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Risks of health damage in the units of the Federal Fire-Fighting Service of EMERCOM of the Russian Federation

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Introduction. Risk assessment is an integral initial stage of the risk management procedure aimed at reducing damage to the health and life of employees. Currently, the legislation does not establish uniform concepts and criteria for assessing occupational risk. Scientific literature presents a variety of approaches and methods for assessing occupational risk from harmful and dangerous factors of industrial activity.

Problem Statement. It is necessary to develop a model for assessing occupational risk in the units of the Federal Fire Service of EMERCOM of Russia, which allows us to take into account the likelihood of harm to the health of an employee as a result of exposure to harmful and (or) dangerous industrial factors and the severity of health disorders as a result of such exposure.

Theoretical Part. For the assessment of occupational risk in the units of the Federal Fire-Fighting Service of EMERCOM of Russia, we take the definition of risk established by the National Standard of the Russian Federation GOST R 12.0.010-2009 "Occupational safety standards system. Occupational safety and health management systems. Hazard and risks identification and estimation of risks". The assessment of the probability of causing harm to the health of an employee was carried out using the following indicators: the frequency of injuries, the frequency of death, the frequency of disability. The severity of health disorder was assessed through the indicator of labor loss by personnel from health damage.

Conclusion. The paper considers various methods for assessing occupational risk from harmful and hazardous factors of industrial activity. A mathematical model is proposed for assessing the risk of health damage in the units of the Federal Fire Service of EMERCOM of Russia on the principle of labor loss by personnel from various types of health damage. Its values were calculated for employees of the Federal Fire Service of EMERCOM of Russia for 2015-2019.

Keywords: risk, damage to health, units of EMERCOM, comprehensive assessment, injuries, disability, death.

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Introduction. Currently, various methods of occupational risk assessment of harmful and dangerous factors of industrial activity have been developed. However, the legislation still does not establish common concepts and criteria for occupational risk assessment [1-3]. We should note that some definitions of risk do not take into account the severity of damage to an employee as a result of an accident or occupational disease. At the same time, the negative consequences for the health of an employee as a result of an accident can have a different degree of severity — from light damage to health to death. In addition, the damage to the health of the employee may have the character of "deferred harm" and manifest itself after some time [4]. Thus, according to the authors, when calculating the amount of occupational risk for fire protection personnel, it is advisable to take into account the "severity of damage" indicator.

The approaches to assessing occupational risk also differ significantly [5-8].

The national standard of the Russian Federation GOST R 12.0.010-2009 "Occupational safety standards system. Occupational safety and health management systems. Hazard and risks identification and estimation of risks" defines risk as "the combination (product) of the probability (or frequency) of damage and the severity of that damage".

Problem Statement. Taking the latter risk definition as a basis, the task of risk assessment consists of solving two things:

— evaluation of the probability (frequency) of harm to the health of employees as a result of exposure to harmful and (or) hazardous production factors;

— assessment of the severity of health disorder.

To assess the first component, the following risk indicators are used:

— accident frequency coefficient — the number of accidents that occurred in one year per 1000 employees;

— the rate of occurrence of fatal accidents — the number of fatal accidents that occurred in one year per 1000 employees.

The assessment of the second component is given in a general form in GOST R 12.0.010-2009: "In general, when assessing the risk in the workplace, an N-level scale of damage can be used, each level of which is assigned a certain weight coefficient by expert assessment". As an example, a three-level scale of damage severity is given: small, medium, and large.

More precise instructions are given in R 2.2.1766-03 "Guidelines for the assessment of occupational health risks for employees. Organizational and methodological bases, principles and evaluation criteria". When assessing the severity of health disorders, it is recommended to follow Order of the Ministry of Health and Social Development of the Russian Federation No. 160 of February 24, 2005 "On determining the severity of health damage in industrial accidents", according to which industrial accidents are divided into two categories: heavy and light. Signs of a serious accident are injuries that threaten the life of the victim.

