

INVESTIGATION OF THE CONTENT OF RADIONUCLIDES IN MONOCOTYLEDONOUS AND DICOTYLEDONOUS PLANTS-DOMINANT BIOGEOCENOSSES OF THE SEMIPALATINSK TEST SITE

On the territory of the experimental sites “Experimental Field”, “Balapan”, “Degelen” of the Semipalatinsk landfill, we identified 505 species of vascular plants. The radioecological range of their growth is wide: from background doses (10-20 $\mu\text{R/h}$) to dangerous (3,000- 6,300 $\mu\text{R/h}$) and especially dangerous ($>6,300$ $\mu\text{R/h}$) (in accordance with the radiation safety standards of the Republic of Kazakhstan, 1996). Most of the plants ($>70\%$) grow at an exposure dose rate of 60-3,000 $\mu\text{r/hour}$ of gamma radiation.

The analysis of the data of the gamma-spectrometric analysis of ash samples of soils, roots and the aboveground part of plants revealed the individual characteristics of the studied dominant species to accumulate certain radionuclides. The greatest number of radionuclides accumulate in meadow ecosystems.

In meadow ecosystems, the most intensive migration of radionuclides occurs from soils to soil solution \rightarrow to plant roots \rightarrow to the aboveground part of plants.

The main pollutants of meadow soils are Cs137 (from 3 200 to 8 552 Bq/kg), beta emitters (from 16 970 to 40 200 Bq/kg), and at least alpha emitters (from 2,100 to 3,970 Bq/kg).

Cs137 accumulates in the roots of dominant plant species in monocotyledonous plants from 1 332 to 3200 Bq/kg, in dicotyledonous plants –from 1 351 to 3 100 Bq/kg. Beta-emitters in the roots of monocotyledonous plants accumulate from 14 400 to 462 000 Bq/kg, in dicotyledonous plants –from 79,100 to 2,240,000 Bq/kg. Alpha-emitters were detected in the roots of monocotyledonous plants 1 600-6 700 Bq/kg, in the roots of dicotyledonous plants 2 100-5 580 Bq/kg (Table 1).

In the aboveground part of the dominant plant species, Cs137 accumulates in monocotyledonous plants 120-392 Bq/kg, in dicotyledonous plants 438-685 Bq/kg. Beta-emitters accumulate in monocotyledonous plants 87 000-260 000 Bq/kg, in dicotyledonous plants 82200 -229 400 Bq/kg. Alpha-emitters accumulate in monocotyledonous plants from 380-1 380 Bq/kg, in dicotyledonous plants from 350-1 400 Bq/kg.

The dominants represented by dicotyledonous plants are hyperaccumulators. This is *Inula britannica*, accumulating in the aboveground part up to 680 Bq/kg Cs137, *Glycyrrhiza uralensis* –438 Bq/kg, *Sanguisorba officinalis* –446 Bq/kg, *Galatella biflora* –533 Bq/kg, *Potentilla acaulis* –390 Bq/kg. Dominant representatives of monocotyledonous plants accumulate in the aboveground part up to 325 Bq/kg Cs137 in *Elytrigia repens*, 238 Bq/kg in *Calamagrostis epigeios* and 382 Bq/kg in *Achnatherum splendens*. The meadow communities formed by these dominants produce significant biomass in the aboveground part. The grass stands of these communities are suitable for haymaking. The yield of hayfields is 18.5-20.0 c/ha in dry form and 36.2-94.0 c/ha in green mass. The weight of the aboveground part of the biomass reaches 3 610 –5 260 kg/ha. Of these, 168-2 250 kg/ha belongs to monocotyledonous plants and 193-3 250 kg/ha to dicotyledonous plants.

In halophytic ecosystems, Cs137 accumulates in soils (in a layer of 0-5 cm) 2 207-2 256 Bq/kg. In the roots of dicotyledonous plants, its content ranges from 76 (*Halimione verrucifera*) up to 82 Bq/kg (*Halocnemum strobilaceum*), in the aboveground part 113 and 556 Bq/kg, respectively.

In zonal ecosystems, a high content of Am241 in soils (in a layer of 0-13 cm) from 5 132 to 12 492 Bq/kg was recorded. In the roots of plants, it ranges from 59 Bq/kg (dicotyledonous) to 255 (monocotyledonous), in the aboveground part, respectively, 43 and 37 Bq/kg.

In zonal ecosystems, a significant content of Eu152,154 in soils (in a layer of 0-13 cm) 3 144-3 540 Bq/kg was also detected. In the roots of dicotyledonous plants, it ranges from 384 (*Artemisia marschalliana*) to 549 Bq/kg in monocotyledons (*Stipa sareptana*), in the aboveground part of plants, respectively, 116 and 182 Bq/ kg.

Analysis of the content of β - emitters revealed a high selective ability in some plants to accumulate them. Thus, *Sanguisorba officinalis* accumulates up to 2 240 000 Bq/kg in the roots, 713 000- 1 100 000 Bq/kg in the aboveground part (41 000 Bq/kg in the 0-10cm soil layer), *Calamagrostis epigeios*, respectively 186 600-460 000 Bq/kg (in the roots) and 189 820-260 000 Bq/ kg (in the aboveground part), in the soil layer 0-10cm 41 600 Bq/kg. *Leymus angustus* accumulates in the roots up to 102 000 Bq/kg, in the aboveground part up to 79 000 Bq/kg (in the soil layer 0-15cm –16 970 Bq/kg) (Table 1).

Analysis of the content of α -emitters revealed a high selective ability in all studied monocotyledonous and dicotyledonous plants - mesophytes, dominants of meadow communities to accumulate more radionuclides in the roots than in the aboveground part. This is typical for *Galatella biflora*: 3 880 –5 600 Bq/kg (in the roots)

and 350-1 100 Bq/kg (in the aboveground part), for *Elytrigia repens*: 3 900-6 500 Bq/kg (in the roots) and 390 Bq/kg (in the aboveground part), *Calamagrostis epigeios*: 6 780-18 600 Bq/kg (in the roots) and 400-1 000 in the ground part, for *Inula britannica*: 1 700-2 100 Bq/kg (in the roots) and 390 Bq/kg (in the aboveground part).

Section

Radiation ecology and methods of analysis (Section 3)

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