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# Case study of lead pollution in the roads of Almaty

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**Abstract**

Lead pollution and its impacts have been studied and evaluated extensively resulting in its use being restricted and banned by many countries. This paper reviews a number of previous studies that have been examining the distribution of lead among other contaminants in the soil near transportation roads. The paper presents the research on lead pollution in the roads of Almaty aiming to raise awareness of the ecological situation in the cities of Kazakhstan. The methodology of the research consists of road selection; choice of method and analysis, sample collection, laboratory tests, result processing and conclusions. Chemical analysis of soil was done by atomic emission and absorption spectrometry – concentrations of lead in the soil exceed the normative (32 mg/kg) in all sampling locations. The results of reference soil samples from the Gorky Park show that the lead concentration in the soil of Almaty could be higher overall all due to the surrounding geological conditions and industrial history. The study found evident correlation between the lead content in the soil from the selected roads and the intensity of traffic on these roads.



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*Keywords:* heavy metal pollution; roadside soil pollution; transportation pollution

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## 1. Introduction

According to the World Health Organization, lead is one of the 10 chemicals detrimental to the health of the population, especially workers, children and women of childbearing age, and requires control by the state.

Road transportation is one of the most significant sources of heavy metal (HM) pollution. Along with the growing human population, traffic intensity is also increasing and is contributing to the roadside soil pollution [1]. Microorganisms are unable to decompose HM therefore HM can cause long term contamination to plants, animals and humans – heightened concentration of HM is a threat to roadside flora and fauna.

Traffic and traffic infrastructure related techno-genic pollution sources of HM can be: depreciation of car parts; incomplete combustion of fuel; engine oil leakage; vehicular exhaust catalysts; HM additives in the fuel; depreciation of the road infrastructure and road maintenance. The amount of HM in the roadside soil is influenced by road design, type of fuel used, traffic density (vehicles per day), driving speed, driving behavior, etc.

The ecological situation in towns and cities of Kazakhstan requires great attention. The majority of urbanized ecosystems including the city Almaty have asphalt pavements that interfere with normal self-cleaning processes of soil. Toxic substances are used both in the production of fuel for vehicles, and in the production of asphalt concrete. Emissions of lead and other HM noticeably exceed the permissible norms in soils exposed to intensive traffic. Microorganisms of soil can be valid indicators for evaluation of the techno-genic impact of asphalt pavements and chemical pollution on the state of soil.

## 2. Literature review

Research by Werkenthin et al. [2] demonstrates that high lead concentrations can be observed near roads – contaminant concentrations are the highest in the distance of 0 to 5 meters from roads.

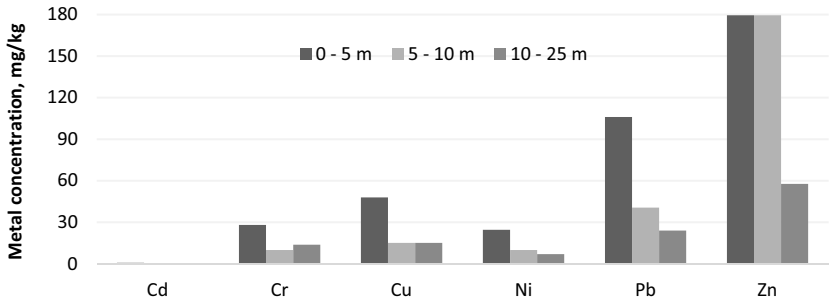


Fig. 1. Metal concentrations in different distances from the road.

Fig. 1 illustrates that the nearer the roads, the higher the concentrations of HM in the soil. The highest concentrations overall can be observed for zinc. According to Werkenthin M. et al., soil within 0–5 metres from the road is built up and contaminants mostly are distributed there due to the road runoff and road embankment slope. Soil within the distance 5 m to 10 m is disturbed and particles are mostly distributed there with splashing water. Soil that is further than 10 m from the road is undisturbed and HM are mainly carried there by the wind. The highest decrease in the concentration due to increase of the distance can be observed for lead.