

Health risks from soil

Soil is an integral part of the human environment. In recent years, its hygienic importance for humans has also been increasing in terms of increasing environmental contamination.

Soil pollution

The migration of contaminants is relatively slow, so that soil in terms of environmental contamination is a very stable indicator and has a long-term impact on the environment in the order of tens, hundreds and theoretically several thousand years.

Soil contamination also has the specificity, compared to water and air pollution, that it is not immediately detectable, not perceived by the senses, but is manifested in many cases covertly (e.g. in the case of toxic metal ions, which have the ability to bind in soil structures for a long time, and in the case of substances such as PCBs and PAHs with long persistence times). These types of contaminants eventually enter the human body where they accumulate. The supply of these substances is either direct or via the food chain. The initial stages of soil contamination are therefore difficult to control. The various pollutants may have a background origin in the geological composition of the soil, which is also influenced by climatic conditions, or they may originate from anthropogenic pollution.

Type of pollution

In terms of the degree of soil and dust pollution, the Czech Republic is one of the European regions, countries with a developed industrial agglomeration, where anthropogenic factors are the predominant source of this pollution, compared to the eastern part of Europe, where geological factors are in balance. Soil contamination in the Czech Republic is of a local nature with links to industry, mining and waste disposal. The largest contaminants originate from urban agglomerations, mainly industrial, where negative factors (traffic, industry, local heating plants) accumulate; there is also contamination in the area of gardening colonies, and in urban agglomerations there is serious contamination of recreational areas with pathogenic microorganisms and parasites. Some anomalies in the occurrence of heavy metals are often related to the levels of these metals in the soil substrate.

Chemical contamination

The main contaminants in soil that can cause harm to health are chemicals (toxic metals and persistent organic pollutants) and pathogenic microorganisms.

Toxic metals

The most important here are Cd, Pb, Hg, Zn, Cu, Se, Ni, as well as Cr, V, As, Tl, Be. The persistence of toxic metals in soil depends on the chemical and physical properties of the soil, which influence their continued activity. Many of them are known to have a carcinogenic effect. The child population, especially pre-school children, is more sensitive to the effects of toxic metals. Increased accumulation of toxic metals has been shown in their blood, urine and hair. Food and water contaminated with dust form a significant part of the exposure. Adverse health effects on children also depend on their socio-economic conditions and family lifestyle (it has been shown that children with poorer family security, low income and poorer sanitation are at higher risk of disability in this respect), gender (boys are worse off) and age (children between 3-6 years are most at risk).

 *For more information see Toxic metals.*

Organic substances

Persistent chlorinated organic substances such as polychlorinated biphenyls (PCBs) pose a serious risk; the acute toxicity of PCBs is low; chronic exposure to low doses is significantly more dangerous, due to their ability to persist and bioaccumulate mainly in tissues with higher fat content. Together with polycyclic aromatic hydrocarbons (PAHs), 97% of which originate from emissions from the incomplete combustion or pyrolysis of fossil fuels, they can significantly affect health. The main health risks are carcinogenicity, reduced immunity, impaired reproductive capacity and hormonal imbalances.

Pesticides

The impact of pesticides on the natural functioning of the ecosystem and human health is mostly adverse. Limited use is desirable. Laboratory studies indicate that many pesticides used in the EU today can be toxic to the development of the nervous system, with damage to brain development that can be severe and irreversible. Exposure to pesticides may also increase the risk of developing leukemia in children. A number of pesticides have the ability to disrupt the hormonal system of humans and animals and are classified as endocrine disruptors.

Nitrates (nitrates, group -NO³)

They are capable of inducing alimentary methemoglobinemia in infants and may be precursors of nitrosamines and nitrosamides in other population groups. They are used as nitrogen fertilizers.

Microbial contamination

Thanks to the amount of organic substances and usually enough macrobiotic and trace elements, oxygen and moisture, there are favorable conditions for the growth and existence of microorganisms in the soil. If there are no extreme conditions in the soil (temperature, pH, redox potential, salinity), microorganisms have an almost ideal environment for their existence. However, any change in conditions in the soil environment can cause significant changes in the structure of the microbial population. This is used to assess soil quality, soil contamination, soil conditions, stress factors, and the like. Based on the reaction to changing conditions, microorganisms can be used as bioindicators of various negative effects.

Bacteria

- Autochthonous – natural, the frequency does not depend on the presence of the substrate
 - Pseudomonas, Agrobacterium, Arthrobacter, Streptomyces, Nocardia, myxobacteria, filamentous fungi
- Zymogenous (allochthonous) – they occur in greater quantities if they are sufficient
 - Bacillus, Mycobacterium, some species of Pseudomonas, Enterobacter, Aeromonas
- Pathogenic
 - primary pathogens (soil is a natural habitat) – Clostridium
 - secondary pathogens (enter the soil secondarily and survive in it) – Bacillus anthracis, salmonella, shigela

Viruses

- Enteroviruses
- Polioviruses

Parasites

- Giardia lambda
- Ascaris lumbricoides

The Ministry of Health issued Decree No. 464/2000 Coll., which sets the hygienic requirements for swimming pools, saunas and hygienic limits for outdoor playgrounds.

Exposure rating

For soil, it is necessary to consider the oral, inhalation and dermal routes of exposure. The risk group is primarily children, who receive an estimated 200 to 800 mg of soil per day in soil and soil dust. For adults, the intake from soil is less, approximately 50–100 mg per day. Calculation of the burden estimate from the uptake of toxic metals from contaminated soil indicates a significant percentage of exposure from soil to the ADI drawdown.

References

1. PODOLSKÁ, Zdeňka, – MATĚJŮ, Ladislava,. *Státní zdravotní ústav : Kontaminace půd* [online]. The last revision 11.2.2008, [cit. 2010-11-02]. <<http://www.szu.cz/tema/zivotni-prostredi/puda>>.
2. BENEŠ, Jiří. *Infekční lékařství*. 1. edition. Praha : Galén, 2009. 651 pp. ISBN 978-80-7262-644-1.
3. Centrum preventivního lékařství 3.LF UK. *MANUÁL VIII: ZÁKLADY HODNOCENÍ ZDRAVOTNÍCH RIZIK : Zdravotní rizika z půdy* [online]. [cit. 2010-11-02]. <http://centrumprev.sweb.cz/MANUAL/MANUALVIII-1.htm#_Toc507302088>.
4. Wikipedie. *Kontaminace půdy* [online]. The last revision 25.9.2010, [cit. 2010-11-02]. <https://cs.wikipedia.org/w/index.php?title=Kontaminace_p%C5%AFdy&oldid=5883168>.
5. Wikipedie. *Pesticid* [online]. The last revision 18.8.2010, [cit. 2010-11-02]. <<https://cs.wikipedia.org/w/index.php?title=Pesticid&oldid=5706591>>.
6. DEPARTMENT OF BIOCHEMISTRY - LABORATORY OF MOLECULAR BIOLOGY. *Mikrobiální ekologie Interakce mikroorganismů s člověkem* [online]. The last revision 7.5.2010, [cit. 2010-11-02]. <<http://www.molbio.upol.cz/stranky/vyuka/MB/15.pdf>>.