steps for Philadelphia garden sites.

Toronto presented the most comprehensive and easy-to-follow instructions on how to determine whether or not a site is safe to grow on. Toronto created a system to identify "levels of concern" that indicate how a grower should interpret soil testing results. The "From the Ground Up" guide shows how gardeners should use the list of soil screening values (*Figure 3*) to categorize their lot into levels of concern based on the chart below (*Figure 4*):

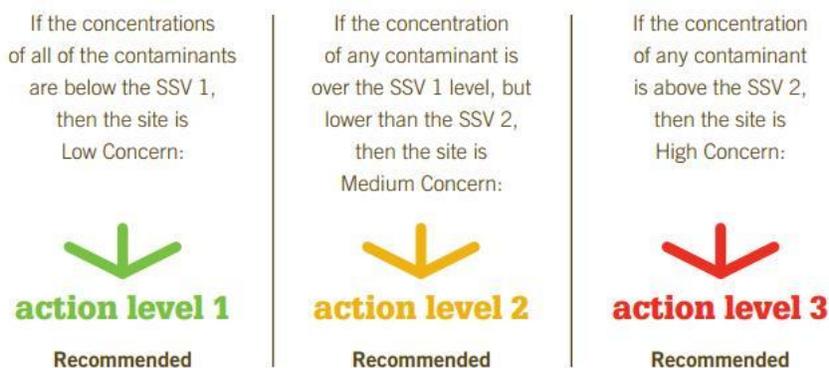


Figure 4

Toronto then attached action steps to the levels of concern. The chart below explains the recommended action steps (*Figure 5*):

²⁰ "Land Recycling Program." Pennsylvania Department of Environmental Protection. http://www.portal.state.pa.us/portal/server.pt/community/land_recycling_program/20541; Harrison, Ellen, Murray McBride, and Hannah Shayler. "Guide to Soil Testing and Interpreting Results." Cornell Waste Management Institute. April 15, 2009. <http://cwmi.css.cornell.edu/guidetosoil.pdf>.

**Table 3: Levels of Concern and Recommended Actions
to Reduce Gardeners' Exposures to Soil Contaminants**

<p>low concern</p>  <p>action level 1</p>	<p>Use good gardening practices:</p> <ul style="list-style-type: none"> • Wash your hands after gardening and always before eating • Wash produce with soap and water
<p>medium concern</p>  <p>action level 2</p>	<p>Use good gardening practices AND:</p> <ul style="list-style-type: none"> • Lower the concentrations of contaminants by adding clean soil and organic matter (compost and manure) to the existing soil. Adding organic matter will also improve the pH level of the soil • Reduce dust by covering bare soil with ground cover or mulch. Peel root vegetables before you eat or cook them • Avoid growing the types of produce that accumulate soil contaminants (See list on next page)
<p>high concern</p>  <p>action level 3</p>	<p>Use good gardening practices AND:</p> <ul style="list-style-type: none"> • Reduce dust by covering bare soil with ground cover or mulch • Build raised bed gardens (add a minimum of 40 cm/16 in. of clean soil on top of garden fabric), or grow food in containers • Add clean soil and organic matter annually (compost and manure) to the raised bed or containers <p>OR</p> <ul style="list-style-type: none"> • Grow only nut and fruit trees (not any other types of produce)

Figure 5

Toronto Public Health encouraged gardeners to grow directly in the ground, even in areas of high concern as long as the gardener used the appropriate protocols and grew the appropriate crops.

The Toronto model is intriguing because it still allows for gardeners to grow directly in-ground, a practice that many existing community gardens already do in Philadelphia. However, the Working Group queried whether the Toronto model was too simplistic because not all gardens are food producing, and therefore the threshold contamination numbers may be different depending on the activities taking place at the garden site. For example,

- Would the soil contamination concentration levels be more conservative for a food-producing garden site compared to a recreational garden site?
- At what level of contamination can we tell gardeners that it is safe to grow directly in-ground, or so dangerous that gardening should not take place on the site at all?

The Working Group identified action steps associated with levels of concern (outlined in the Recommendations Section), but have yet to link levels of concern with specific soil contamination concentration levels. The Working Group leadership continues to seek strategies to identify appropriate levels.

Best Practices for Growing Food

The research process revealed a variety of best practices for growing food in urban, potentially contaminated soils from sources all over the country. In addition to USEPA's interim guidelines, many cities and extension offices have published sets of best practices. Drawing from these sources, the research team consolidated the following set of best practices for growing food in urban soil.²¹

1. Amend Soil

- Incorporate organic matter (such as compost or manure) into your soil to reduce exposure pathways and immobilize contaminants and limit their uptake into plant matter.
- Maintain soil pH levels near neutral by adding soil amendments such as lime. After using lime, cover the area with organic matter, including homemade compost or leaves.
- Consult the Colorado State University Extension site on soil amendments for more information on choosing soil amendments.²²

2. Minimize Exposure

- Cover soil and walkways with landscape fabric, bricks, mulch, or a ground cover such as grass or clover.
- Use mulch or salt hay in garden beds to reduce soil splashing on to plant leaves.
- Select materials to build raised beds that will not add contaminants to the soil.
- Minimize contact with native soil while building raised beds.
- Place beds beyond the reach of building runoff to minimize exposure to lead dust.

3. Grow Up

- Build raised beds one foot high out of untreated lumber, or by simply mounding soil above ground into windrows. Plastic barriers last longer.
- Import clean soil and clean compost, to the extent possible.
- Place a protective barrier below raised beds. Barriers that biodegrade easily, such as landscaping fabric, mulch and burlap, are only effective for 1-3 years.
- Perennial crops are helpful because they do not require as frequent contact with the soil.
- Instead of planting seeds directly into the ground, use transplants & apply organic matter after planting.

²¹ See e.g., "Reusing Potentially Contaminated Landscapes: Growing Gardens in Urban Soils." U.S. Environmental Protection Agency Office of Superfund Remediation and Technology Innovation. 2011.

https://clu-in.org/download/misc/urban_gardening_fact_sheet.pdf;

"Environmental Best Practices Agreement and Waiver." NeighborSpace.

<http://neighbor-space.org/wp-content/uploads/2013/02/Final-Environmental-Agreement.pdf>;

"Soil Safety Resource Guide for Urban Food Growers." Johns Hopkins Center for a Livable Future. February, 2014. http://www.jhsph.edu/research/centers-and-institutes/johns-hopkins-center-for-a-livable-future/_pdf/projects/urban-soil-safety/CLF_Soil_Safety_Guide.pdf.

