

Dirt Alert



Soil Sampling Guidance

for Owners, Managers and Administrators of
Large Properties Where Children Play

Publication #06-09-098

Who should read and use this guide?

Everyone who plays a role in keeping children safe at schools, parks, camps and recreational facilities, and large childcares located in counties with lead and arsenic soil pollution. This guide provides information on how to sample soil on your property.





Do I live in an affected area?

Do I live in an affected area?

Large areas of Washington state have soil polluted with lead and arsenic from smelter air pollution and lead-arsenate orchard pesticides in use in the early- to mid-1900s. Counties that may have polluted soil are listed on this page. If you live in one of these counties, this guide is for you. Other historical sources of these pollutants include arsenic treated wood, lead paint, and air emissions from the combustion of leaded gasoline. Lead and arsenic soil pollution from these sources tends to be found in the upper 6 to 18 inches of soil.

Counties that may have polluted soil include:

- King
- Pierce
- Snohomish
- Kitsap
- Thurston
- Stevens
- Yakima
- Chelan & Douglas
- Spokane
- Okanogan

Dirt Alert Guides



What is in this guide?

This guide provides step-by-step information on how to sample soil at large properties where children play, such as schools, parks, camps and recreational facilities, and large childcares. It explains how to identify:

- Where to collect soil samples;
- How to collect soil samples;
- What laboratories are appropriate for soil sample analysis; and
- What directions should be provided to the lab when you submit your soil samples.

This guidance is not intended to meet sampling requirements for state hazardous waste cleanups (Model Toxics Control Act [MTCA] Chapter 70.105D RCW) or real estate transactions.

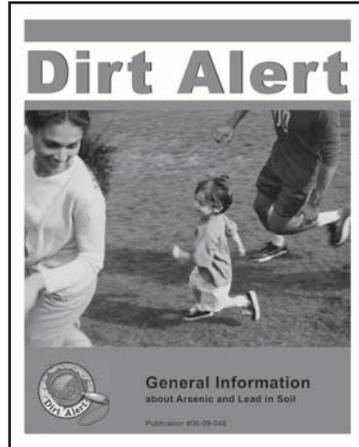
Where can I find additional information?

You can find additional guides at your regional Department of Ecology office or your local health department or district. Contact information is provided at the end of this guide.

Additional guides are available for:



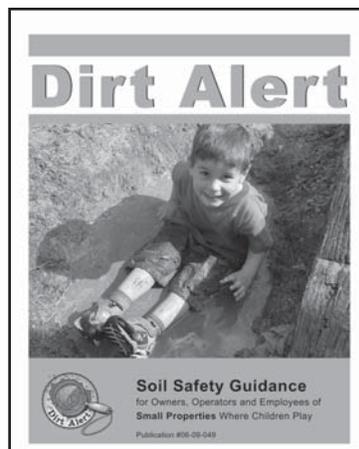
Soil sampling of small properties where children play, such as homes and home-based childcare facilities



General information about arsenic and lead in soil



Specific soil safety actions you can take for large areas where children play



Specific soil safety actions you can take for small areas where children play

Your Health



Can lead and arsenic cause health problems?

Arsenic can cause cancer and lead can cause developmental disabilities. You can be exposed to arsenic and lead in soil by swallowing small amounts of soil and dust. People at greatest risk are those exposed to soil on a regular basis, such as children, gardeners, construction workers, and landscapers.

Additional information on the health effects of these pollutants and actions you can take to prevent exposure may be found in the soil safety guides available through Ecology or your local health department or district.

Soil sampling is a three-step process

1

Plan

How will soil sampling help me?

The concentration of lead and arsenic in polluted soils can vary significantly on a single property. Soil sampling is the only reliable way to learn about soil pollution concentrations on your property. Once you know the location of lead and arsenic polluted soil in areas where children play, you can take the actions described in the soil safety guides to reduce contact with this soil.

2

Collect

How do I sample soil on my property?

