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Development of a methodology for assessing professional risks for a drilling enterprise

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Introduction. The article discusses the problems of limited assessment of occupational risk using the existing Fine-Kinney method, which does not take into account the results of a special assessment of working conditions, therefore the authors propose an improved methodology for assessing occupational risk taking into account the working conditions indicator.

Problem Statement. The purpose of this study is to analyze the existing methods of assessing professional risks, analyze the labor protection system at the drilling enterprise, and develop a methodology for assessing professional risks for the drilling enterprise.

Theoretical Part. The existing methods for assessing professional risks and the enterprise standard were used as basic information.

Conclusion. The improved technique will reduce the degree of risk, prevent accidents at work and generally be used at other enterprises.

Keywords: occupational risk, special assessment of working conditions, methods for assessing occupational risks, Fine-Kinney method.

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Introduction. Occupational risk assessment is a mandatory procedure for enterprises. However, to date, there is no approved methodology for occupational risk assessment. To implement this procedure, any risk analysis methods that are most convenient for each individual enterprise can be used.

The approaches used in the occupational risk assessment are similar to those used in the special assessment of working conditions. A special assessment of working conditions also allows you to determine the harmful factors that affect the employee in the working process.

According to the results of a special assessment of working conditions, classes (subclasses) of working conditions in the workplace are formed. There are four such classes in total, and class 4 is the most dangerous [1, 2].

The purpose of this work was to develop a methodology for assessing occupational risks, taking into account the results of a special assessment of working conditions.

Problem Statement. It is necessary to develop and test a methodology suitable for assessing risks at the drilling company's workplaces based on the analysis of the existing methods for professional risks assessment.

The most well-known methods used in occupational risk analysis are the following: the Elmery system method, the brainstorming method, the Delphi method, the matrix method, and the Fine-Kinney method [3-5].

Theoretical Part. Description of risk assessment methods. To solve this problem, the analysis of regulatory documents on the professional risks assessment was carried out (GOST 12.0.230.4–2018, GOST 12.0.230.5–2018, etc.). A brief description of some of the considered methods is presented below

The Elmery system method is based on the use of test sheets and is a visual method of observing working conditions in the workplace [6].

The brainstorming method is based on the consideration of the problem by a group of specialists, the purpose of which is to make the final decision. The main task is to obtain and collect the maximum number of ideas for further analysis [7].

When using **the Delphi method**, experts express their own views anonymously, having the opportunity to find out the views of other experts. This method can be used at any stage of the work on hazard recognition and risk analysis [7].

The matrix method is used for the initial assessment when possible risks are identified. It is necessary to identify the most significant ones for prioritizing their management. The method identifies two extreme risk zones — significantly large and negligibly small degrees of possibility (probability) and degrees of significance (severity). From the point of view of significance, risks can be negligible, acceptable and unacceptable, and probabilities —unlikely, probable and very likely.

Thus, all these methods are not effective enough due to the incompleteness of risk assessment, labor intensity and subjectivity.

As for the methodology for calculating occupational risk using the Fine-Kinney method, the risk assessment is carried out according to the degree of danger in 5 groups and is expressed by the formula [8]:

$$R_{ПР} = P \cdot V \cdot C \quad (1)$$

where P — the exposure to risk; V — the probability of risk realization; C — the potential damage consequences.

The advantages of this method are the simplicity of calculation, visibility and the possibility of using it at any domestic enterprises.

Suggested solutions. Let us evaluate the professional risk of drilling company employees using the improved Fine-Kinney method. More fully, the risk value can be estimated by changing one indicator in the original formula to another, taking into account the results of the special assessment of working conditions.

The most unfavorable factors of the production environment at the drilling plant are noise, vibration, the severity of the labor process, the chemical factor, as well as dust. Certain employees of the enterprise are assigned the final class of working conditions 3.1 (Table 1) [9-10].

Table 1

Adverse factors affecting oil and gas industry specialists

Profession/position	Name of harmful and/or dangerous production factor	Class of working conditions
Electric and gas welder of the 5 rank	Noise, vibration, chemical factor	3.1
Master of well repair (capital, underground) of the 6 rank	Dust	3.1
Motorist of the cementing of the 6 rank	Severity of the labor process	3.1

Accordingly, taking into account harmful and dangerous production factors, an indicator of working conditions is introduced (replaced by an indicator of risk exposure), which will help to take into account the data of a special assessment of working conditions.

Thus, the improved formula of the Fine-Kinney method for occupational risk assessment will look like this:

$$R_{ПР} = S \cdot V \cdot C \quad (2)$$

where S — the indicator of working conditions; V — the probability of risk realization; C — the potential damage consequences.

The next step is to draw up the scales of probability, potential damage and the indicator of working conditions presented in table 2.

Table 2

Point scales of the Fine-Kinney method parameters

Risk realization probability scale (V)	Points	Potential damage consequences scale (C)	Points	Working conditions indicator scale (S)	Points
Can be expected	10	Disaster	100	1 (optimal)	1
Is likely to happen	8	Destruction	60	2 (acceptable)	2
Rare, but there is a possibility	6	Pretty much severe	25	3.1	
Impossible	1	Disability	10	3.2 (harmful)	3
Possible, but very unlikely	0,7	Temporary disability	5		4
Impossible in practice	0,2	Minor injury	1	3.3	5
					6
				3.4	
Impossible in real life	0,1	-	-	4 (dangerous)	7

The indicator of working conditions is determined on a point scale from 1 to 7. The probability of risk realization is from 0.1 to 10. Potential damage consequences are from 1 to 100.

The last step is the creation of a numerical designation of risks. They are presented in table 3.

Table 3

Numerical designation of risks

$R_{пр}$	Risk level
0–40	Low risk
41–70	Possible risk
71–120	Serious risk
120–200	High Risk
More than 200	Extremely high risk

Thus, the developed methodology provides an opportunity to fully assess the occupational risk according to the Fine-Kinney method, taking into account the results of a special assessment of working conditions.

Conclusion. In the course of the carried out work, a methodology for professional risks assessment was developed, which was tested on the drilling company employees. With the help of the proposed methodology, it is possible to effectively manage professional risks and achieve their reduction at the drilling enterprise. In the future, this technique can be used at other enterprises to reduce accidents at work.

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