

## HEALTHY SOILS: Information about testing your yard or garden

*The Oregon Health Authority (OHA) has received many questions from private citizens, daycares, schools, and neighborhood gardeners about soil testing on private properties located one-half mile away from artisan glass factories in Southeast and North Portland. This fact sheet provides answers to common questions. Additional resources are available at:*

*[SaferAir.oregon.gov](http://SaferAir.oregon.gov).*

### Considerations prior to testing

In all urban areas, it is important to consider past and present uses of, and around, your yard and garden site. If you have concerns based on known or potential contamination, testing your soil is the only way to know what is in your soil. Whether you test your soil or not, we recommend that all urban gardeners adopt best practices for urban gardening referenced in the [OHA Healthy Gardening fact sheet](#), and [website](#).

Before you make a decision about testing, consider how likely it is for you or others to come into contact with the soil. Is your yard covered by a lawn, mulch, rock, or other materials that do not allow bare soil to be exposed? When bare ground is covered, it's harder for people to come into contact with the soil. A person must come into contact with, or be exposed to, a high enough level of contamination in soil for it to cause harm to their health. For metals in the soil a person must swallow the contaminated soil in order to be exposed to it. Metals do not absorb through skin and the particle size of metals is too large to get into the lungs. Eating soil is of most concern for young children who play on the ground, in dirt, and frequently put their hands in their mouths. Children and adults should wash their hands before eating and after playing outdoors.

The only way to know what is in your soil is to test for the contaminants of concern. There are [laboratories serving Oregon](#) that will test soil for heavy metals. Most laboratories provide instructions for how to collect, store, and deliver soil samples for accurate testing. Review the resources provided under "How to test your soil" on the OHA Healthy Gardening [website](#) before you sample soil in your yard or garden and have it tested.

### Getting started – creating a sampling plan

Creating a sampling plan will assist you with collecting samples that are meaningful and address your sampling goals. Consider the following in your plans for sampling:

#### 1- Soil depth

If your goal is to understand the risks from soil in your yard, you will most likely want to collect soil samples less than six inches below the surface. This is because digging deeper than 6 inches is not a common activity for people in yards and it's less likely that you will be exposed to soil at depths. If you want to understand risks in an area of your yard or garden

where digging at depths below 6 inches is a common activity, then your soil samples will need to be collected at a deeper level. Note: Advice for testing nutrients and pH in soil may direct you to sample at levels deeper than 6 inches to assess soil fertility within the root zone of common garden plants. It's important to ensure that you are collecting soil samples at depths that will be meaningful to understanding your soil fertility as well as soil contaminants. You may come across differences in guidance.

## 2- *Past and current use*

Information about past uses, current uses and your knowledge of your property should inform what to test for. Do you live in an area that was at one time agricultural, an orchard, next to a gas station, dry cleaner, atop a former landfill, or nearby a traffic corridor? The type of use will help determine the types of contaminants commonly associated with the uses.

## 3- *Consider how certain parts of your yard are different*

It may be informative to keep samples from specific areas of your yard separate from one another. For example, if you sample close to the exterior walls of a home or building built before 1980, there is a higher likelihood that your samples will test higher for lead, due to lead-based paint chips that remain in the soil. You may have an area of your yard where children play and dig in the soil. Part of your yard may include an in-ground or raised garden beds, another area of your yard may be covered with sod. By keeping soil samples separate, you will be able to identify where contamination is higher. This will inform your efforts to lower contamination levels and potential risks.

Some substances that can be contaminants also occur naturally in soils—for example, metals. Lead is a metal that is found naturally in soil, and prior to the 1980s it was used in leaded gas and lead paint. Since metals are found naturally in soil, and because they are also byproducts of urban activity, it is recommended that urban gardeners test for metals in garden soil. It's also important to test for indicators of soil health such as nutrient and pH levels. This is because research has found that healthier soil lowers risks of contaminants moving through the food chain and harming people.

## **Interpreting yard or garden soil test results**

The process of interpreting yard or garden soil test results involves comparing the number that you get back for each contaminant that you tested for against screening levels. It's important to know that, currently, there are no federal or state agency standards for soil screening levels specifically for gardens. We recommend comparing against three screening levels, included in Table 1.

- 1- The *first type of screening* is the Department of Environmental Quality (DEQ) estimate of the background levels for metals. Find the background levels for metals the geographic area where you live (for example, the Portland Basin). The DEQ [fact sheet](#) provides the values for background levels of metals for the different regions, and explains how background numbers were determined. Comparing your soil sample results to

background levels lets you know if your results are higher than what is expected for your region.

- 2- The *second type of screening* is DEQ's Residential Screening Level. DEQ's Residential Screening Levels are Risk Based Concentrations ("RBCs"). They establish soil cleanup levels based on proposed reuse for contaminated sites. Residential reuse requires the most stringent cleanup level as it assumes children and families will live on the property. The Residential Screening Level is used for residential (yard) soil.
  
- 3- The *third type of screening* level is developed by the federal Agency for Toxic Substances and Disease Registry (ATSDR), which is part of the Centers for Disease Control and Prevention (CDC). These public health screening levels are called [Environmental Media Evaluation Guides](#) (EMEGs) and Reference Dose Media Evaluation Guides (RMEGs). Public health screening levels are calculated in a way that is very similar to DEQ's residential screening levels. ATSDR screening levels are different because they are not calculated for purposes of establishing levels for cleaning up soil contamination in residential soil; rather they are calculated to assess human health risks.

Note: There are no federal or state agency standards for soil screening levels for gardens. Urban agriculture doesn't fit into the current zoned land use categories. The overall time and proximity to soil and potential contaminants make gardening different from residential use. Gardening creates unique exposure pathways. People are in closer contact with the soil than for any other category, for different time periods. Most states use Residential screening levels as their guide however the Residential and ATSDR Values were not calculated for gardening scenarios.

