

The model of quantitative assessment of risk to human health

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Assessment of risk to human health from exposure to environmental factors is a multidisciplinary international concept used for assessment of a health safety degree. Presently we have a practically fully developed and widely implemented theory of health risk assessment covering hazardous factors in the atmospheric air, as well as well developed methodologies for assessing the radiation risk, however the results of researches of risks from physical, biological and other factors need to be systematized. There are no procedures at present for assessment of risk to human health in emergency situations and that is the reason for this study.

Development of a methodology for assessment of risk to human health from exposure to chemical, physical and other environmental pollutants will contribute to development of the theory of risks assessment. The methodology can be used in practical activities of design engineers, environmentalists, heads of companies in assessing environmental impacts and in calculations of sanitary protection zones, etc.

In the United States, methodological approaches to assessment of risk to human health from exposure to chemical factors in the environment are described in documents issued by the Environmental Protection Agency and the National Academy of Sciences (1975-2005) (R 2.1.10.1920-04, US EPA, 1989, WHO/IPCS,1999). The methodology has also been used and developed in methodical documents issued in Canada, Australia and Russia.

The Russia's Directorate for Consumer Rights and Health Protection (Protocol 18) considers acceptable (allowable) level of risk as a criteria of safety of the environment for life and health of citizens (Federal law No.184, On Technical Regulation). The Russia's health legislation also contains a provision on assessment of environmental factor impacts on human health, forecasting of social and economic consequences of the observance of sanitary rules currently in force (Federal Law 52-FZ, On the Sanitary and Epidemiological Welfare of the Population, Article 38). Russia's standard SanPiN 2.2.1/2.1.1.1200-03 establishes a requirement to assess risk for human health when determining the size of sanitary protection zone established around industrial enterprises. Criteria of acceptable (allowable) risk to human health when exposed to chemical factors are described in R 2.1.10.1920-04. The Russia's state-run system of social and hygienic monitoring carried out in its regions serves as an information-analytical basis for assessing and managing risks to human health.

Methodological approaches to risk assessment and management are described in international standards ISO 31010:2009, ISO 73:2009 and ISO 31000:2009, EU Commission

Directives, in technical regulations and regulatory acts applicable in different countries, in departmental methodical papers and some thesis works.

In the Republic of Kazakhstan, assessment of risk to human health in terms of HSE is defined in the Labour Code (Articles 309, 317). Risk assessment when designing sanitary protection zones at Class 1 and Class 2 enterprises is stipulated by the Government Decree No.93, p.41, Methodical Guidelines for Assessment of Risk to Human Health from Chemical Factors of the Environment approved by Order of the Chairman of the Committee for State Sanitary and Epidemiological Surveillance at the Ministry of Health of Kazakhstan No. 117 of December 28, 2007. We used an analytical method and comparative analysis. Quantitative assessment of risk to human health is based on a comparison with standards RFC and MPC for air pollutants (R 2.1.10.1920-04), and maximum allowable limits for physical impacts. The assessment has been carried out in routine and emergency situations. The assessment of working places was performed with the use of hygienic criteria (R 2.2.755-99).

The results of are presented in Table 1 below.

Table 1. Quantitative Assessment of Risk to Human Health

Factor, indicator	In residential areas	Class of working conditions at working places according to R 2.2.755-99				Hazardous (extreme) working conditions (Class 4)	
		Optimum, permissible	Harmful - 3				
			Degree 1	Degree 2	Degree 3		Degree 4
		1, 2	3.1	3.2	3.3		3.4
For working areas in standard situations, individual risk throughout the life			For emergency situations				
Risk gradations according to MR 2.1.10.1920-04	Equal to or less than 1×10^{-6}	More than 1×10^{-6} but less than 1×10^{-5}	More than 1×10^{-5} but less than 1×10^{-4}	More than 1×10^{-4} , but less than 1×10^{-3}	Life-threatening situation, high risk of acute and severe (including occupational) diseases		

The proposed model when compared with other models has the following advantages: it is applicable for assessment of health risks both from air pollutants including micro-organisms, suspended particles, aerosols, also for assessment of risks to health from noise, vibrations, light, non-ionizing electromagnetic radiation, non-ionizing electromagnetic radiation of the optical range (laser, ultraviolet). It can be used not only to assess risks at workplaces but in residential areas too. It takes into account emergency situations and it does not require the time and costs usually involved in hiring health professionals to assess the effects of exposure.

In contrast to quantitative risk assessment methods applied for assessing physical impacts of individual factors (MP 2.1.10.0059-12, Risk Assessment of Aircraft Noise, 2009) this assessment procedure is simple and convenient for practical use.

Thus, the proposed model of quantitative assessment of risk to human health will help to integrate different methodological approaches to assessment of air pollutant, physical and other

factor impacts into a uniform doctrine by completing it with the assessment of risk to human health from emergency situations.

References

1. MR 2.1.10.1920-04 Guidance on assessing the risk of exposure to chemical pollutants, M: Gossanepidnadzor Federal Center of the Russia's Ministry of Health, 2004. 143 pages.
2. MR 2.2.775-99, Hygienic criteria for assessment and classification of working conditions in terms of harmfulness and hazards in the work environment, severity and intensity of labour process (Reg. room ADZ RK No. 1.04.001.2000, of November 30, 2000).