Theoretical Part. The proposed model of occupational risk assessment in the units of the Federal Fire Service of the EMERCOM of Russia (FFS EMERCOM of Russia) includes the principle of loss of labor capacity of personnel from various types of health injuries.

The following categories of health injuries were considered:

— fatal or resulting in death within 1 year after an accident in the employment context or as a result of a disease from the group of industrial-related diseases for firefighters [9], in the employment context or within 1 year after leaving the service — 100% loss of labor capacity (247 working days per year);

— accidents that lead to permanent disability after an accident in the employment context or as a result of a disease from the group of industrial-related diseases for firefighters, within 1 year after leaving the service — 100% loss of labor capacity due to the inability to perform official or labor duties (247 working days per year);

— injuries in the employment context that cause temporary disability — the average loss of labor capacity was estimated (the number of days after injuries is about 22 on average) [10].

Microtraumas without disability were not taken into account.

Having used the bank of statistical data on injuries, disabilities and deaths of personnel of the units of EMERCOM of Russia in the performance of official duties [11], the cases of injuries and deaths of personnel of the FFS EMERCOM of Russia in the performance of official duties from 2013 to 2019 were analyzed.

It is proposed to assess professional risks in the units of the Ministry of Emergency Situations (R, nondimensional) as the sum of the risks (per year or over 5 years on average) of health damage multiplied by the corresponding damage severity coefficients calculated for each type of health damage.

$$R = k_t \cdot P_t + k_g \cdot P_g + k_i \cdot P_i \quad (1)$$

where k_t — the coefficient of severity of injury damage (nondimensional), assumed to be 22/247=0.089; P_t — the frequency of injuries in the performance of official duties, year^{-1}.

$$P_t = \frac{N_t \cdot 1000}{N_{JIC}}, \quad (2)$$

where N_t — the number of injured in the performance of official duties for the reporting year, pers., N_{JIC} — the average number of personnel for the reporting year, pers.; k_g — the coefficient of the severity of damage to death (dimensionless), assumed to be 1; P_g — the frequency of death from injuries or due to a disease from the group of industrial-related diseases for firefighters, year^{-1}.

$$P_g = \frac{N_g \cdot 1000}{N_{JIC}}, \quad (3)$$

where N_g — the number of deaths from injuries or due to a disease from the group of industrial-related diseases for firefighters, for the reporting year, pers.; k_i — the coefficient of the severity of damage from disability, dimensionless, assumed to be 1; P_i — the frequency of disability due to an injury or disease from the group of industrial-related diseases for firefighters, year^{-1}.

$$P_i = \frac{N_i \cdot 1000}{N_{JIC}}, \quad (4)$$

where N_i — the number of persons recognized as disabled for the first time due to an injury or a disease from the group of industrial-related diseases for firefighters for the reporting year, pers.

Table 1 presents the main indicators of injuries and deaths of employees of the FFS State Fire Safety Service during their official activities from 2010 to 2019. Due to the lack of representative data on disability of employees of the FFS EMERCOM of Russia for 2016-2019, the average values of the frequency of disability due to injury or disease from the group of industrial-related diseases for firefighters (0.5), obtained in previous years, were used as the components of P_i [11-12].

Table 1

Main indicators of injuries and deaths of employees of the FFS EMERCOM of Russia during their official activities from 2015 to 2019

Year	Frequency of injuries in the performance of official duties	Frequency of deaths from injuries in the performance of official duties	Frequency of deaths due to a disease from the group of industrial-related diseases
2015	1.04	0.07	0.22
2016	0.95	0.15	0.11
2017	0.82	0.05	0.07
2018	0.69	0.06	0.05
2019	1.01	0.08	0.04

Figure 1 shows the results of occupational risk assessment in the units of the FFS EMERCOM of Russia for 2015-2019.

