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The indicators of soil and plants resistance to the contamination by heavy metals under technogenic emission

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The effect of soil properties and distance from the source of technogenic emission on the input of Pb, Zn, Cd, Cu, Mn, Cr, and Ni into daisy family plants (Asteraceae) has been studied. Novocherkassk power plant (NPP) is the largest power plant in the South of Russia. It has been found that the high level of anthropogenic load related to the atmospheric emissions favors the accumulation of heavy metals (HMs) in herbaceous plants. Contamination with Pb, Cd, Cr, and Ni is revealed in plants growing near the NPP. Coefficients characterizing the resistance of soil to pollution have been proposed. These are the mobility coefficients of the HMs in the soils and the stability coefficients of the soils for the HMs. The studied soils formed the following sequence according to the degree of resistance to the contamination with HMs: Phaeozems Calcaric > Haplic Chernozem > Fluvisol. The main factors affecting the distribution of HMs in the above- and underground organs of plants include individual physiological features of plant species controlling the barrier functions of different plant organs. Ambrosia artemisiifolia L., Artemisia austriaca Pall. ex.Wild. Jack., and Tanacetum vulgare L. are accumulators of HMs. The resistance of herbaceous plants to pollution has been determined from the acropetal coefficient and actual biogeochemical mobility of HMs. Ambrosia artemisiifolia L. is most resistant to contamination with Mn; Achillea nobilis L. is most resistant to Pb, Ni, and Cd; Cichorium intybus L. is most resistant to Zn and Cu. Significant accumulation of Cr in different species of daisy family is established, which can be a regional feature of plants in the Lower Don region, which grow on soils with the high initial content of this element. Three zones of risk of the soil contamination with metals were determined in the studied territory: the zone of high risk, up to 1.6 km to the NW (the dominating direction of the wind); the zone of medium risk of contamination, a similar distance to the N, NNW, and NE; and the zone of low risk of contamination, more than 5 km to the NW and more than 3 km to the SW from the NPS.

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