Abstract

The goal of the doctoral thesis is to present an issue of a human body response to low dose ionizing radiation and an evaluation of the post-irradiation cancer induction probability. The first part includes an overview of radiobiological terms, cancer risk analysis based on an example of the correlation of radon concentration at homes and lung cancer cases, both mortality and morbidity. This part includes as well results of a project, carried out by the author of the dissertation, concerning the individual sensitivity to ionizing radiation and low-dose hyper-radiosensitivity phenomenon. Various radiation risk assessment methods has been presented, demonstrating difficulties in dose-response relationship selection for low-dose radiation region. For this reason, in the second part of this paper, an author made an attempt has been made to combine radiobiological and epidemiological knowledge with mathematical modeling, assuming that in physics human body can be treated as a physical complex system, that is non-linear in response to given stimuli. Biophysical model has been introduced, presenting series of cancer transformation pathway, that starts with single structural damage in genetic material ending on solid tumor creation. The biophysical base for Gompertz function for the description of tumor expansion in time and the analogy of the percolation phenomenon to the process of carcinogenesis in early stages of avascular tumor growth.

Keywords:

radiation physics, low dose of ionizing radiation, biophysical modeling, post-irradiation cancer transformation, adaptive response, hormesis, radiation risk, individual sensitivity to ionizing radiation, dose-response relationship.