Soil sampling is a three-step process:

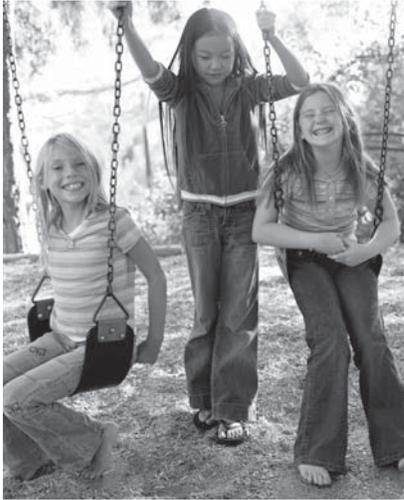
- Step 1: Planning the Sampling – Decide where and how to collect soil samples on your property.
- Step 2: Collecting the Soil Samples – Understand how to collect the soil samples.
- Step 3: Analyzing the Soil Sample – Select a private lab to analyze soil samples and provide instructions to the lab.

3

Analyze

Follow the steps below to determine if lead and arsenic are in your soil and whether they are a health concern. The information you learn will help you manage potential exposure to children and adults on your property.

Step 1



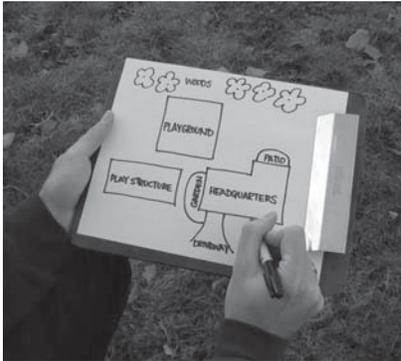
Planning the Sampling: Where do I collect the samples?

The concentration of lead and arsenic in soil can vary a great deal, even on one property. Therefore, it is important to sample in more than one area of your property. To decide where to collect soil samples, think about areas where children play directly in the dirt. These are considered high-use areas. We are most concerned about young children eating the dirt on their hands or toys. Ask yourself:

- **Where do children usually play?**
- **Where do children spend the most time?**
- **Is exposure to dirt possible?**

Ground surface covers (such as ball courts with hard surfaces or play areas covered with gravel or wood chips) help to limit the contact that children have with polluted soil. These are considered low-use areas. You may want to sample soil at these locations only if the ground surface cover has been disturbed or removed.

Step 1

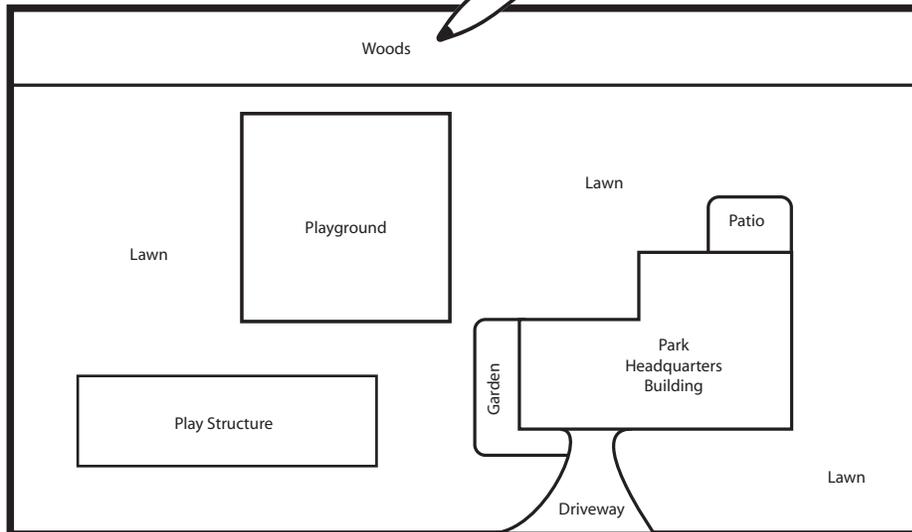


Once you have identified where children play on your property, divide these areas into the two categories: high-use areas (where children frequently play) and low-use areas. You will collect more samples from high-use areas than from low-use areas.

To identify the areas where children play, it is helpful to prepare a site diagram of your property. A site diagram will help make sure that you consider all areas of your property and can be used to remember the areas where you decide to collect your samples.

