

# COMPARISON OF THE SOIL RADIOACTIVE AND HEAVY METALS POLLUTION WITH PHYSIOLOGICAL PARAMETERS OF TEST PLANTS AT THE FACILITIES OF SUKHACHEVSKY INDUSTRIAL SITE

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The work aimed to assess the impact of Baza S uranium ore storage site and Sukhachevskoye uranium mill tailing impoundment on physiological parameters of test plants.

For the city of Kamenskoye and the Dnipropetrovsk region there is much tension around the issue of handling radioactive waste from the uranium production of the former Production Association "Pridneprovsky Chemical Plant" (PCP), one of the largest uranium processing enterprises in the Soviet Union from 1948 to 1991.

Taking into account that the processed raw materials and wastes of the PCP production are sources of radiation and chemical hazards, the study of the distribution of radionuclides, heavy metals and associated chemical elements is important.

On the territory of the investigated objects 20 samples of the upper soil layer were taken, 10 points on the uranium ore storage "Baza S" and 10 points along the internal contour of the second section of the uranium mill tailing impoundment "Sukhachevskoe". Samples of soil were taken in the places where the test plants grew. As a control point, the soil taken in the area of the Kamenskoye meteorological station was used.

To determine the sterility of the pollen, *Barbaréa vulgáris*, *Sálvia officinális* and *Chelidónium majus* were used as test plants. For the growth test, we used *Raphanus sativus* and *Secále cereále*.

The content of natural and man-induced radio nuclides is given as well as exposure dose rate.  $U^{238}$ ,  $Th^{230}$ ,  $Ra^{226}$ ,  $Pb^{210}$ ,  $Th^{232}$ ,  $K^{40}$  and  $Cs^{137}$  concentrations were measured using HPGe low-background semi-conductor gamma-spectrometer with GMX40 ORTEC detector, exposure dose rate of gamma radiation was measured using DKS 97 dosimeter.

Specific activity of radionuclides at the sampling points at the uranium ore storage "Baza S" (kBq / kg): – of the uranium series:  $U^{238} = 0.03 - 13.2$ ,  $Th^{230} = 0.03 - 14.9$ ,  $Ra^{226} = 0.04 - 12.7$ ,  $Pb^{210} = 0.3 - 0.35$ ; – thorium series:  $Th^{232} = 0.02 - 0.51$ ;  $Cs^{137}$  and  $K^{40}$  at the background level.

Using IRIS Intrepid II ICP atomic-emission spectrometer, the content of trace elements As; Cd; Pb; Se; Zn; B; Co; Cr; Cu; Ni; Sb; Al; Ba; Mn; Sr; V and accompanying elements was measured. Correlations were established between radionuclide specific activity and metal concentration in soil of Baza S uranium ore storage site.

The content of the mobile forms the I–III hazard classes and accompanying elements in the soil of the uranium ore storage "Baza S" far exceeds the concentration on the uranium mill tailing impoundment "Sukhachevskoe".

Comparison of data about the bioindicator damage with the magnitude of the gamma radiation exposure dose and the specific activity of radionuclides in the territory of the uranium ore storage "Baza S" and the second section of uranium mill tailing impoundment "Sukhachevskoe" does not allow to make a firm conclusion about the correlation dependence between these factors.

In general, the value of the test plants pollen sterility on the uranium ore storage "Baza S" is less than in the second section of the uranium mill tailing impoundment "Sukhachevskoe". The depressing effect on the relatively elongated root and culm was exerted by almost all soil samples, but stronger effect was for the uranium mill tailing impoundment "Sukhachevskoe". Only for some samples an increase in the length of the root and culm relative to the control sample was observed.

A correlation was found between the concentration of mobile forms of some elements and the specific activity of the isotope  $U^{238}$ .

**Key words:** Uranium Mill Tailing Impoundment, Uranium Ore Storage, Radionuclides, Heavy Metals, Specific Activity, Exposure Dose Rate of Gamma Radiation, Bioindication