

## **Traffic intensity and lead content in the soil of Abakan**

Soil is the fertile surface layer of the Earth's lithosphere, which is a heterogeneous open four-part system (solid, liquid, gaseous phase and living organisms) formed by the weathering of rocks and activity of organisms. Soil is the uppermost part of the lithosphere and thus in general inherits its chemical composition. About 50–60 % of the volume and up to 90–97 % of the weight of the soil are mineral components. [1]

Soil pollution – a form of anthropogenic degradation of soil, in which the content of chemicals in soils exposed to anthropogenic impact exceeds the natural regional background levels of their content in the soils. High levels of contamination of a wide number of metals and metalloids (Bi, Hg, Sb, Pb, Cu, Se, Ag, As, Mo, Sn, Cr, Zn), which need different types of production is high. [2]

Technogenic pollution of soil is generally understood as accumulation, associated with industrial or other human activities, of a number of substances and organisms in amounts that reduce the technological, nutritional and sanitary value of crops, degrade the quality associated with other natural objects (surface and ground waters, atmosphere, biocenosis) and leading to the degradation of the soil.

Rationing of chemical contamination of soils is set to the maximum permissible concentrations (MPCs). MPCs – this is such a concentration of a chemical (in mg per kg of soil in the plow layer), which should not cause direct or indirect negative impact on contact with the soil environment and human health, as well as the soil's ability to cleanse itself. [3]

Lead, aldehydes, sulfur oxide are among the most dangerous substances.

**Contamination of soil with metals.** Heavy metal pollution – an excess accumulation of chemical elements of ecotoxic group in the soil, typically Pb, Cu, Zn, Cd, Cr, Ni, Co, Sb, Sn, Bi, Hg, Mo, V, Mn, Ti, W.

Heavy metal soil contamination has two major downsides. First, it causes interruptions in the food chain from soil to plants and from plants into the body of animals and humans. Heavy metals cause serious illnesses thus impeding growth of population by raising morbidity and reducing life expectancy, as well as reducing the quantity and quality of crop yields and livestock production [4].

Secondly, accumulation of large quantities of heavy metals in the soil may lead to change many of soil properties. First of all, the changes affect the biological properties of the soil: reduced total number of microorganisms, narrowed down biota variety (species composition), changes in main microbiological processes and falling activity of soil enzymes, etc. Strong contamination with heavy metals leads to changes in more conservative features of the soil, such as humus status, structure, pH and others. The result of this is partial, and in some cases, complete loss of soil fertility. [5]

We decided to analyze soil samples and find out level of heavy metal contamination in Abakan.

**Sampling.** The soil was taken at a distance of 1–2 meters from the road with a depth of 20–25 cm. The sample mass of about 0.5 kg.

For this study 7 sampling plots were defined in different directions of the wind rose and characterized by different level of transport intensity. The south-western direction prevails during the year. Dangerous direction of the wind in terms of air pollution to the residential areas of the city of Abakan are West (13 %) and Northwest (4 %). Thus, the high frequency of calms and light winds combined with temperature inversions in winter causes the most adverse weather conditions for dispersion of pollutants in the atmosphere of the city. Lead ion content was determined using standard procedure (see [6]) in a chemistry lab of school no. 43 of Abakan.

Table 1

*Lead ion content and traffic intensity in Abakan, 2013*

№ п/п	Test area	Cars per 5 min	Correlation coefficient	The presence of lead ions					
				1	2	3	4	5	Average
1	Central Park	2	0,55	1	1	2	1	1	1,2
2	South exit from Abakan	38	0,635	2	3	2	2	3	2,4
3	Central Market	115	0,65	2	3	2	3	3	2,6
4	Central Post Office	136	0,77	3	3	4	3	3	3,2
5	Krylov St	100	0,51	1	1	2	1	2	1,4
6	Druzhba Hotel	109	0,74	2	3	2	3	2	2,4
7	MPS	89	0,53	2	2	1	2	2	1,8
	AVERAGE		0,63						

The lead content is low enough so that the differences in areas quite low. Possibly, a small score is due to the fact that use of lead ethyl as a fuel additive is prohibited in Russia since 2002, but, nevertheless, accumulated lead was found in all the sampled areas.

Today there are more than 40 thousand cars in Abakan, so traffic is quite intense. Since the activity of transport should influence the composition of the soil pollutants we made counts of cars passing by at the sampling areas. Three counts were made at each location and average number was taken.

In order to determine whether there is a relationship between the number of vehicles and ion content in the soil, we determined the coefficient of correlation using the Microsoft Office Excel 2013.

The contents of lead ions in the soil shows strong correlation with the transport activity (0.63), probably, most of the lead in the soil is the exhaust gas of automobiles.

Concluding, soils contain various substances and its constitution is subject to change by the vehicle exhaust gases. Especially dangerous is the accumulation of lead ions, which are carcinogens, their presence leads to the death of soil animals, their accumulation in plants, as well as and the possibility of getting them into the human body. Exhaust gases influence soils in the presence of carbonate ions, a gradual acidification leads to a loss of fertility and subdued microbial activity due to which the soil eventually lose the ability to repair itself.

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