Add-on Test: Heavy Metals- Field Sampling

Add-on tests

The Cornell Assessment of Soil Health packages have a Heavy Metal Contamination analysis available as an add-on test. The complete list of the packages we offer in addition to the add-on tests is available on our website at soilhealthlab.cals.cornell.edu.

Background

Metallic elements are naturally present in the minerals, rocks and soils in the environment. Human activities and manufactured materials can lead to increased metal levels in the soil. *Heavy metals* are a group of contaminant elements that are considered to have potential health effects on plants and humans. While small amounts may required in healthy tissues, the potential for health effects is increased at high exposure levels, particularly over long time periods. Human activities in urban environments that can result in contaminated soils include industrial spills, chemical leaks, garbage dumping, junk automobile storage, paint residues and treated lumber. Soil testing can be used to determine the levels of heavy metals present to assess the suitability of a site to various uses.

When to soil test

Soil can be collected from locations of interest to address questions of potential contamination. Use current visual site information and historic land activities to determine if there are issues of potential soil contamination. For options in land use development, consider where information from soil testing could be useful to inform decisions to minimize exposure risk. The results obtained from testing samples from target locations across a site can be used to develop a map of contaminant levels. When developing a site management plan for a contaminated site, it is important to balance the many known benefits of farming, gardening, outdoor recreation, and consuming fresh fruits and vegetables with possible risks from exposure to soil contaminants.

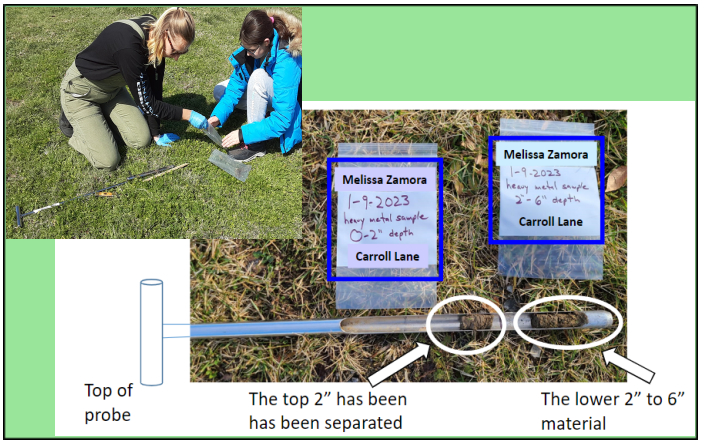

Figure 1. Often soil samples are collected from the 0-6 inch depth. This project sampled to compare contamination in the surface (0- 2") versus subsurface (2"- 6") https://thrivingearthexchange.org/project/corpus-christi-tx/

Soil sampling approaches

A careful analysis of an area is required to develop a sampling plan. Consider locations to sample that will be useful in the understanding of potential contamination. Create a detailed sketch of the zone of interest or save a Google image of the site including landmarks to record the selected sampling target points. Since contaminant levels can vary across a site, choosing a series of sampling locations along a "transect" line can be used. The sampling plan may target specific "hotspots" of interest. Collect samples from locations where information on contaminant levels are desired. More information is available from the Cornell Waste Management Institute's "Guide to Soil Testing and Interpreting Results" (available at cwmi.css.cornell.edu/guidetosoil.pdf).

Figure 2. Urban sites can have complex histories of use and possible contamination. Google Maps is used to identify children play areas **A** and a picnic area **B**. Fine tune the sampling plan on site to accommodate sampling goals and hotspots.
https://earth.google.com/web/@27.80341748,-97.4135765,4.99864372a,453.82256657d,30.00024099y,0h,0t,0r

Add-on Test: Heavy Metals- Field Sampling

Basic protocol

Any field sampling enterprise requires a prepared site map of the location with landmarks. Targeted sampling locations and names are identified the map. Good notes (and pictures) of interesting features will make the information gathering exercise more useful.

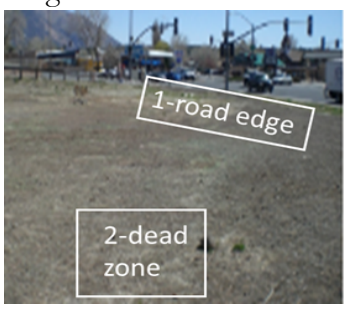

Figure 3. Site maps are essential equipment for targeted soil sampling. Keep notes to help with interpretation of results.

Collecting the samples

At each targeted sampling location, use a clean spade or trowel to create a one cup sample to submit from a composite of several subsamples mixed together in a clean bag or clean pail. Remove surface debris and collect soil from the desired depth(s). Typical depth increments to collect are the surface 2 inches, 2- 6 inches and the 0-6 inch depth in gardens. Label separate bags for each depth increment chosen. Record the depth sampled, date and location (use same name as on the site map). Double bag the samples. Repeat at other locations of interest.

Figure 4. A) A soil probe is very accurate. **B)** A spade or trowel can be used to dig a hole. Sample from the side of the hole.

Submitting samples

Use the Individual Soil Analyses submission form found at the Cornell Soil Health lab website https://soilhealthlab.cals.cornell.edu/testing-services/ Record the number of heavy metal test sample analyses desired. Send samples in a box to the address on the form. Invoicing arrives after the results, usually about four weeks.

Interpretation

Lab analyses of soils for heavy metals generally involves dissolving the sample in strong acid. This solution containing all of the dissolved elements is analyzed and the elements are reported in parts per million (ppm). While there are no standard levels for metals protective of human health, guidance values have been developed. These levels and typical background levels are presented in the table below.

Metals commonly found in urban garden soils: Guidance values and background levels [a]

Metal	Level in soil (parts per million [ppm])		
	Guidance Value Protective of Public Health	NYS Rural Background Level	NYC Urban Background Level
Arsenic	16	< 0.2 - 12	4.1 - 26
Barium	350	4 - 170	46 - 200
Cadmium	2.5	< 0.05 - 2.4	0.27 - 1.0
Chromium	36	1 - 20	15 - 53
Copper [b]	270	2 - 32	23 - 110
Lead	400	3 - 72	48 - 690
Mercury	0.81	0.01 – 0.20	0.14 – 1.9
Nickel [b]	140	0 - 25	10 - 43
Zinc [b]	2200	10 - 140	64 - 380

[a] References, online in Metals in Urban Garden Soils

[b] Can be toxic to plants at levels below guidance values protective of public health

Table 1. This table is taken from Metals in Urban Garden Soils, https://hdl.handle.net/1813/48147 part of the Healthy Soils, Healthy Communities project uniting New York's urban gardeners with research and education information. HS, HC website at https://blogs.cornell.edu/healthysoils/

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