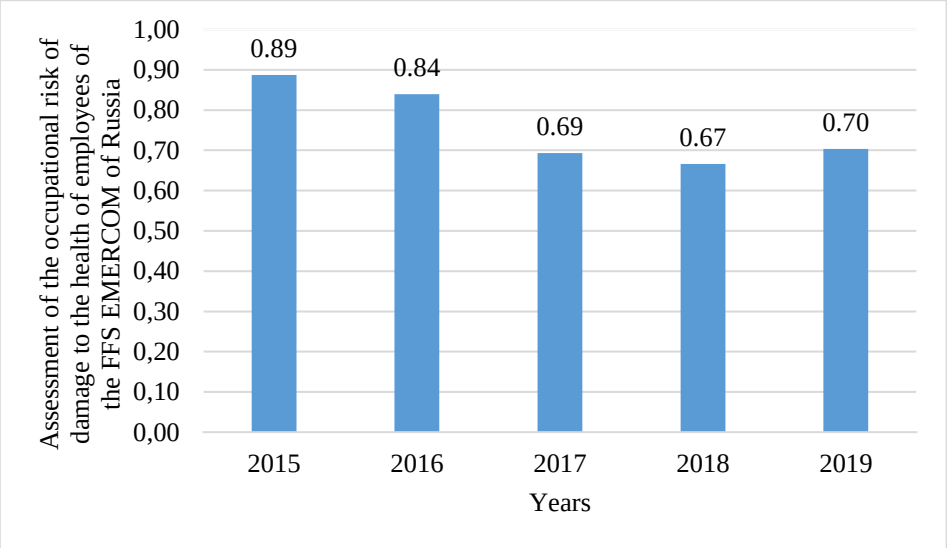

Fig. 1. Results of occupational risk assessment in the units of the FFS EMERCOM of Russia for 2015-2019

As it can be seen from Figure 1, in the last three years, there has been a steady decrease in occupational risk among employees of the FFS EMERCOM of Russia compared to previous years.

Conclusion. Such occupational risk assessments in the departments of the FFS EMERCOM of the Russian Federation should be carried out separately for each identified hazard, as well as for each workplace (position) and the subject of the Russian Federation.

The proposed approach to the occupational risk assessment in the units of the FFS EMERCOM of Russia is more adequate than the used index approach, in which the occupational risks from microtrauma (high probability, rank — 5, low severity of damage, rank — 1) are equal to the occupational risks from death (low probability, rank — 1, high severity of damage, rank — 5). The multiplication of the weight coefficients gives the same value of 5. The obvious disadvantage of index methods is their subjectivity and specificity in relation to individual factors, which is manifested in the risk assessment for individual identified hazards. There is a large group of rare hazards that differ in their frequency by orders, but all of them are assigned the same rank in the probability of occurrence — 1.

It should be noted that for rare identified hazards or for small units where statistically rare health injuries may not occur in the reporting year, continuity corrections should be used to estimate the frequency of health injuries [8].

It should be also emphasized that an occupational risk assessment alone will not bring results. The task is to identify dangerous events that may occur during the service, identify the most dangerous of them and develop correct, balanced, effective measures to ensure the safety of personnel, in order to neutralize these dangers.

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O. G. Meretukova — review of publications on the topic of the article, participation in the collection and processing of the material, participation in the writing of the text of the manuscript, editing and revision of the text; T. A. Shavyrina — participation in the collection and processing of the material, participation in the writing of the text of the manuscript, design of the final version of the article; E. Yu. Udavtsova — development of the design of the study, preparation of literature, participation in the collection and processing of the material, participation in the writing of the text of the manuscript; E. V. Bobrinev — formulation of the main idea and concept of the research, scientific guidance, analysis of the results of the research, participation in writing of the text of the manuscript, correction of the conclusions; A. A. Kondashov — development of the purpose and objectives of the research, calculations, analysis and interpretation of data, formulation of the conclusions, participation in writing the text of the manuscript.