

Novocherkassk Power Station emissions effect on PAHs accumulation in the adjoining soils

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Polycyclic aromatic hydrocarbons (PAHs) are one of the most significant groups of hydrophobic organic compounds affecting all living organism by their mutagenicity and carcinogenicity. From 16 up to 32 PAHs compounds are subjected to monitoring by a legislative regulation. PAHs are widely distributed environmental toxicants primarily formed during the incomplete combustion of organic materials (for example, coal, oil, gasoline and wood). That's why power energy plants are the main sources of organic contaminants including PAHs because of their using of coal for electricity producing. The purpose of the present study was monitoring of the Novocherkassk Electric Power Station (NEPS) emission zone soils contaminated by PAHs. The regional levels, types (groups) and spatial distribution of 16 priority PAHs were investigated. The monitoring sites were located on fallow lands of the 20 km around NEPS. PAHs extraction from collected soil samples was performed using the ecologically clean express-method of subcritical water extraction. The study of PAHs content in 20cm soil layer of monitoring sites located in the zone of NEPS aerotechnogenic impact showed intensive accumulation of polyarenes in 2016 that increased in 2017. The 16 priority PAHs total concentration in 20cm soil layer of monitoring sites in NW direction of predominant winds from NEPS was $1196,9 \pm 17,0$ - $1000,0 \pm 17,0 \mu\text{g kg}^{-1}$ in 2016 to $1514,1 \pm 12,1$ - $1196,9 \pm 17,0 \mu\text{g kg}^{-1}$ in 2017. A similar trend was observed at monitoring sites located in other directions from the source of emissions. The 16 priority PAHs total concentration was $580,8 \pm 6,6 \mu\text{g kg}^{-1}$ in soil for monitoring sites around NEPS in 2016. It was observed the increase of PAHs total concentration for this sites up to $946,3 \pm 7,4 \mu\text{g kg}^{-1}$ in 2017. The level of total PAHs concentrations varied from $383,3 \pm 11,6 \mu\text{g kg}^{-1}$ up to $842,5 \pm 8,4 \mu\text{g kg}^{-1}$ in 2016 and from $600,3 \pm 11,0 \mu\text{g kg}^{-1}$ up to $1135,2 \pm 13,4 \mu\text{g kg}^{-1}$. The total PAHs content in monitoring site no. 5 (1,2 km w) was the highest for all sites around NEPS from $863,5 \mu\text{g kg}^{-1}$ up to $2168,0 \mu\text{g kg}^{-1}$ that connected mostly on location. Site no. 5 (1,2 km w) situated most close to the NEPS, but it is less affected compare to site no. 4 (1,6 km nw) caused by predominant winds direction out of this site. The ratio of high- and low-molecular weight PAHs content in soils of monitoring sites was taken as an index of environmental soil contamination. The high-molecular weight PAHs concentration prevailed in monitoring sites soils situated in direction of predominant winds from NEPS, while the concentration of low-molecular weight PAHs prevailed in the monitoring sites soils situated around NEPS. Soil properties also influenced PAHs accumulation. Polyarenes content in Haplic Chernozems and Haplic Chernozems (Stagnic) was higher versus Fluvisols. This study provides the understanding and model the fate of PAHs in regional technogenic landscape.

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