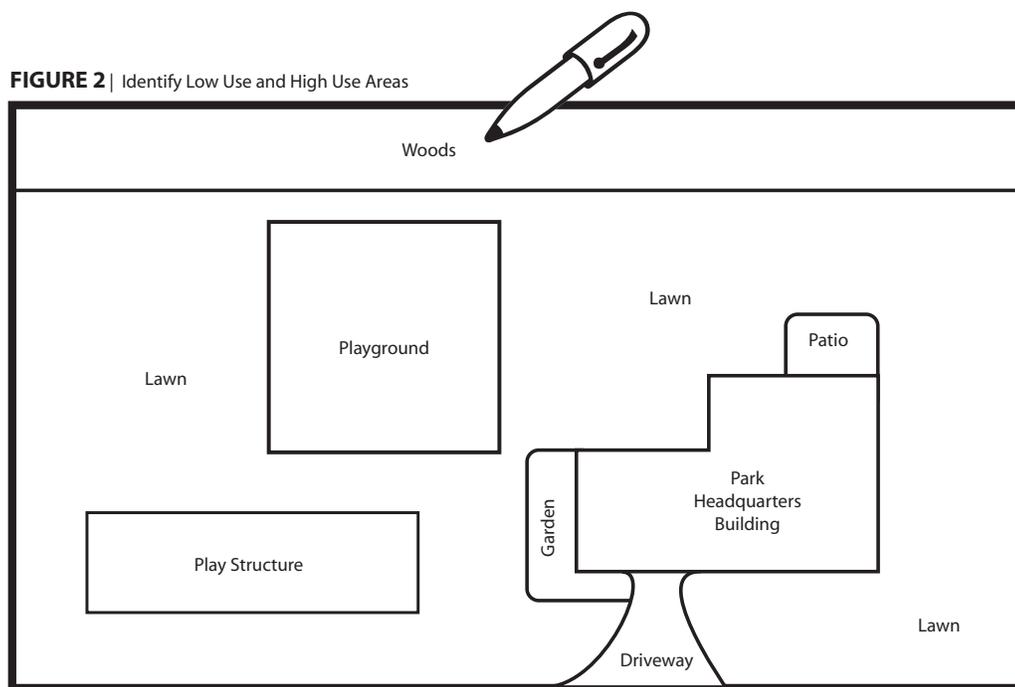
Figure 1 shows an example of a large property site diagram.

FIGURE 1 | Prepare a Site Diagram



Step 1

Figure 2 shows an example of a large property divided into high-use and low-use areas for soil sampling.



Step 1



How many samples should I collect?

Ecology recommends collecting a minimum of four samples per area, regardless of its size. For each large or small area identified as high-use, collect at least four soil samples. Collect more samples if a high-use area is large (greater than 40 feet by 100 feet) or if children younger than 6 years old play in the high-use area. The concentrations of lead and arsenic can vary significantly. Collecting several samples in each high-use area will provide a better estimate of the average concentration of lead and arsenic in soil.

Group all low-use areas together, and take a minimum of four soil samples from this grouped area. For example, in Figure 3, both the woods and the lawn areas are classified as low-use, so they would be grouped together for sampling.

