Groups of Contaminants that Can Be Found in Urban Soils

	Description	Example of sources	Where is it mostly found?			Hint when to include this analysis when testing soil
			Soil	Ground-water	Behavior	
Heavy metals[1]	Lead, Zinc, Cadmium, Copper, Nickel, Chromium	Vehicle emission, mining, industrial wastes, fertilizers, pesticides, paints, aging water supply infrastructures.	X		Mobility of heavy metals is greatly affected by soil conditions. They are not degraded by bacteria or by chemical action and easily bind with soil particles and organic matter. They are therefore mostly found in the shallow layers of soil.	▪ Residential areas built before 1980s where buildings can contain lead-based paint; ▪ Site close to intense traffic such as highways; ▪ Site used for agriculture; ▪ Site close to industrial or mining activities.
Polycyclic Aromatic Hydrocarbons (PAH)[2],[3]	Hundreds of different chemicals. Example of compounds are Benzo(a)pyrene, anthracene, phenanthrene.	These compounds are formed during incomplete combustion of organic matter like coal, oil, garbage or wood (wildfire). They deposit on the soil through air emission.	X		PAH are not soluble with water and are immobile in the environment. They easily bind to soil particles and are therefore mostly found in the shallow layers of soil.	▪ Site close to intense traffic such as highways; ▪ When wildfire has occurred, presence of (wood) ash or site close to (waste) burning facility; ▪ Use of crude oil products, storage tank leaks
Organochlorine pesticides[4]	Man-made chemicals. Examples are Aldrin, Benzene hexachloride (BHC), Chlordane, DDT, DDE, Dieldrin, Endosulfan, Endrin, Heptachlor, Hexachlorobenzene,	Now banned, these pesticides were produced between the 1950s and the 1970s. They were widely used in agriculture and they are persistent in the environment.	X		They have a low solubility in water and easily bind with soil particles. They are not easily broken down. They are mostly found in upper layer of soil.	▪ Site having had long and intensive agricultural use in the past (especially before the 70s).

	Description	Example of sources	Where is it mostly found? Soil	Ground-water	Behavior	Hint when to include this analysis when testing soil
	Methoxychlor, Toxaphene.					
Polychlorinated Biphenyls (PCB)[5]	Man-made organic compounds consisting of carbon, chlorine and hydrogen atoms. They differ by the amount and the position of chlorine atoms in the molecule.	Manufactured from 1930s to 1980s, they were used for their ability to resist to high temperature. Examples of application include cooling systems, transformers, electrical equipment, insulation material and many more. They can be released in the environment from waste sites, industrial wastes, leak from old transformers.	X		PCB strongly binds to soil and tend to stick to organic material. They have a low solubility in water.	▪ Presence of old electrical equipment disposed on site (transformers, cooling equipment); ▪ Illegal dumping, junkyard
Asbestos[6]	Asbestos are natural fibrous minerals present in underground rocks.	Mined from 1850s to 1990s, asbestos was used in building construction materials for insulation and as fire retardant. Asbestos contaminate soil through deposition of fibers from the air.	X		Asbestos does not bind with soil and is not soluble in water. It can be spread by wind and mixed with soil. It is mostly found in the upper layers of soil.	▪ When demolition of building dating from before the 1980s occurred on the site; ▪ Presence of asbestos containing material on the soil.

	Description	Example of sources	Where is it mostly found? Soil	Ground-water	Behavior	Hint when to include this analysis when testing soil
Petroleum hydrocarbons (TPH)[7]	Hundreds of chemical compounds originating from crude oil. Example of compounds are, gasoline, diesel and motor oil.	Underground tank leakage, industrial release, spill runoff from parking lots or roads.	X	X	TPH migrates through the deep layers of soil to the groundwater. Some fractions are lighter than water and will float. Some fractions are volatile and can contaminate the soil air phase.	▪ Site previously used as parking, or tank station, auto repair or auto yard. ▪ Presence of an underground or aboveground storage tank containing petroleum product.
Volatile Organic Compound (VOC)[8]	Manufactured solvents, widely used in the dry-cleaning industry, car and metal industry as a degreasing agent. Include compounds such as tetrachloroethylene (PER), trichloroethylene (TCE), dichloroethylene (CIS), vinylchloride (VC).	VOC contaminate soils mainly because of unproperly disposal of industrial wastes, spills or industrial accident.	X	X	Volatile organic compounds are denser than water and will migrate through the groundwater table until reaching a denser layer. In water, it can migrate miles away from the source. In the soil, it strongly binds to organic matter. These compounds can spread through the soil air to the surface and can penetrate home's inner air.	▪ Site close to or where dry-cleaning activity, metal industry or auto repair shop took place.

Sources:

[1] Raymond A. Wuana and Felix E. Okieimen, "Heavy Metals in Contaminated Soils: A Review of Sources, Chemistry, Risks and Best Available Strategies for Remediation," ISRN Ecology, vol. 2011, Article ID 402647, 20 pages, 2011. doi:10.5402/2011/402647

[2] Registry, A.f.T.S.a.D., *Polycyclic Aromatic Hydrocarbons (PAHs)*, D.o.T.a.H.H. Sciences, Editor. 1996. p. 2.

[3] Hussein I. Abdel-Shafy, Mona S.M. Mansour, A review on polycyclic aromatic hydrocarbons: Source, environmental impact, effect on human health and remediation, In Egyptian Journal of Petroleum, Volume 25, Issue 1, 2016, Pages 107-123, ISSN 1110-0621, https://doi.org/10.1016/j.ejpe.2015.03.011.

(http://www.sciencedirect.com/science/article/pii/S1110062114200237)

[4] Registry, A.f.T.S.a.D., *DDT, DDE, and DDD* D.o.T.a.H.H. Sciences, Editor. 2002. p. 2.

[5] Registry, A.f.T.S.a.D., *Polychlorinated Biphenyls*, D.o.T.a.H.H. Sciences, Editor. 2014. p. 2.

[6] Agency, U.S.E.P. *Learn About Asbestos*. 2016; Available from: https://www.epa.gov/asbestos/learn-about-asbestos#asbestos

[7] Registry, A.f.T.S.a.D., *Total Petroleum Hydrocarbon (TPH)* in *Agency for Toxic Substances and Disease Registry ToxFAQs,* 1999

[8] Registry, A.f.T.S.a.D., *Tetrachloroethylene (PERC)* in *Agency for Toxic Substances and Disease Registry*, 2014