



Using biogeochemical complex approach in soil contamination risk assessment for human health

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Crimean peninsula shows a remarkably wide range of biogeochemical characteristics. Soil contamination, human consumption of contaminating substances and impacts on human health strongly depends on these characteristics. As such it is important to determine the acceptable limits for pollutants assuming regional specificities. This approach was proposed by expert groups of European LRTAP Convention and is used along with other approaches suggested by authors to provide integration of medical and ecological monitoring data on Crimea territory.

Methods. Concentrations of heavy metals (HM) were determined by atomic absorption and X-ray fluorescence methods in soil samples, selected agricultural products (foodstuff samples) and human hair of local inhabitants in different regions of peninsular (urbanized, recreational, rural, residential, natural). To estimate current ecological situation for definite ecosystems critical loads were calculated for Hg, Cd and Pb and their exceedances (method of LRTAP Convention) were estimated based on the field monitoring results. An ecological situation on monitoring sites was estimated based on both European (critical loads) and national (maximum acceptable concentrations) standards. In order to assess human health impacts correlation analysis of biomonitoring and physiological data of functional state of human body systems was carried out.

Results. The results indicate that HM content differs depending on biogeochemical and anthropogenic soil characteristics and in some sites exceeded for Pb (10-513 mg/kg), Cr (9-123 mg/kg), o (1-40 mg/kg), Sr (121-774 mg/kg), V (23-171 mg/kg), Ni (18-86 mg/kg), Zn (78-347 mg/kg) and did not exceed for Hg and Cd according to the national or European standards. For Cd and Pb exceedances were revealed in agricultural products. Similar situation was observed for hair content of toxic metals (Pb, Cd, Cr) while the content of essential elements (Fe, Zn, Mn, Cu) was lower than normal reference ranges. Large number of revealed correlations suggests significant impact on nervous, immune and cardiovascular systems for some metals even being present within normal ranges (Hg) in human hair. Methods are suggested for quantitative estimation of metal-induced effects on central, autonomic nervous, cardiovascular and immune systems and human health risk assessment based on obtained data of correlation and multiple regression analysis.

Conclusion. Results indicate that complex approach is needed for risk assessment of soil contamination for human health and possible perspectives for future applications of given approaches in relation to ecological and anthropogenic conditions of Crimean peninsula as a model for other similar biogeochemical regions.

This research was supported by the V.I. Vernadsky Crimean Federal University's Development Programme 2015-2024, within the project entitled "Application-Based Support for the University's Staff Academic Mobility 2017" at RUDN University of Russia.