**Assessment of Beta-Emitting Radionuclide Accumulation in Food and Tobacco Products During Long-Term Storage**

**Yuliya Zaripova,\* Alexandr Yushkov, Askhat Bekenov and Kuralay Dyussebayeva**

*Al-Farabi Kazakh National University, 050040 Almaty, Kazakhstan*

\* *e-mail:* [*zarypova.iulyiya1@kaznu.kz*](mailto:zarypova.iulyiya1@kaznu.kz)

According to the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC), by 2030, the number of new cancer cases and cancer-related deaths is expected to increase by more than 20% [1]. In Kazakhstan, cancer incidence rates remain among the highest in the CIS countries, with trachea, bronchus, and lung cancer ranking second among newly diagnosed cases in both genders, accounting for 10.5% (first place among men at 18.4%), and stomach cancer accounting for 7.8% (11.8% in men) [2]. Radon is the leading cause of lung cancer among non-smokers [3], contributing at least 50% to the annual radiation dose. Besides inhalation of radon and its decay progeny (RDP), humans also consume radionuclide-containing food products. Additionally, tobacco smoke not only contains toxic chemical substances but also radioactive heavy elements, which significantly contribute to internal radiation exposure. Many safety standards focus on fresh products, while the effects of long-term storage on the radiation background remain insufficiently studied. Investigating this aspect will allow for the development of new recommendations and regulations to ensure the safety of products stored or sold for extended periods. The aim of this study is to examine the absorption of beta-radionuclides of radon decay products in food and tobacco items during long-term storage.

The objects of the study were food products among the most commonly consumed in the country (according to data from the National Bureau of Statistics [4]) and tobacco products most popular in the Republic of Kazakhstan, with storage periods ranging from 2 months to 3 years. The subject of the study was the specific beta-activity of the samples, as well as the quantitative assessment of Pb-210 and Bi-210 concentrations in the analyzed samples. Radon decay products include beta-emitting radionuclides Pb-210 and Bi-210 with beta particle energies of 0.063 MeV and 1.161 MeV, and half-lives of 22.2 years and 5.012 days, respectively. These are the longest-lived beta radionuclides formed during radon isotope decay, which necessitates accounting for the dose they contribute. Sample preparation for counting was performed according to the standard methodology for counting samples for spectrometric measurements. After sample preparation, beta spectra were obtained using the SKS-99 "SPUTNIK" beta-spectrometric setup equipped with a scintillation detector, with a measurement exposure of at least 10,000 events, followed by calculating the specific beta-activity of the samples. The results showed that when assessing the contribution of long-lived beta radionuclides, the levels of Pb-210 and Bi-210 in the samples did not exceed the permissible values established by the sanitary standards of the Republic of Kazakhstan: 0.12 Bq/kg for Po-210 and 0.2 Bq/kg for Pb-210.

1. Global Cancer Observatory: Cancer Today. Available from: <https://gco.iarc.fr/en>
2. Kazakh Research Institute of Oncology and Radiology. Available from: <https://onco.kz/>
3. Jankovic M.M., Todorovic D.J., Todorovic N.A., Nikolov J. Natural radionuclides in drinking waters in Serbia // Appl. Radiat. Isot. – 2012. – Vol. 70. – p. 2703-2710.
4. Bureau of National Statistics <https://stat.gov.kz/ru/industries/labor-and-income/stat-life/spreadsheets/>