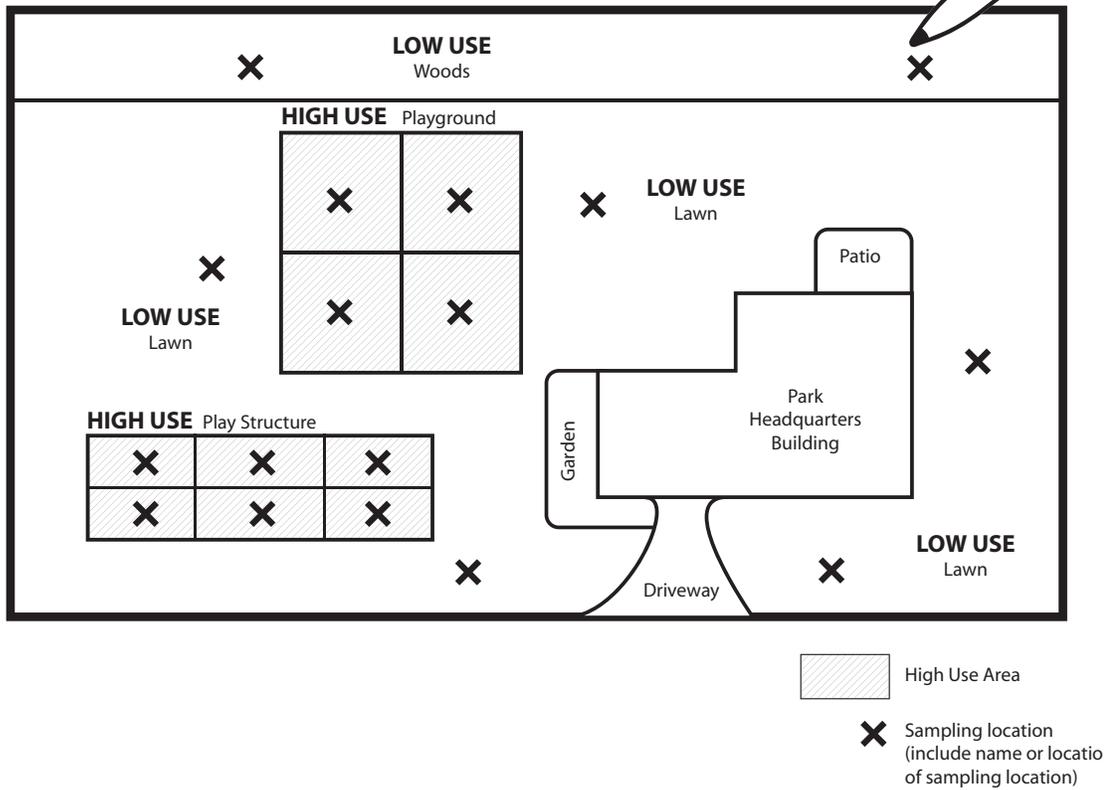
How do I decide where to collect samples within an area?

Collect samples throughout each area. Separate each area into approximately equal-sized blocks and collect a single sample from the center of each block. Try to collect samples in open areas and near play structures. Sample exposed soil located near buildings if children play in these areas. If you sample near older buildings, wood play structures and roads, your results may be higher due to lead-based paint, arsenic-treated wood or leaded gasoline exhaust.

Step 1

Figure 3 shows an example of sampling locations for a large property where children play.

FIGURE 3 | Set Sampling Locations



Step 1



How deep should I sample?

Most children play and dig in the top layer of soil. Therefore, collect your samples from the surface to a depth of six inches. Your samples should consist of only soil; therefore, clear or cut away grass, gravel, wood chips or other similar materials prior to collecting your samples. Remember, samples from the top six inches of soil will not necessarily provide a good estimate of deeper soil pollution, which may also exist on your property. If you believe children might be exposed to soil deeper than six inches, you may want to collect separate samples from these deeper areas.

Should I prepare mixed samples?

Increasing the number of samples collected from an area provides a better estimate of soil

pollutant levels; this process is also more costly. You can reduce costs by mixing individual samples from different locations in an area into a single sample. This is called compositing.

The composite result is an average of the soil mixed into the sample. For example, by collecting and mixing individual samples from different locations in each low-use area, you can get a reasonable estimate of the average concentration. You would then collect a portion of the mixture for analysis, thus reducing the cost of analysis.

Composite samples should be used only for sampling soil in low-use areas. They should not be used in high-use areas, where each sample should be individually analyzed. Composite sampling is discussed in Step 2.

Step 2



Healthy Sampling Steps

- Wear gloves.
- Limit dust by dampening soil before you sample, or wear a dust mask.
- Wash hands and face after sampling.
- Wash clothing separately from other laundry, if it becomes dirty.

Collecting the Soil Samples

Once you have planned your sampling, the samples are relatively easy to collect. To help you with collecting your samples, the steps listed below are repeated on the tear-out checklist at the end of this guide.

