Assessment of lifetime attributable risks from internal radiation exposure

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The method for estimating lifetime attributable risk from internal exposure to radiation with account of the sex and age of an exposed person is presented. Initially it was developed to implement the principle of socially acceptable risk in Russia. By the Russian radiation safety standards the acceptable individual lifetime risk from planned exposure should not exceed 5×10^{-5} and 1×10^{-3} for the members of public and workers respectively. These limits were standardized using ICRP nominal risk coefficients, calculated for a composite population and cannot be used for making prediction of effects of radiation exposure on a real population. Therefore, it is reasonable to use the models recommended by ICRP for estimating radiation risks.

The calculation of radiation risks from internal exposure is based on the modern ICRP models [1] and on the dynamics of equivalent doses in various organs and tissues. The dose coefficients (Sv/Bq) allow to transfer the activity of different radioisotopes in organs and tissues to equivalent radiation doses depending on the time after intake. This information is taken from the ICRP database [2]. The database contains dose coefficients for 738 different radionuclides. Data are available for both inhalation and ingestion radionuclides. For inhalation intake – for each radionuclide, there are dose coefficients for 10 different values of the median aerodynamic diameter (AMAD) activity, μm: (0,001, 0,003, 0,01, 0,03, 0,1, 0,3, 1,0, 3,0, 5,0, 10,0) and three solubility options: slow (S), intermediate (M) and fast (F). In addition, the database takes into account the age at intake of radionuclides. Also, there are separate coefficients for workers and members of public.

The presented method for estimating lifetime attributable risk developed in accordance with international recommendations is the scientific support to the principle of socially acceptable radiation risk. Risk assessments are used for predicting radiation effects on human health as a result of planned, existing and emergency exposure. The method can be useful for experts in radiological protection and radiation hygiene, referring medical practitioners and radiologists, medical physicists and radiobiologists.

References

1. ICRP Publication 103. Eds.: M.F. Kiselev, N.K. Shandala. Moscow, PKF «Alana», 2009. 312 p. Available at: http://www.icrp.org/docs/P103_Russian.pdf (Accessed 16.05.2018). (In Russian).

2. ICRP Database of Dose Coefficients: Workers and Members of the Public; Ver. 3.0, official website. Available at: http://www.icrp.org/page.asp?id=145 (Accessed 16.05.2018).