²² Davis, J.G, and D. Whiting. "Choosing a Soil Amendment." Colorado State University Extension. February, 2013. <http://www.ext.colostate.edu/pubs/garden/07235.html>.

4. Practice Good Habits

- Wear gloves when handling soil, and wash your hands after coming into contact with soil.
- Thoroughly wash produce before storing and eating, with 1% vinegar solution before washing with clean water. Peel vegetables, especially root crops.
- Remove outer leaves of leafy vegetables before consumption.
- Keep soil outdoors by cleaning tools and boots outside.

5. Choose Appropriate Crops

- Fruiting plants (tomatoes, cucumbers, squash, apples, etc) are generally the most appropriate to grow in contaminated soil.
- Tuber and root crops (such as onions, potatoes, beets, and carrots) are less desirable to grow in potentially contaminated soil.
- Leafy vegetables (collards, kale, lettuce, spinach) need to be thoroughly washed, as they can easily be contaminated by backsplash.

CONCLUSIONS

Guided by discussion of the research presented above and the expertise of each participant, the Philadelphia Soil Safety Working Group participants identified the following recommendations at the conclusion of the working group meetings.

Site Histories

The Working Group concluded that:

- City of Philadelphia agencies should strongly recommend and encourage gardeners and farmers to conduct site histories for every parcel utilized, despite the recognition that site histories may be limited by available print and digitized information and may not always provide sufficient or conclusive information about likely contaminants.
- Gardeners and farmers should include research into the land use surrounding the lot because slope of the land may result in contamination down gradient of the contaminated site.
- Gardeners and farmers should research as far back in time as possible. However, in Philadelphia, there are often gaps in research between 1910 and 1942, and the EPA gas tank information only goes back to 1985.
- Site history responsibility might be overly burdensome for some gardeners and farmers. The group identified two options for conducting site histories:
 - o City provides guidance for gardeners to use, similar to the Toronto model;
 - o City partners with universities or libraries to conduct site histories for gardeners and farmers or assist them completing and interpreting the histories.

Soil Testing

The Working Group concluded that:

- Soil testing is recommended in every instance where gardening and farming occurs, working from the assumption that all soil in Philadelphia is contaminated.
- Growers should test for nutrients annually.
- Growers do not need to test for contaminants annually if site conditions remain unchanged because contaminant accumulation is a slow process.
- Market farms²³ should be required to test soil, if the activity will occur on city-owned property.
- Soil testing for heavy metals is relatively inexpensive, while soil testing for polycyclic aromatic hydrocarbons (PAHs)²⁴, polychlorinated biphenyls (PCBs)²⁵,

²³ A “market farm” is an area managed and maintained by an individual or group of individuals to grow and harvest food crops or non-food crops (e.g., flowers) for sale or distribution that is not incidental in nature. Market farms may be principal or accessory uses and may be located on a roof or within a building according to the Philadelphia Zoning Code, Chapter 14-601 Use Categories, Section 11c.

and volatile organic compounds (VOCs)²⁶ is often cost prohibitive. Working Group participants feel that asking growers to bear the cost of testing for both heavy metals and non-heavy metals is unrealistic. However, Working Group participants are concerned that growers who test only for heavy metals may not get a full picture of their site's soil contamination. As a first step to understanding their site's soil contamination, growers should simultaneously test for a panel of common heavy metals contaminants and conduct a site history, two low-cost activities. If the heavy metal screening results look safe, but the site history indicates a likely non-heavy metal contaminant, growers should test for broader panel of contaminants based on the site history.

- XRF test is suitable for conducting a heavy metals screening, but gardeners must follow the correct process for preparing samples.
- Local institutions, including various universities and USEPA, could provide technical assistance to local growers by administering XRF testing opportunities.

Contaminants and Thresholds

The Working Group determined that:

- Lead is the contaminant of highest concern for gardeners in urban environments.
- At a minimum, the heavy metal panels offered by University of Massachusetts and Penn State, as well as conducted using XRF, are a crucial step to identifying levels of contaminants found in urban areas. However, gardeners and farmers need guidance on how and when to expand testing to include other substances and what the results of any testing mean for their activities on and in urban soils.
- In Philadelphia, many local gardeners send their soil samples to the University of Massachusetts, whose lab offers affordable testing for heavy metal contaminants. –
- Pennsylvania State University also offers slightly more expensive testing for contaminants, but also includes a wider panel of contaminant tests. Penn State Extension intends to work with the Penn State lab develop a more affordable soil testing panel for Philadelphia growers.
- Benzopyrene is the most potent and carcinogenic polycyclic aromatic hydrocarbon (PAH). If gardeners can only test for one PAH it should be this one.
- EPA residential standards are conservative and are not practical as contaminant concentration thresholds for growing in interim guidelines.
- Working Group leadership reached out to the PA Department of Environmental Protection about using the Act 2 residential soil screening levels, but PADEP does not think they are appropriate.

²⁴ PAHs are carcinogenic contaminants created by the incomplete burning of products like coal, oil, gas, and garbage. <http://www.epa.gov/osw/hazard/wastemin/minimize/factshts/pahs.pdf>

²⁵ PCBs are carcinogenic contaminants that were manufactured for industrial and commercial applications from 1929 until 1979, when their manufacture was banned. <http://www.epa.gov/solidwaste/hazard/tsd/pcbs/about.htm>

²⁶ VOCs are pollutants found in many manmade products and materials. <http://www.epa.gov/iaq/voc2.html#definition>

- Working Group leadership will consider using the New York State residential Soil Cleanup Objectives, and reach out to the Cornell Healthy Soils, Healthy Communities research group about their recommendations to New York City gardeners.

With further research and discussion with experts after the Working Group meetings, FPAC determined that:

- The contaminant exposure pathway of highest concern is incidental ingestion of soil either by inhaling dust particles while gardening, or eating produce that has not been properly washed.
- Research has shown that contaminant uptake in plants is an exposure pathway of low concern, with the exception of carrots.²⁷
- Setting threshold contaminant concentration levels for various contaminants specific to Philadelphia in an urban gardening context is an extremely complicated process. Many experts do not recommend setting these values in policy, and prefer to evaluate contamination on a site-specific basis.

General Recommendations

The Working Group concluded that:

- In developing recommendations that might limit food production, the advantages of growing fresh produce and making healthy food accessible to Philadelphians outweigh the possible risk of growing in and consuming food from potentially contaminated soil.
- Soil safety recommendations developed should apply to both community gardens and market farms, including both new and more established sites.
- While developing a strategy for analyzing soil test results and identifying risk levels for contaminants, interim guidelines should recommend growing in raised beds.