1. Collect your sampling equipment.

- Shovel, trowel or bulb planter.
- Clean stainless-steel or plastic spoon.
- Permanent marking pen.
- Small ZipLoc™ plastic bags or 4 oz. glass sampling containers. Clean glass containers can be obtained from the analytical lab that you choose for your soil analysis. Choosing your lab is discussed in Step 3.
- Paper towels or wash bucket and scrub brush.
- A large stainless-steel, plastic, or glass bowl (if you are going to mix individual soil samples together).
- The tear-out checklist on page 23 of this guide.

2. Collect the soil samples.

- Follow Healthy Sampling Steps (see box on left).
- Using the permanent marker, label a ZipLoc™ bag or glass container with the following information:
 - The number or name of the sampling location from your property diagram.
 - Your name.
 - Date.
 - What you want to analyze (arsenic and lead).

Step 2



- Clear away any debris or grass from the soil surface.
- Dig a 6-inch deep hole with your shovel, trowel or bulb planter.
- Scrape soil from the sides of the hole with the spoon and fill up a plastic bag or a jar. Avoid or discard pebbles, rocks, leaves, roots and stems. Be sure to collect soil from throughout the entire hole.
- Either discard the spoon, or clean it using a paper towel or wash bucket and scrub brush. If the spoon is to be used again, it should be free from any visible dirt.
- Seal the sample jar or ZipLoc™ bag securely.

3. If you want to create a composite (mixed) sample.

- Collect all individual samples (as described above) from low-use areas. Then, put equal amounts of soil from each sample into the large bowl.
- Mix the soil thoroughly.
- Using a clean spoon, fill up a plastic bag or jar with a portion of the mixed soil.
- Discard the remaining soil back into the holes.

4. List all of your soil samples on the Sample Inventory Sheet.

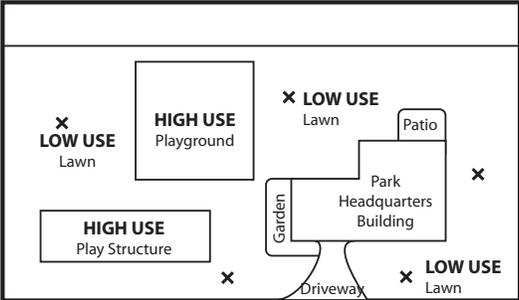
- The Sample Inventory Sheet is included inside the back cover of this booklet for you to use in recording your samples.
- Indicate which samples are composites.
- Until you deliver your individual samples to the lab, store them together in a large ZipLoc™ bag, box, cooler, or similar container with a copy of the inventory sheet for reference.

Step 2

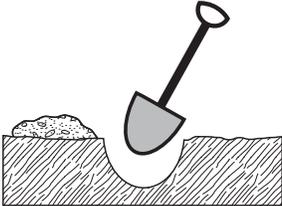
Figure 4 shows an example of how a composite sample is collected.

FIGURE 4 | COMPOSITE SAMPLING | A step-by-step approach

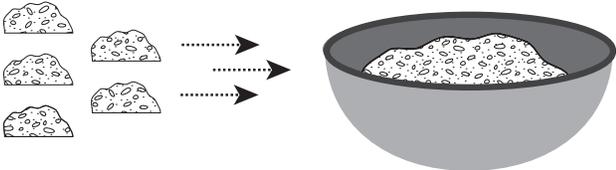
1 | Set composite sampling areas



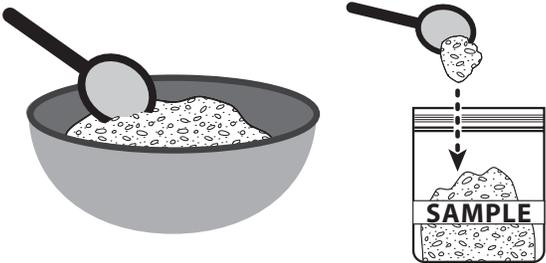
2 | Gather soil from each sampling location



3 | Soil from each location is combined and mixed



4 | Soil sample is taken from mixture and prepared for lab analysis



Step 3

Analyzing the Soil Samples



How are the samples analyzed?