Table 1 illustrates how you can compare your individual results against screening levels. In this table, the background levels for metals are reported in milligrams per kilogram (mg/kg), which is the same as parts per million (ppm) for the "Portland Basin". If you do not live in the Portland Basin you will need to update the numbers with those from your region. Background levels for each region are found [here](#).

**Table 1 Screening level comparisons**

All concentrations in in mg/kg

<b>Metal</b>	<b>Portland Basin Background<sup>1</sup></b>	<b>DEQ Residential Screening Levels<sup>2</sup></b>	<b>Public Health Screening Levels<sup>3</sup></b>
Aluminum	52,300 <sup>b</sup>	77,000 <sup>a</sup>	50,000
Arsenic	8.8	0.43	15
Cadmium	0.63	78	5
Total Chromium <sup>e</sup>	76	120,000	75,000
Chromium +6	NA	0.3	45
Cobalt	33 <sup>c</sup>	23 <sup>a</sup>	500
Iron	36,100 <sup>b</sup>	55,000 <sup>a</sup>	NA
Lead	79	400	NA
Manganese	1,800	1,800	2,500
Mercury	0.23	23	15
Nickel	47	1,500	1,000
Selenium	0.71	390 <sup>a</sup>	250
Uranium	3 <sup>d</sup>	230 <sup>a</sup>	150
Zinc	180	23,000 <sup>a</sup>	15,000

1- Source DEQ background metals fact sheet – Portland Basin Regional Background Concentrations for Metals in Soil <http://www.deq.state.or.us/lq/pubs/docs/cu/FSbackgroundmetals.pdf>

2 - Residential Levels are DEQ soil screening levels, where available, or EPA regional screening levels (RSLs) when no DEQ residential value is published.

3 - Agency for Toxic Substances and Disease Registry (ATSDR) Screening Levels. ATSDR levels are environmental media evaluation guides (EMEGs), or reference dose media evaluation guides (RMEGs).

a - Residential levels for these metals are the US EPA Regional Screening Levels (RSLs) for residential use.

b - Background levels shown are from Washington Department of Ecology Pub. No. 94-115

c - No background estimate for cobalt has been published by DEQ. Value shown is average of Willamette Valley soil from DEQ database.

d- Background estimate from Toxicological Profile for Uranium, US ATSDR, February 2013.

e- Background value is based on total chromium. Screening Levels are based on trivalent chromium.

NA - Not Available - No estimate of background soil concentration or screening levels are available for this metal or from this agency.

## What to do if your yard or garden soil is higher than screening levels

When reviewing your soil test results and comparing to screening levels, keep in mind that there are no health-based standards specifically for contaminant levels in garden soils in Oregon. All of the values included in the table are for screening purposes only. Soil testing results that are higher than screening levels do not confirm health risks. Rather, they help to identify levels that may call for further evaluation and steps to reduce potential exposures to soil. In urban soils, it is not uncommon to find metals at levels near or above screening levels.

All soils contain metals. Arsenic, lead, cadmium and other metals occur naturally in soils. In Oregon, arsenic is commonly detected at levels that are higher than screening levels because of

Oregon's volcanic past. Lead is also commonly higher than screening levels in urban soils due to its long use in lead-based paint and in leaded gasoline.

DEQ Residential and Public Health values were developed to consider residential exposures that assume that you live on the soil and that you will swallow 200 mg per day (which is one-fifth the weight of a paperclip), every day, over a lifetime. They were not calculated to assess gardening risks. The DEQ Residential and Public Health values also assume that the metals found in your soil test are in one of the most toxic and bioavailable chemical forms, which is not typical for metals in garden soil. Studies have found that adding compost and keeping garden soil near neutral pH creates healthier plants and makes it harder for metals and other contaminants to get absorbed into plants. There are also relationships between metals, for example, cadmium and zinc. When zinc is present in the soil, it makes cadmium less bioavailable. With that in mind, the risks for exposure to metals in soil for urban gardeners are likely much lower than the risks calculated by the residential exposure assumptions used.

### **Further evaluation and steps to take**

For further evaluation, contact the Environmental Public Health Section at the Oregon Health Authority, Public Health Division at [ehap.info@state.or.us](mailto:ehap.info@state.or.us) or 971-673-0440.

Steps to reduce metal contamination in your soils.

- 1- Use clean soil and add compost to gardens.
- 2- Maintain soil nutrients and neutral pH.
- 3- Cover bare ground where soil is exposed.
- 4- Test your soil and add the right amendments to grow healthy plants.
- 5- If contamination is a concern, build raised garden beds (avoid treated wood).

Ways to reduce soil exposure:

- 1- Do not eat soil.
- 2- Avoid overhead watering. Water plants near the soil to avoid soil splash.
- 3- Take off shoes and do not track soil into your home.
- 4- Wash your hands.
- 5- Wash and peel (when appropriate) garden grown foods.

### **Additional resources for interpreting soil test results**

Understanding Your Test Results: Metals in Garden Soils and Vegetables – New York State Department of Health and Cornell University  
<http://cwmi.css.cornell.edu/UnderstandingTestResultsMetalsSoilsVeg.pdf>

Healthy Soils, Healthy Communities – Metals in Urban Garden Soils – New York State Department of Health and Cornell University  
[http://cwmi.css.cornell.edu/Metals\\_Urban\\_Garden\\_Soils.pdf](http://cwmi.css.cornell.edu/Metals_Urban_Garden_Soils.pdf)

Oregon Health Authority, Public Health Division, Healthy Gardening  
<https://public.health.oregon.gov/HealthyEnvironments/HealthyNeighborhoods/HealthyGardening/Pages/resources.aspx>