Next Steps

The Working Group determined that the FPAC Vacant Land Subcommittee and partner agencies should:

- Explore opportunities to expand access to clean soil and untreated wood for raised beds.
- Submit grant applications to USEPA for Brownfields funding to support soil testing and other related projects.
- Develop step-by-step site history guide.

²⁷ Hettiarachchi, Ganga, and Sabine Martin. "September 2014 - Contaminant Uptake in Food Crops Grown on Brownfield Sites Webinar." Redevelopment Institute. September, 2014. <http://redevelopmentinstitute.org/webinar/september2014/>.

- Develop a memorandum describing background research, working group discussion, and resulting policy recommendations to submit to the following City of Philadelphia agencies: Health, Parks, Law Department, and land holding agencies.
- Work with City agencies to adopt standard soil safety protocols and guidelines.
- Develop materials to inform public about soil safety guidelines, based on feedback from City agencies,
- Create a narrative describing working group process of developing recommendations to share with other cities.

Identified Research Projects

The Working Group identified the following projects for further research:

- Digitize site history resources.
- Conduct a comparison of XRF and ICP testing methods to determine to a testing method that that effectively balances affordability and accuracy.
- Develop more affordable ICP testing panel.
- Work to expand opportunities to test for PAHs and VOCs.
- Analyze soil in existing gardens to determine if long-term gardening improves soil quality.
- Establish contaminant concentration thresholds specific to urban agriculture in Philadelphia, like Toronto model. Alternatively, identify appropriate third party contaminant concentration thresholds that are regularly updated for urban gardeners to reference.
- Understand municipal liability with respect to soil safety and food production on publicly owned property.

POLICY RECOMMENDATIONS

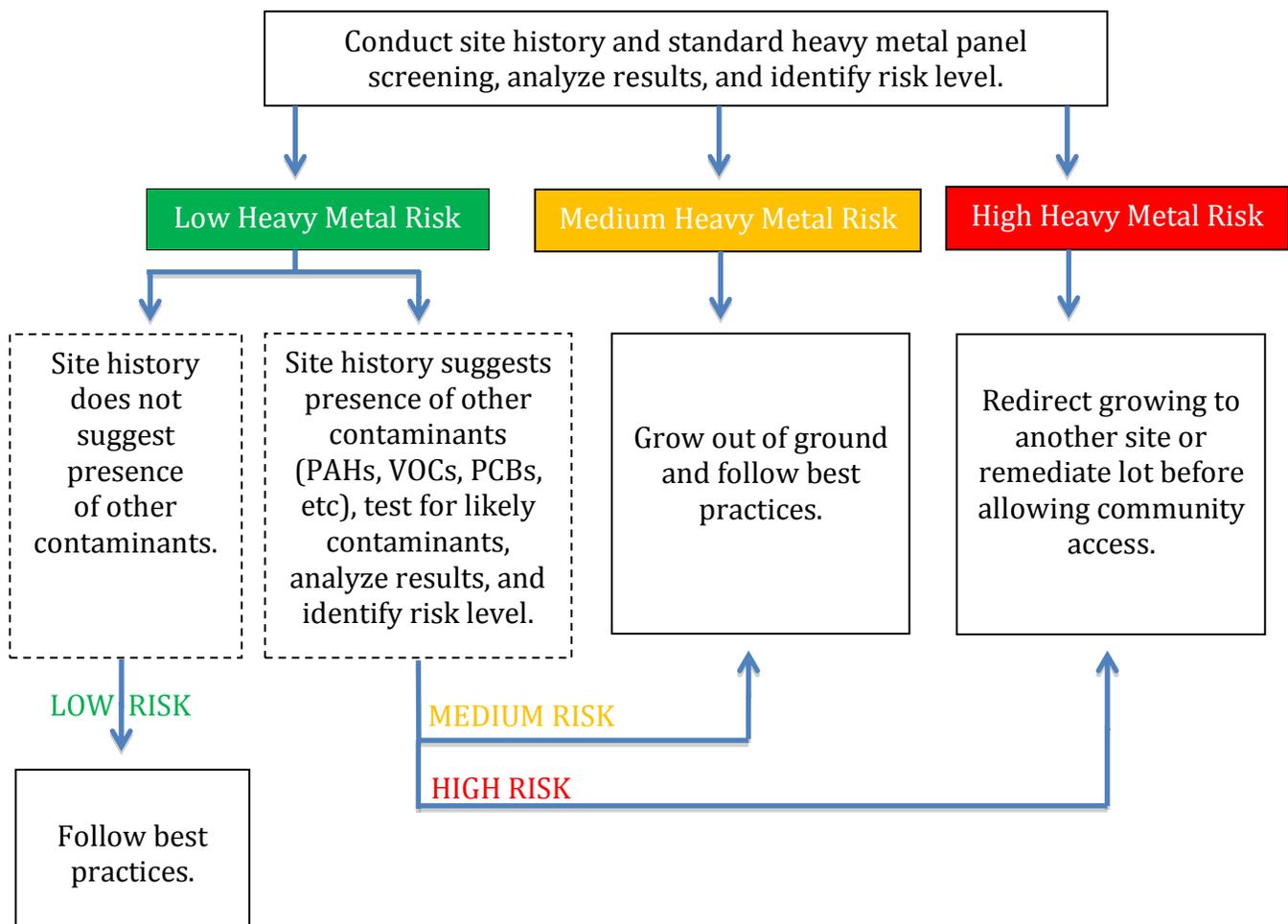
Guided by the Working Group conclusions and feedback from soil contamination experts, the Soil Safety Working Group developed the following policy recommendations to determine how the City of Philadelphia should approach soil safety and contamination in urban agriculture. FPAC recommends these policies for gardens and farms on both City-owned and privately-owned land, but recognizes that the City cannot enforce these policies on privately-owned land.

Recommendations to All Urban Growers from the City of Philadelphia

FPAC recommends that the City of Philadelphia ask all growers to follow the protocols below to help mitigate risks from contaminated urban soil:

1. Always conduct a site history and test soil for contaminants.
2. Test soil annually for nutrients.
3. Use best practices to mitigate risks of exposure (see chart below).
4. Use the step-by-step flow chart below to carry out testing on urban soil.

Soil Testing Process for Urban Growers



Recommendations to the City of Philadelphia

FPAC recommends that the City of Philadelphia pursue the following activities to support safe urban gardening:

1. Endorse growing best practices (below) and provide guidance and resources for urban gardeners on submitting soil samples for testing, building raised beds and other out-of-ground growing structures, and importing safe, healthy, and affordable soil.
2. Support the digitization of resources used to conduct site histories.
3. Support development of appropriate strategy and guidance for analyzing soil test results and identifying risk levels for contaminants.