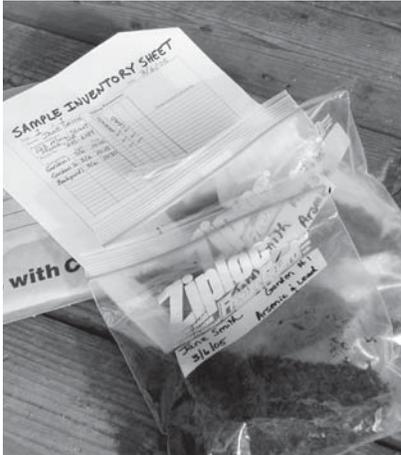
An analytical laboratory must analyze your soil samples to identify the levels of lead and arsenic in the soil. Not all laboratories can conduct this type of analysis. Additional information about finding a lab can be found on page 18. The lab can also provide a general estimate of the cost to analyze your samples.

Transport the samples to the lab as soon as it is convenient. In the meantime, store them in a cool, dark place until they can be delivered to the lab. The samples can be delivered to the lab or shipped using a parcel service. If you will not be able to get the samples to the lab for a week, the samples should be refrigerated. Once the lab receives the samples, they should be able to perform the analysis and report their results to you within three to four weeks.

The lab can use a variety of methods to analyze for total arsenic and lead. You should ask the lab to analyze the samples by one of the following methods:

- Arsenic: SW 846 Methods 6010, 6020, or 7060
- Lead: SW 846 Methods 6010, 6020, or 7421

Step 3



What other instructions should you give to the lab?

- Thoroughly mix each sample prior to analysis.
- The soil grain size in the sample should be less than 2 millimeters (mm), or about a tenth of an inch. If the soil grain size appears to be greater than 2 mm, the lab should screen the samples and remove all soil and debris in the sample greater than 2 mm. This may add to your cost.
- Report the sample concentrations in units of milligrams per kilogram (mg/kg).
- The samples should be reported relative to the dry weight of the soil (i.e., on a dry weight basis).
- The samples have to be analyzed so that very low concentrations can be determined accurately. The reporting limits should be no greater than 5 mg/kg arsenic and 10 mg/kg lead.

Should I have the lab analyze for both arsenic and lead?

Generally, soil samples are analyzed for both arsenic and lead to get the best understanding of soil pollution on your property, especially if young children are likely to be exposed. For counties in western Washington affected by smelter emissions, it is acceptable to test only for arsenic because if arsenic concentrations are low, lead should also be low. Please refer to Table 1 to see if limiting your analysis to one chemical is possible.

Step 3

Table 1: Sources of Contamination Related to Lab Analysis

Ask the lab to analyze for:	If the source of contamination is:	
	Smelter emissions	Lead-arsenate pesticides
<i>Arsenic only</i>	Yes, if cost is a concern, you can have the lab analyze just for arsenic. Lead is usually present if arsenic is present. Arsenic is the greater health threat.	Not recommended.
<i>Lead only</i>	Not recommended.	Not recommended.
<i>Both Arsenic and Lead</i>	Recommended for soil samples taken from child use areas.	Yes, you may find just arsenic, just lead, or both.

Step 3

How do I find an analytical lab that can complete these tests?

Analytical labs are listed in the yellow pages. You do not necessarily need to use a lab near your home because many labs can work with you through the mail. Only a few labs can analyze metals in soil.

Ecology maintains a list of labs that are accredited by the state to perform soil analyses using methods 6010, 6020, 7060 (arsenic only) or 7421 (lead only). The web-site, <http://www.ecy.wa.gov/apps/eap/acclabs/labquery.asp> may help you locate an appropriate lab to analyze your samples. If you have questions about using the web-site or would like Ecology to send you a current list of labs, please contact us at the phone numbers listed on page 20.

When you talk to the lab, you should ask the following questions:

- Can they analyze arsenic and lead in soil by methods 6010, 6020, 7060 (arsenic) or 7421 (lead)?
- Can they screen the sample to 2 mm if necessary?
- Can you mail samples to them?
- How much will it cost?
- How long will it take?

