

BACKGROUND LEVELS OF NATURAL AND ARTIFICIAL RADIONUCLIDES IN SOILS OF THE LOCAL AREA OF THE EURASIAN STEPPE ZONE: CONTRIBUTION TO GLOBAL ENVIRONMENTAL MONITORING

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This study presents the findings on background content of natural (^{238}U , ^{235}U , ^{232}Th , ^{226}Ra , ^{210}Pb , ^{212}Pb , ^{214}Pb , ^{40}K) and artificial (^{137}Cs , ^{90}Sr , ^{241}Am , $^{239+240}\text{Pu}$) radionuclides in soils of the local zone of the Eurasian Steppe located within the territory of the Republic of Kazakhstan. The study area is located within 49-55°N and 65-75°E and covers steppe and forest-steppe landscapes. The area geographically belongs to the mean latitudes zone of the Northern Hemisphere, which is characterized by an increased density of global precipitation of artificial radionuclides. The data obtained make it possible to assess the current radiation status of the area, determine the spatial distribution of radionuclides, and form a base of initial values for subsequent radiation monitoring. The studies are important both for the regional analysis of the state of the environment and for the generation of global reference data used in environmental monitoring and assessment of interest areas for siting of radiation-hazardous objects. In the study area, 3 research profiles along the meridians 65°, 70° and 75° E were laid. The length of the profiles was about 440-540 km and was limited to latitudes from 49° to 55° N. In each profile, a spot sampling of 15 topsoil samples was accomplished from a depth of 0-5 cm. After the samples were prepared for the laboratory analysis (drying, removal of stones and plant inclusions, sieving, grinding, homogenization), the activity concentrations of natural and artificial radionuclides were determined. The activity concentrations of ^{137}Cs , ^{241}Am , ^{238}U , ^{235}U , ^{232}Th , ^{226}Ra , ^{210}Pb , ^{212}Pb , ^{214}Pb , ^{40}K were determined by direct gamma-ray spectrometric measurement, ^{90}Sr and $^{239+240}\text{Pu}$ by β - and α -spectrometric methods, respectively preceded by radiochemical preparation.

Mean values were determined as a result of studies using statistical data processing methods (arithmetic mean for natural radionuclides, geometric mean for artificial radionuclides) of the activity concentrations of radionuclides in the soil cover with a 95% confidence level: ^{238}U – 24-26 Bq/kg, ^{235}U – 1.1-1.4 Bq/kg, ^{232}Th – 32-37 Bq/kg, ^{226}Ra – 30-35 Bq/kg, ^{210}Pb – 65-74 Bq/kg, ^{212}Pb – 32-37 Bq/kg, ^{214}Pb – 20-23 Bq/kg, ^{40}K – 513-600 Bq/kg and ^{137}Cs – 8-14 Bq/kg, for ^{241}Am – 0.14-0.24 Bq/kg, for ^{90}Sr – 1.6-3.1 Bq/kg and for $^{239+240}\text{Pu}$ – 0.35-0.53 Bq/kg. The data obtained can serve as reference values for long-term radiation monitoring and detection of changes in the radiation background as a result of human impact.

Studies of the vertical distribution of radionuclides in the soil profile and in fractions of soil microaggregates of various dispersity have also been conducted to identify the features of their migration and redistribution in various soil components.