Best Practices for Growing Food Chart

Amend Soil	Minimize Exposure	Grow Up	Practice Good Habits	Choose Appropriate Crops
Incorporate organic matter (such as compost or manure) into your soil to reduce exposure pathways and immobilize contaminants and limit their uptake into plant matter.	Cover soil and walkways with landscape fabric, bricks, mulch, or a ground cover such as grass or clover.	Build raised beds one foot high out of untreated lumber, or by simply mounding soil above ground into windrows. Plastic barriers last longer.	Wear gloves when handling soil, and wash your hands after coming into contact with soil.	Fruiting plants (tomatoes, cucumbers, squash, apples, etc) are generally the most appropriate to grow in contaminated soil.
Maintain soil pH levels near neutral by adding soil amendments such as lime. After using lime, cover the area with organic matter, including homemade compost or leaves.	Use mulch or salt hay in garden beds to reduce soil splashing on to plant leaves.	Import clean soil and clean compost and test that soil for contaminants and nutrients.	Thoroughly wash produce before storing and eating, with 1% vinegar solution before washing with clean water. Peel vegetables, especially tuber crops.	Tuber and root crops (such as onions, potatoes, beets, and carrots) are less desirable to grow in potentially contaminated soil.

Amend Soil	Minimize Exposure	Grow Up	Practice Good Habits	Choose Appropriate Crops
Consult the Colorado State University Extension site on soil amendments for more information on choosing them. ²⁸	Select materials to build raised beds that will not add contaminants to the soil.	Place protective barrier below raised beds. Barriers that biodegrade easily, such as landscaping fabric, mulch and burlap, are only effective for 1-3 years.	Remove outer leaves of leafy vegetables before consumption.	Leafy vegetables (collards, kale, lettuce, spinach) need to be thoroughly washed, they can easily be contaminated by backsplash.
	Minimize contact with native soil while building raised beds.	Perennial crops are helpful because they do not require as frequent contact with the soil.	Keep soil outdoors by cleaning tools and boots outside.	
	Place beds beyond the reach of building runoff to minimize exposure to lead dust from paint.	Instead of planting seeds directly into the ground, use transplants & apply organic matter after planting.		

²⁸ Davis, J.G, and D. Whiting. "Choosing a Soil Amendment." Colorado State University Extension. February, 2013. <http://www.ext.colostate.edu/pubs/garden/07235.html>.

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APPENDIX

- A. Philadelphia Soil Safety Working Group Participants
- B. Research and Discussion Questions
- C. Philadelphia Soil Safety Working Group Meeting Agendas and Minutes
- D. Guide to Conducting Site Histories
- E. Best Practices for Growing Food Chart

APPENDIX A: Philadelphia Soil Safety Working Group Participants

Total Number of Participants: 56

Name	Affiliation
Brian Abernathy	Philadelphia Redevelopment Authority
Rafael Alvarez	
Aviva Asher	Mill Creek Farm
Stephanie Branche	U.S. Environmental Protection Agency
John Byrnes	Penn State Extension
Amy Laura Cahn	Public Interest Law Center of Philadelphia
John Carpenter	Philadelphia Redevelopment Authority
Eric Carr	Rodale Institute
Hannah Chatterjee	Mayor's Office of Sustainability
John Chibirka	United States Department of Agriculture - Natural Resources Conservation Service
Elizabeth Coward	University of Pennsylvania
Nicholas Davatzes	Temple University
April Doroski	Sovereign Consulting Inc.
Patrick Drohan	Penn State University
Susan Eleanor	
Nan Feyler	Philadelphia Department of Public Health
David Grandstaff	Temple University
Cynthia Hall	Westchester University
Meghan Hazer	
Curtis Helm	Philadelphia Parks and Recreation
Anna Herman	Penn State Extension
David Hewitt	University of Pennsylvania
Nicole Hostettler	Philadelphia Water Department
John Jaudon	Summer Winter Garden
Amanda Johnson	Huertos De Salud, Frankford Garden
Adam Kassner	Public Interest Law Center of Philadelphia
Jack Kelly	U.S. Environmental Protection Agency

Name	Affiliation
Bojeong Kim	Temple University
Robert Labrum	Philadelphia Redevelopment Authority
Deborah McColloch	Philadelphia Office of Housing and Community Development
Lisa Mosca	Pennsylvania Horticultural Society
Jess Naugle-McAtamney	Saul Agricultural High School
Dennis O'Terry	Temple University
Hamil Pearsall	Temple University
Stephen Peterson	Temple University
Annie Preston	Philadelphia Parks and Recreation
Palak Raval-Nelson	Philadelphia Department of Public Health
Viery Ricketts-Thomas	Glennwood Green Acres
Camila Rivera-Tinsley	Schuylkill Center for Environmental Education
Tina Rosan	Temple University
Ari Rosenberg	Center for Environmental Transformation
Elisa Ruse-Esposito	Philadelphia Parks and Recreation
Richard Shaw	United States Department of Agriculture
Mark Smallwood	Rodale Institute
Richard Stehouwer	Penn State University
Maddie Stone	University of Pennsylvania
Nicole Sugerman	East Park Revitalization
Owen Taylor	
Ayse Unver	Pennsylvania Horticultural Society
Jenny Van Skiver	Agency for Toxic Substances and Disease Registry
Benoit Van Aken	Temple University
Rachel Weiner	Tulane University
Lora Werner	Agency for Toxic Substances and Disease Registry
Jonathan Wheeland	Philadelphia Law Department
Alice Wright- Bailey	PA Department of Environmental Protection
Sarah Wu	Mayor's Office of Sustainability
Mickey Young	U.S. Environmental Protection Agency

APPENDIX B: Research and Discussion Questions

SITE HISTORIES

1. Assuming that site histories should be conducted, who conducts the history?
2. What are the recommended sources for site histories? What sources are accessible to all? What are the easiest to navigate?
3. At what level of detail should gardeners be researching?
4. How far back should the site history go?
5. What criteria are used to identify low, medium, and high levels of concern for past land use?

TESTING TRIGGERS

1. What triggers testing? Is there a trigger for testing?
2. Should testing always happen?
3. What are the limitations of testing?

TESTING PROTOCOLS

1. Who conducts soil sampling? Who funds soil testing?
2. For what contaminants does one test?
3. What type of soil testing method should be utilized?
4. Who conducts analysis?