If the answer to the first two questions is yes, the lab should be able to provide you with an accurate analysis.

Step 3

What should I do with the lab results?

Once you have received your soil test results from the lab, you will need to compare them to the arsenic and lead levels listed in Table 2. The lab will most likely report your arsenic and lead levels in mg/kg. The higher the levels, the greater the potential for health risk. Table 2 lists a range of arsenic and lead levels that are considered unsafe for areas where children play. If your lab results fall within this range, you should plan to take actions to prevent or minimize children's contact with soil. If your lab results are greater than the upper value of the range, you should take immediate actions to limit soil contact.

The range of arsenic and lead levels considered to be unsafe for schools and

childcares is lower than the levels for parks and camps. This is because children typically spend more time playing at their school or childcare than at their local park or camp. Regular contact with polluted soil increases the potential for health risk, so Ecology sets lower levels for these areas. Contact Ecology if your sampling results are greater than the levels listed in Table 2.

In addition to contacting Ecology, there are soil safety actions that you can take to protect children in your care. These actions are described in the soil safety guides available through Ecology or your local health department or district.

Table 2: Range of arsenic and lead levels in soil considered to be unsafe for areas where children play

		Arsenic Level	Lead Level
Average of all samples	Schools and Childcares	20 to 100 mg/kg*	250 to 500 mg/kg*
	Parks and Camps	20 to 200 mg/kg*	250 to 700 mg/kg*
Any one sample	Schools and Childcares	40 to 200 mg/kg*	500 to 1,000 mg/kg*
	Parks and Camps	40 to 400 mg/kg*	700 to 1,400 mg/kg*

*mg/kg or ppm = milligrams per kilogram or parts per million

Help is Available

The Washington State Department of Ecology or your local health department or district can help as you plan each step. We want you to succeed in protecting children, employees, and yourself from harmful lead and arsenic in soil.

Learn more about soil safety

Soil safety guides with step-by-step instructions are available to help you through simple actions to protect the children in your care. Please call your regional Department of Ecology office or local health department or district for these guides.

Learn about funding

Funding options are available and vary by region. Public properties, such as schools or parks, may apply for state remedial action grants to help pay for testing, covering, mixing, and removing polluted soil. These grants require a 50% match.

Information is available from your regional Department of Ecology office

To find Ecology staff in your region to assist you with polluted soil, visit the Ecology web-site: http://www.ecy.wa.gov/programs/tcp/sites/dirt_alert/dirt_alert_hp.htm, or call:

Northwest Region: 425-649-7000

Southwest Region: 360-407-6300

Central Region: 509-575-2490

Eastern Region: 509-329-3400

Summary of Steps 1–3

STEP 1: Planning the Sampling

- Divide your large property into high-use and low-use areas according to where children play.
- Identify where to collect a minimum of four samples from each use area.
- Flag or stake your sampling locations.
- Prepare a site diagram that shows sample locations, number of samples, and depths (6 inches deep for most samples).
- Select a lab to analyze the samples.

STEP 2: Collecting the Soil Samples

- Collect your soil sampling equipment.
 - Shovel, trowel or bulb planter.
 - Clean stainless-steel or plastic spoon.
 - Permanent marking pen.
 - Small ZipLoc™ plastic bags or 4 oz. glass sampling containers.
 - Paper towels, or wash bucket and scrub brush.
 - A large stainless-steel, plastic, or glass bowl (if you are going to mix individual soil samples together).
- Collect the soil samples.
 - Follow the Healthy Sampling Steps on page 12.
 - Using the permanent marker, label a ZipLoc™ bag or glass container with the following information: the number or name of the sampling location; your name; date; and what you want to analyze (arsenic and lead).
 - Clear away any debris or grass from the soil surface.
 - Dig a 6-inch deep hole with your shovel, trowel or bulb planter.
 - Using the spoon, scrape soil from the sides of the hole and fill up a plastic bag or jar. Avoid or discard pebbles, rocks, leaves, roots, and stems. Be sure to collect soil from throughout the entire depth of the hole.
 - Clean the spoon using a paper towel or wash bucket and scrub brush. If the spoon is to be used for another sample, it should be free from any visible dirt.
 - Seal the sample jar or ZipLoc™ bag securely.

