PAPER TITLE The Mathematical Model for Risk Assessement

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ABSTRACT (See instructions overleaf)

The suggested model can be used for constructing of the objective number measure of the rising risk of the definite degree of the damage. The effect of such action is described by the binary index when taking two values $e=0$ ("no" effect) and $e=1$ (presence of the effect). The effect $e=e(r,a)$ is the function of two arguments, where a-the dose(intensity of radiation action), r-the resistance. In the simplest case the function $e(r,a)$ may be set by the formula:

$$e=e(r,a)=\begin{cases} 0, & a \leq r \\ 1, & a > r \end{cases} \text{ where } r, a \in [0,\infty).$$

According to this formula the resistance r has a meaning of the "threshold", i.e. the effect is absent as long as the action a will not exceed the meaning r. The probability $P\{r'<r\}$ of r' being smaller than the fixed resistance r is given by the function of distribution $P\{r'<r\}= F_{r'}(r)$. The randomized action of doses a' is introduced by the analogy with randomized resistance r'. It is described by the function of distribution $F_{a'}(a)$: $P\{e'(r)=1\} \approx 1-P\{e'(r)=0\} = 1 - F_{a'}(r)$. The randomized effect $e'(a)$ can be given in the following way:

$$e'(r) =\begin{cases} 0, & \text{with the probabilily } F_{a'}(r); \\ 1, & \text{with the probabilily } 1-F_{a'}(r). \end{cases}$$

"Dose-effect" curve deduced from these relations implies the next information about the action of irradiation: 1) Coinciding with the function of distribution $F_r(r)$, the "dose- effect" curve describes the distribution of meanings of the radioresistance threshold among the individuals of the studied population; 2) The "dose-effect" function being the probability of appearing of the effect $e=1$ at the random taken organism determines the fraction $m(a)$ of the individuals with the observed effect $e=1$ under the action of the dose a; 3) The "dose-effect" function being the mathematical expectation of the effect value observed after the dose a is the measure of the mathematical expectation of the individual damage weight among the population irradiated with dose a.