CONTAMINANTS AND THRESHOLDS

1. What are the background levels in Philadelphia?
2. What are the contaminants for which we want to set numbers?
3. How do we determine levels of concern for Philadelphia garden sites?
4. Is there one number or multiple numbers depending on land use (e.g. non-food gardening activities, food production, recreational use)?

BEST PRACTICES

1. What are the best practices for safe food production and recreational space?
2. Do best practices vary for different levels of concern?
 - a. If so, how do levels of concern translate into action steps?
 - b. Do we create a spectrum of best practices from no/low risk (minimal safety measures) to high risk (remediation or redirection to new site)?
3. Is there a level at which we recommend growing in-ground?
4. At what level of risk should no food production be allowed? At what point do we recommend redirection or remediation?
5. How do we address place-based projects that involve high-risk sites?

COMMUNICATION AND IMPLEMENTATION

1. Where will we still have gaps in knowledge?
2. In what form should this working group make recommendations?
3. How does the working group get the recommendations implemented?

4. Does the working group have interim recommendations for testing and growing while recommendations to city agencies are still pending?
5. How do we reach the public with the working group's recommendations? How should outreach materials be distributed and by whom?
6. How do we communicate the limitations of testing and best practices?
7. Have we identified any research gaps?
8. Are there opportunities for partnerships coming out of this process?

APPENDIX C: Philadelphia Soil Safety Working Group Meeting Agendas and Minutes

MEETING 1 – AGENDA

MAY 2014

- A. Introductions
- B. Overview of Meeting Framework and Working Group Questions
- C. Research Presentation
- D. Discussion
- E. Pre-Testing Protocols and Logistics
- F. Testing Protocols and Logistics
- G. Next Steps and Close

Pre-Testing Protocols and Logistics Questions

Site History

1. Assuming that site history should be conducted, who conducts the history?
2. What are the recommended sources for site histories? What sources are accessible to all? What are the easiest to navigate?
3. At what level of detail is necessary?
4. How far back?
5. How does site history inform next steps? (See Toronto example for one model.)

Testing Triggers

1. Should testing be mandatory? Is there a screening mechanism that would eliminate need to test?
2. At what level of concern should testing occur? Should testing occur at every level of concern?

Testing Protocols and Logistics

1. Who conducts soil sampling? And who funds the soil testing?
2. For what contaminants does one test?
3. What process should be used to test?
4. How can gardeners best interpret test results? With what guidance?
5. What are the background levels in Philadelphia?

Pre-Testing Protocols and Logistics

Site History

- Site assessments must happen.
- Site histories are imperfect. Very early uses are important, but we don't always have that information. Also, gasoline tanks for example weren't permitted until a certain point (possibly 80s), so the information regarding gas stations is limited. It is not uncommon to find a surprise gas tank where there is no record.
- Group feels comfortable producing a step-by-step comprehensive guide that includes the risks, limitations, and possibilities of the site history. The guide must be transparent about risks and gaps in data in order to avoid giving people a false sense of safety.

What are the recommended sources for site histories? What sources are accessible to all?

What are the easiest to negotiate?

- Look into permits in order to know if a site was permitted to take a gasoline tank out of the ground.
- EPA for status of gasoline tanks.
- Sanborn Fire Insurance Maps require a login, so they aren't regularly accessible to - people outside academia.
- Philly GeoHistory website has maps from 1942 and 1962 that include zoning but no specifics about land use.
- Zoning Permits: allude to activity on site over the last half-century
EPA Toxic Release Inventory Maps

At what level of detail should gardeners be researching?

- Often we can find out if a lot has residential, commercial, or industrial use, but it is difficult to know exactly what type of business or industry operated on the lot.
- The site history should also include land use surrounding the lot depending on the slope of the land, because if a lot is down gradient from a gas station, it is likely contaminants ended up on the lot.

How far back?

- As early as possible. Very early uses are sometimes critical.
- In her research, Elisa went as far back as 1942, but usually ended up in the 40s or 50s.
- Maps from 1818-1843 are not free, and having students do the research still requires oversight, time and funding.
- There are also gaps in research between 1910 and 1942.
- EPA gas tank info only goes back to 1985.

Who conducts the history?

- Attendees hesitant to put the responsibility on the gardeners and farmers.

- If a garden is on a City-owned property, what is the question of liability? Bring Law Department to table)
 - o Option 1: City provides guidance and hope people use it.
 - o Option 2: City partners with universities or libraries to conduct site history.
 - o Option 3: City takes on all responsibility for site history.

What criteria are used to identify low, medium, and high levels of concern?

- Alice from EPA is the Manager of grants for communities to conduct a Phase I and Phase II environmental site assessment. If the group can select a finite universe and then write a grant proposal under the EPA brownfields program, the group will be able to conduct Phase Is and IIs, pull out gas tanks, etc (about \$400,000). The grant is due in October, and the EPA can help put that together with this group.

How does site history inform next steps?

- Through the grant, we can conduct a pilot using a set of criteria for low, medium and high, and then decide what to do in terms of next steps through the pilot.

Testing Triggers

What triggers testing? Or is there a trigger for testing? Should testing always happen?

- Consensus: YES. All City-owned and private properties should be tested. Soil in Philadelphia is contaminated. Group discussed the possibility of working backwards, assuming all soil in Philadelphia is contaminated and therefore testing should always be required.

How many lots are currently used for food production/growing?

- 400 is a conservative estimate

Have existing community gardens been tested?

- Pennsylvania Horticultural Society (PHS) works with 140 sites, all of them have been tested, and so far only 1 garden has come back with lead levels that are too high. However, the gardens have not been tested for PAHs or VOCs. PHS also retests soil in raised beds and conducts a site history.

Is there an instance where testing does not happen?

- Only if we always require raised beds and cap soil, in which case the City should provide comprehensive guidelines for doing raised beds correctly.

Should we recommend the same guidelines for new gardens as well as old gardens?

- Yes.

Testing Protocols and Logistics

- General consensus to recommend testing always. There should never be a baseline for no testing.
- However, there may be a point at which you recommend that growing should never happen on that site. Maybe we can try to map this.
- We should require people who are selling vegetables to test.
- We should also be cognizant of weighing the benefits of fresh produce against the possibility of soil contamination. Attendees are less worried about the bioavailability of produce, and more worried about the physical exposure to contaminated soil while gardening.

Who conducts soil sampling?

- Master Gardener Program and Penn State Extension helps gardeners conduct soil samples. Ideally, Penn State Extension/City/PHS can go around every neighborhood with a soil kitchen to give gardeners an opportunity to conduct samples and test soil.
- Gardeners test using Penn State Guidance or City guidance, and university lab provides interpretation of results. Soil kitchen is the intermediate step between those two.