- If you want to create a composite sample:
 - Collect all individual samples from an area. Then, put equal amounts of soil from each sample directly into the large bowl.
 - Mix the soil thoroughly.
 - Using a clean spoon, fill up a plastic bag or jar with the mixed soil.
 - Discard the remaining soil back into the holes.

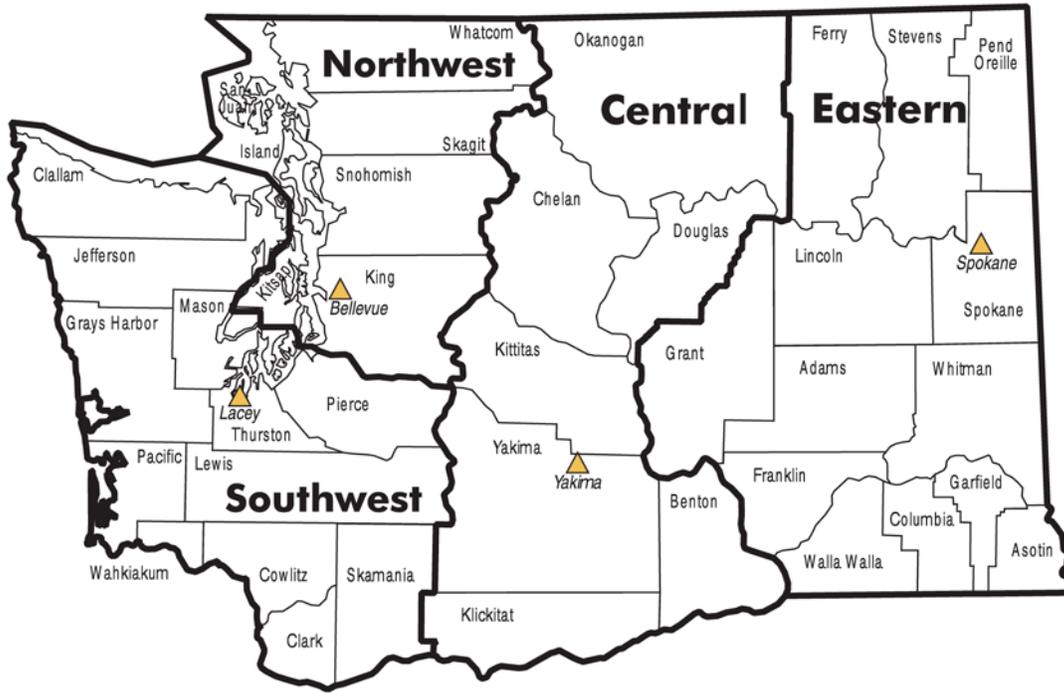
- List all of your soil samples on the Sample Inventory Sheet, included in this booklet for your use.
 - Indicate which samples are composites.
 - Until you deliver your samples to the lab, store them together in a large ZipLoc™ bag, box, cooler or similar container with a copy of the inventory sheet for reference.

STEP 3: Analyzing the Soil Samples

Tell the lab to:

- Screen samples to 2 mm (1/10 inch) if necessary.
- Report on dry-weight basis.
- Report in units of mg/kg.
- Use one of these methods:
 - Arsenic: SW 846 Methods 6010, 6020, or 7060.
 - Lead: SW 846 Methods 6010, 6020, or 7421.
- Analyze with reporting limits no greater than: 10 mg/kg (lead) or 5 mg/kg (arsenic).

Sketch diagram of your property here:



▲ = Regional Office Location



Your local health department or district may have information about lead or arsenic in your area.

If you need this publication in an alternate format, please contact the Toxics Cleanup Program at 360-407-7170. For persons with a speech or hearing impairment call 711 for relay service or 800-833-6341 for TTY.



Toxics Cleanup Program
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Olympia, WA 98504-7600