What method of soil testing?

- Gardeners want to combine testing for contaminants with testing for nutrients, so a lab that offers both in the same package will attract gardeners.
- XRF can be used as a first pass to identify contamination hot spots.
- XRFs have many different modes and settings, so you need to know what you are looking for before using it.
- Multiple organizations at the table have access to an XRF.
- AccuTest
- Sequential extraction for bioavailability: organics v. metals at Temple
- State-certified labs: some do include PAHs and petroleum, costs about \$140
- Soil Kitchen
- Targeted Brownfields Assessment Grant (EPA)

Who conducts analysis?

- University may be able to run a Philadelphia-specific profile for the group at a lower cost if we sent the samples in bulk.
- USDA, NIH and National Institute for Children's Environmental Health may be interested in participating (possible provided funds)

For what contaminants does one test?

- N, P, K, Pb, heavy metals
- For older gardens, PAHs are a problem.

- EPA thinks they can come up with a list of contaminants for Philadelphia and will bring it to the next meeting.

What are the levels of concern?

- No consensus on this yet.

What are the background levels in Philadelphia?

- Lead is 33ppm

Who do we connect with at the State level?

- Palak can connect us to the right person.

What about phytoremediation?

- Not a good recommendation because you transfer the problem somewhere else rather than fixing it.

Should we require yearly testing?

- Yes. There is no point in doing initial testing if you do not plan to retest.
- We need to consider how to conduct consistent testing and retesting.

What are the protocols for demolition?

- Protocols for demolition in the City are instrumental to *not increasing* the problems we already have. The City needs to change the standards for how demolitions are executed in order to prevent future contamination. Since this is a Licenses and Inspections issue, the group can send a letter directly to L&I with that recommendation. That will be in the parking lot for Meeting #3.

Next steps for Meeting #2

- Anna Herman (Penn State Extension), Alice Wright (EPA) and Maddie Stone (UPenn) will work with the soil safety leadership team on developing recommendations for this set of questions.
- Attendee suggested that each agency come to the table at the next meeting with a description of the organization's "toolkit," explaining what resources the organization has. The more resources the group can use, the better. A unified grant proposal from many different organizations will also be stronger.
- DVRPC and Law should be at the next meeting.

Ideas from group:

- Research project: on pilot sites, conducting soil testing and tissues samples as best practices/other action steps are taken (EPA research funding exists for pilot studies like this, and EPA Grant for Brownfields testing opens in October).
- Building on GeoHistory to develop more extensive, consolidated site history databases.
- Penn State, EPA, NRCS, City could provide a soil kitchen opportunity in neighborhoods annually.
- Education around best practices (some already occurs through City Harvest); Certificates for having conducted soil testing.

Additional Questions Raised:

- How to fill the research gap between 1910 and 1942?
- Should guidelines for best management practices be recommended to existing gardens? When are BMPs sufficient?
- Is there the potential to create a Philadelphia-focused base soil profile?
- How to assist people who cannot afford testing?
- What organizations could partner to provide testing and interpret results?

Action Steps Before Next Meeting

- Get Law Dept., PRA, OHCD representatives at the table (PP&R, MOS)
- Likely list of contaminants for Philadelphia (EPA)
- SE PA region USDA reps (Sarah)
- Ideal recommended protocol for soil testing (Anna Herman)
- At next meeting, each person at meeting brings the toolkit, skills, resources they/their organization are bringing to the table.

- A. Introductions
- B. Introduction to FPAC
- C. Overview of Meeting Framework
- D. First Meeting Recap and Takeaways
- E. Research Presentation
- F. Discussion
- G. Evaluating Risk Levels
- H. Best Practices for Growing and Open Space
- I. Next Steps and Close

Evaluating Risk Levels

There does not seem to be consensus across city or agencies about the numbers. Some cities recommend different levels of exposure for different activities. It is not entirely clear how the various agencies came to these numbers.

Questions

1. What are the contaminants for which we want to set numbers?
2. How do we determine levels of concern for Philadelphia garden sites?
3. Is there one number or multiple numbers? (e.g. Non-food gardening activities, food production, recreational use)
4. Where will we still have gaps in knowledge?

Using Risk Levels to Inform Growing Practices

We have a lot of good information about best practices for safer food production and use of urban open space. We want input about anything that is missing from the research and would like to come to consensus around a set of recommendations. We want to address how we deal with a spectrum of risk and whether there are different recommendations for no/low risk or high risk sites.

Questions

1. What are the best practices for safe food production and recreational space?
2. Do best practices vary for different levels of concern? (i.e. Do we want to use a model like Toronto?) If so, how do levels of concern translate into action steps?
3. Do we create a spectrum of best practices from low/no low risk (minimal safety measures) to high risk (remediation or redirect to new space)?
4. Is there a level at which in-ground growing could be recommended?
5. At what level of risk should no food production be allowed? At what point do we recommend, “redirect to another site or remediate?” How do we address place-based projects that involve high-risk sites?

Evaluating Risk Levels

Definitions of Contaminant Types

- PAHs: Polycyclic aromatic hydrocarbons
 - o byproducts of combustion; i.e. sites used for steel-making, coal burning
- VOCs: Volatile Organic Compounds
 - o chemicals that vaporize; often found in commercial household products such as paints, lacquers, pesticides, printer cartridges, and adhesives
- PCBs: Polychlorinated biphenyl (very hard to break down)
 - o used widely in coolant fluids, transformers, vacuum pump fluids, and to stabilize oil
- Heavy metals
- General consensus: heavy metals test should be conducted first.
 - o if heavy metal content does not raise flags, but site history indicates high risk, test for other contaminants (PAHs, VOCs, PCBs, etc) after the heavy metal screening test
 - o if heavy metal content is high, grow above-ground

What are the contaminants for which we want to set numbers?

- **EPA-ASTDR** has come up with a list of likely contaminants in Philadelphia
 - o how do we narrow down this list?
 - o Benzopyrene is the most potent PAH carcinogen, so if you can only test for one PAH, do this one.
- threshold numbers: EPA has set numbers for ingestion and dermal exposure; PA DEP standards are around use in its Land Recycling Program
- Penn State Extension feels that Toronto's numbers are conservative

Testing Cost

- heavy metals - cheapest, fastest test
- PAHs – Penn State doesn't do; UMass test costs \$250/sample
- PCBs- Penn State test costs \$80/sample
- No testing for pesticides
- **Penn State** is willing to offer discounted testing for larger bundle of properties

XRF Testing

- Suitable for testing for heavy metals (42 total)
- Quality control for samples is very important since the samples do have to go through certain processes in order to produce the most accurate result
- there should be a submission process for samples
- Range is whole numbers only, not fractions
- **UPenn** is interested in doing an XRF pilot project

How do we set numbers to determine levels of concern and action steps?

- Equation Toronto used to determine SSVs (Soil Screening Values) needs to be adjusted to Philadelphia
- Toronto's numbers are low for Philadelphia (lead levels across Philadelphia are above 340 ppm)
- **Temple** soil scientists can try to run the numbers on this equation
- New York State numbers based on commodity crops, not standard crops grown in an urban setting

Additional Questions on Threshold Contaminant Concentration Numbers

1. Should there be different numbers for different uses? (i.e. bioavailability vs. exposure via skin/inhalation)
 - pH is very important when talking about bioavailability because different metals/contaminants react differently to acidic or basic pH levels in soil
2. Is the Toronto policy working? What is the response?
3. How does soil change over years of gardening? (potential research project)
4. How valid are old wives' tale remediation techniques? (potential research project)
5. Who enforces soil standards?
6. Who is liable for clean up?
7. What to do with levels that are dangerously high?
8. What are the possibilities for remediation?

Growing Best Practices

- Grow appropriate crops
 - avoid hyper-accumulators such as leafy greens and root crops, which tend to uptake contaminants, even at levels below EPA regulations
 - EPA Interim Guidelines provide crop recommendations
 - UMass does produce tissue testing
- Build soil
 - higher pH lowers certain chemicals' particular bioavailability
 - for thorough sampling on Philadelphia soils, NRCS mapping has not been conducted since the mid-1970s, and requires samples to be meters deep (may not even be relevant for urbanite soils)
 - a geoprobe is simpler: soil cores sent to scientists
- Build up
 - barriers that biodegrade easily, such as landscaping fabric, mulch and burlap, are only effective for 1-3 years
 - Gardeners recommend raised beds be 1ft high
 - Be specific about *how* to build raised beds, *where* or *where not* to build them
 - plastic-based barriers under raised beds should be recommended for longer lasting solution
 - raised bed requirement only for new gardens on city-owned lots, the rest of the best practices are recommendations
- Amend Soil
 - "Biosolids" is a contentious matter, caution against using that in chart.

Soil Resources

Where can people find soil that is suitable for growing? (Can PPR offer good soil?)

- DEP regulates fill soil for agricultural use, we can ask them for resources.

Additional Questions on Philadelphia's Soil

1. What are the original layers of soil in Philadelphia? How do they react to changes in chemical structure?
2. How does mineralogy and soil texture affect bioavailability? Lead has been found to be concentrated on smaller particles

Interim Guidelines

- Should we utilize EPA residential standards for contamination numbers? Consensus that they are very conservative.
- City should offer sources for good soil: PA DEP Act II standards for clean fill soil (50 ppm for lead, no standards for agricultural use)
- Gardeners should grow in raised beds
- **CDC and ASTDR** can make a table with Act II and clean fill numbers for reference

Areas for Further Investigation

- Comparing XRF vs. ICP (inductively coupled plasma) testing
 - o XRF tests for 42 different elements
 - o arsenic levels below 0.4 don't show up on XRF test
- How much do soil amendments reduce exposure? And what are the most effective amendments for different contaminants?
- Is there a way for the Recycling Center to purchase a saw mill so that untreated lumber from forestry projects could be used for raised beds?
- Can Fairmount Park's Recycling Center do compost testing?
- How clean and usable is in-fill from construction projects?

Next Steps

- July 12th: EPA is doing an XRF pilot at NKCDC
- EPA Smart Growth Local Food Grant opportunity closes July 15
- Final meeting on policy recommendations, implementation, and outreach on July 17th from 3pm to 5pm

- A. Introductions
- B. Introduction to FPAC
- C. Overview of Meeting Framework
- D. Second Meeting Recap and Takeaways
- E. Discussion
- F. Implementation
- G. Next Steps and Close

Implementation Questions

1. In what form should this working group make recommendations?
2. How does the working group get the recommendations implemented?
3. Does the working group have interim recommendations testing and growing while our recommendations to city agencies are still pending?
4. How do we reach the public with the working group's recommendations? How should outreach materials be distributed and by whom?
5. How do we communicate the limitations of testing and best practices?
6. Have we identified any research gaps?
7. Are there opportunities for partnerships coming out of this process?

Site Histories

- Still need a more detailed step-by-step guide that is paired with charts that list likely contaminants based on past land use. Guide should include limitations & caveats of site histories.
- Ideas to facilitate gardeners conducting research
 - o Workshop days at libraries, KEYSPOt locations, Penn State Extension office
 - o Penn State Extension Master Gardeners as site history trainers

Policy Recommendations

- Still need:
 - o numbers for levels of contamination to denote low, medium and high concern (*Temple will work on calculating*)
 - o PADEP MSC Numbers (Act II) are not for gardening, numbers too high
 - o Toronto numbers are calculated based on a shorter growing season (need to be adjusted to a longer time of exposure)
 - o Makes sense to bring in the USDA to designate safe levels?? (*Alice, DEP representative, will be in touch with USDA*)
 - o Level of contamination when people can be recommended to grow in ground
 - o Preliminary explanation in policy explaining WHY we need to protect and mitigate lead contamination
 - o Loop in UPenn Center for Excellence and Environmental Toxicology

Soil Testing on Publicly-owned Land

- Jonathan working with Environmental Lawyers to determine City's liability
- If gardeners do not test, they'll be recommended to use Growing Best Practices

Dissemination and Outreach

- Master Gardener workshops at libraries (*Anna Herman- assessing PSU resources*)
- City Harvest could provide annual testing and best practices guidance for gardeners
- Train the trainers workshops through NACs, CDCs, Block Captains, Health Centers
- Work with Health Department's Lead Safety Campaign to develop accessible, positive language
- Clean soil standards certification
- Create garden signage about soil health (*Maddy will contact Franklin Institute*)
- Regular, annual (or many times a year) neighborhood-based soil kitchen, working with the Food Trust, Farm to City to set up at farmer's market locations
- 311 Script for people calling the City wanting to garden

Outstanding Questions

1. What is the extent of City's (or any property owner's) liability when it comes to soil testing, contamination, land use and remediation?
2. If we follow state or federal guidelines, will those higher-level governments be liable?
3. Is a heavy metal panel always necessary (even if the past use was not hazardous)?

APPENDIX D: Conducting a Site History in Philadelphia

Introduction

Knowing the past uses of a farm or garden site can alert growers to the presence of potential contaminants, and provide guidance regarding next steps to make sure that food is grown in the safest way possible.

A vacant lot, for example, may be the former site of a dry cleaning operation that may have left behind a legacy of carcinogenic cleaning solvents. Adjacent land use is also important. A potential garden site may have at one time neighbored a gas station, factory or the site of a chemical spill, and the soil may contain pollutants from runoff from those contaminated sites.

Many urban growers learn about prior land use from first-hand knowledge, or from people living in the community (CITA). While oral histories are a fantastic starting point, there are additional resources that can supplement local knowledge, such as local, federal and state environmental agencies. The following checklist of sources details how and where to look into past uses of your site, and what to keep an eye out for during your research:

Geographic History

[Philageohistory.org](http://www.philageohistory.org)

On the website's *Interactive Maps Viewer*, you are able to look at land use maps dating back to the early-1800s. Enter the address of your site, choose the years you want to look at, and take note of the land use of your site as well as the surrounding parcels.

Key maps to look at are:

1875 Philadelphia Atlas

1895 Philadelphia Atlas

1942 Land Use Map (Works Progress Administration)

1942 WPA Land Use Map legend can be found here:

<http://www.philageohistory.org/rdic-images/view-image.cfm/LUM1942.Index>

1962 Land Use Map (Works Progress Administration)

1962 WPA Land Use Map legend can be found here:

Philadelphia Zoning Archives

<http://www.phila.gov/zoningarchive/>

City zoning archives list past building permits, which reveal information about historical land use and consolidation of properties. When entering the address, try a variety of submissions (i.e. 215 N. 50th Street, 215 50th St, etc.), as well as historical lot consolidations and subdivisions.

Sanborn Maps

The Sanborn Maps are detailed maps used widely across the environmental industry. Check for land use and gas tanks on the parcel and directly adjacent sites. The maps cover three eras: 1916-29, 1929-51, 1951-75. Sanborn Maps from each era are divided up into

volumes and numbered plates, which can be found alongside the publication year in the upper right-hand corner of each map.

These maps can be accessed for free at:

The Central Library of the Free Library of Philadelphia

1901 Vine Street Philadelphia, PA 19103

2nd Floor, Social Science and History Department

Contact: Rich Boardman boardmanr@freelibrary.org (215) 686-5397

1916-29 maps are in book form.

1929-51 maps are digitized. They can be accessed on the computer in the maps section by looking under *Programs for Historic Sanborn*.

1951-2006 maps are digitized. They can be accessed on the computer in the maps section by looking under *Programs for Sandborn Maps*. Click on *Current Maps* and *Search for Address*.

If your address is on a numbered street (i.e. 1525 S. 25th St), you must look up the plate number in the Sanborn Maps binder on the bookshelf behind the computer.

Don't forget to save your digitized map. Save the image as a JPEG, crop it, print and fit to page. Save the image as a JPEG to a flash drive, or send it via email. Printing your map will cost money.

The Sanborn Maps can also be accessed for free online. This source does not have a "search for address" function, so you must already know the volume and plate number of your site. Once you have tracked down that information at the Free Library, this website can be useful for future reference: <http://www.libraries.psu.edu/psul/digital/sanborn.html>

Philadelphia Board of Revision and Taxes

Provides basic information on owners, condition of property, and valuation over time.

<http://www.phila.gov/brt/propertyinformation/Pages/default.aspx>

APPENDIX E: Best Practices for Growing Food Chart²⁹

Amend Soil	Minimize Exposure	Grow Up	Practice Good Habits	Choose Appropriate Crops
Incorporate organic matter (such as compost or manure) into your soil to reduce exposure pathways and immobilize contaminants and limit their uptake into plant matter.	Cover soil and walkways with landscape fabric, bricks, mulch, or a ground cover such as grass or clover.	Build raised beds one foot high out of untreated lumber, or by simply mounding soil above ground into windrows. Plastic barriers last longer.	Wear gloves when handling soil, and wash your hands after coming into contact with soil.	Fruiting plants (tomatoes, cucumbers, squash, apples, etc) are generally the most appropriate to grow in contaminated soil.
Maintain soil pH levels near neutral by adding soil amendments such as lime. After using lime, cover the area with organic matter, including homemade compost or leaves.	Use mulch or salt hay in garden beds to reduce soil splashing on to plant leaves.	Import clean soil and clean compost, to the extent possible.	Thoroughly wash produce before storing and eating, with 1% vinegar solution before washing with clean water. Peel vegetables, especially root crops.	Tuber and root crops (such as onions, potatoes, beets, and carrots) are less desirable to grow in potentially contaminated soil.

²⁹ Anigma, S.D, and D.M Sullivan. "Evaluating and Reducing Lead Hazard in Gardens and Landscapes." Oregon State University Extension Service. March 1, 2008. Accessed May 14, 2015.

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/19844/ec1616-e.pdf>;

"Brownfields and Urban Agriculture: Interim Guidelines for Safe Gardening Practices."

http://www.epa.gov/brownfields/urbanag/pdf/bf_urban_ag.pdf. 2011;

Kessler, Rebecca. "Urban Gardening: Managing the Risks of Contaminated Soil." *Environmental Health Perspectives*, Vol. 121, 11-12. November-December 2013;

Turner, Allison H. "Urban Agriculture and Soil Contamination: An Introduction to Urban Gardening." Center for Environmental Policy and Management, EPA Region 4. 2009.

<http://efc.muskie.usm.maine.edu/docs/PG25.pdf>.

Amend Soil	Minimize Exposure	Grow Up	Practice Good Habits	Choose Appropriate Crops
Consult the Colorado State University Extension site on soil amendments for more information on choosing them. ³⁰	Select materials to build raised beds that will not add contaminants to the soil.	Place a protective barrier below raised beds. Barriers that biodegrade easily, such as landscaping fabric, mulch and burlap, are only effective for 1-3 years.	Remove outer leaves of leafy vegetables before consumption.	Leafy vegetables (collards, kale, lettuce, spinach) need to be thoroughly washed, as they can easily be contaminated by backsplash.
	Minimize contact with native soil will building raised beds.	Perennial crops are helpful because they do not require as frequent contact with the soil.	Keep soil outdoors by cleaning tools and boots outside.	
	Place beds beyond the reach of building runoff to minimize exposure to lead dust.	Instead of planting seeds directly into the ground, use transplants & apply organic matter after planting.		

³⁰ Davis, J.G, and D. Whiting. "Choosing a Soil Amendment." Colorado State University Extension. February, 2013. <http://www.ext.colostate.edu/pubs/garden/07235.html>.