The formula for determining motivation indicators in the occupational risk management system

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Abstract. Improper organization of production, unsatisfactory working conditions, industrial accidents and occupational diseases cause serious economic losses for the government and employers. The labor protection management system formed during the Soviet era cannot reduce occupational injuries and morbidity, does not encourage employers to improve working conditions, and requires modernization. The article deals with motivation indicators in the occupational risk management system. Much attention is paid to the hazard prevention method aimed at identifying and analyzing circumstances causing dangerous situations. In assessing the motivation indicators and competence in the production and occupational risk management system, employee’s abilities to identify, evaluate and manage occupational risks, knowledge of occupational safety requirements, personal characteristics, skills, and experience in occupational safety are analyzed. It allows for reduction of the individual occupational risk level. The article concludes that it is necessary to study scientific and methodological foundations of an informative, simple, objective and understandable ORMS which includes motivation and competence indicators, to solve actual scientific and practical labor protection problems which are studied by Russian and EU experts.

1. Introduction

Unsatisfactory working conditions, industrial accidents and occupational diseases cause serious economic losses for the government and employers. The expert assessment of the All-Union Scientific Research Institute of Labor Protection and Labor Economics shows that annual losses are about 1.94 trillion roubles, or 4.3 % of the GDP. They include expenses of the Social Insurance Fund of the Russian Federation on insurance payments to compensate for industrial accidents and occupational diseases (159 billion roubles), expenses of the Pension Fund of the Russian Federation on early pensions paid to employees working in hazardous working conditions (300 billion roubles), and expenses due to the loss of the fund of working time associated with adverse working conditions and injuries (1.48 trillion roubles) [1]. These funds are used to eliminate and compensate for consequences of injuries, harmful working conditions rather than to prevent occupational injuries and occupational diseases, and improve working conditions [2]. The Soviet labor protection management system based on the analysis of decisions or past events is not able to reduce injuries and morbidity of workers, does not encourage employers to improve working conditions and is costly.
2. Hazard prevention method in the occupational risk management system

Based on the current situation in the field of labor protection, in 2011, the concepts of occupational risk and occupational risk management were introduced in Article 209 of the Labor Code of the Russian Federation. Creation of high-quality jobs was determined as a priority [3]. The main goal of labor protection management system modernization, improvement of working conditions is the transition from a compensatory, costly model of occupational safety management to a modern occupational risk management system (ORMS) which allows for implementation of preventive approaches to preserve health of workers and reduce expenses on improvement of working conditions. The ORMS should be understandable for workers, determine the procedure for analyzing and assessing occupational risks and increase the motivation, competence and safety levels (Figure 1) [4, 5].

\[ R = V \cdot P, \]  

Figure 1. The scheme of occupational risk management.

The occupational risk (OR) of an employee is probability of causing harm to health as a result of exposure to hazardous and (or) harmful production factors (HHPF) when performing professional duties or other legitimate occupational activities. Occupational risk management (ORM) is aimed at continuous improvement of the safety level. Risk assessment can be planned and unplanned working conditions and technological processes change, in newly created workplaces (for new jobs, departments), in case of diseases, incidents, accidents, information about identified hazards. The value of occupational risk R can be determined by formula:

where \( V \) is the degree of risk (probability) of a dangerous event; \( P \) is severity of consequences.

The approach is based on a combination of hazard probability and consequences for health and / or safety of workers if the threat is fulfilled. The risks can vary from minor to unacceptable [6]. The results are recorded into risk assessment maps (RAM) developed for all employees as an informative document.
used for identifying hazardous and harmful production factors for developing a plan of preventive measures which is the basis of the ORMS. The procedure for special assessment of working conditions is foundation of the ORMS based on the results of instrumental measurements [7].

Any incident, accident, microtrauma, and even a deviation from the expected positive result provide vital information when using the method for preventing dangerous situations - “updating of prerequisites” in the ORMS. The method is aimed at identifying circumstances causing dangerous situations and is based on the analysis of relevant conclusions. Hazardous situations which did not cause accidents or caused minor injuries are usually not recorded. These situations are prerequisites for accidents with serious or fatal consequences. Using the ORMS method developed in Oktyabrsky, the Packer Company analyzes all hazardous conditions which allows the company to prevent negative consequences for its workers.

3. The role of motivation indicators for determining individual occupational risks

According to numerous studies using the monographic injury analysis method, the cause of most industrial accidents is wrong human actions (dangerous behavior or management errors when solving production safety issues) rather than working conditions (up to 93-97% of injuries) [8].

It is well known that there are four possible combinations of errors in the “person-machine” system (Figure 2): wrong human actions – fault-free machine; proper human actions - faulty machine; wrong human actions - faulty machine, proper human actions – fault-free machine [9].

![Figure 2. Combinations of errors in the "man-machine" system.](image)

As a result of this interaction, only two outcomes are possible: the system continues operations, or fails as a result of an accident. The number of dangerous situations (DS) is always greater than the number of accidents (A). The larger the number of DSs, the larger the number of As is. The more severe cases of As we consider, the greater the difference between the number of DSs and As. By controlling the number of DSs created as a result of violation of safety rules, we manage the number of As. It is unlikely to create a completely safety-friendly production environment, therefore, the key factor determining the OR level in the ORM system is a “human factor” which is dangerous employee behavior and managerial errors in solving occupational safety tasks [10].

Prevention of hazardous and harmful production factors in the ORMS is a method for enhancing the competence and motivation of personnel in the field of labor protection which can prevent dangerous situations and indicate dangerous factors.

The average OR value for a profession or a position in the department can be determined as a ratio of the sum of all risk values to the number of risks by formula:

\[
R_m = \frac{\sum_{i=1}^{n} R_i}{n},
\]

where \( R_i \) is the value of the i-th risk by profession (position); \( n \) is the number of risks by profession (position).

At the same time, the employee's OR value \( R_{ind} \) is directly proportional to the average OR value and is inversely proportional to the product of his/her competence and motivation indicators:

\[
R_{ind} = \frac{R_m}{K \cdot M_i}
\]

where \( R_m \) is the mean occupational risk; \( K \) is the level of labor protection competence; \( M \) is the level of labor protection motivation.
The concept of occupational safety and health competence of an employee includes the ability to choose a behavior with minimal risk own health and health of other employees when performing duties. It involves knowledge, skills and experience in the field of labor protection [2, 10].

The level of labor protection competence is determined in points as an average of two parallel assessments:

1) TCA is assessment of the theoretical component (knowledge of safety methods when performing duties) established by the results of exams, tests, training, etc.;

2) ACA is assessment of the actual component (skills, experience) established by the results of the analysis of identified safety violations, incidents and (or) accidents. The form for assessing the level of labor protection competence and motivation is presented in Table 1.

| FULL NAME of the employee, profession (position), department | Date | TCA competence | ACA competence | Final assessment |
|-------------------------------------------------------------|------|----------------|----------------|------------------|
| Date                                                        |      |                |                | TCA (points) + ACA (points) / 2 |
| Competent (4 points)                                        |      |                |                |                  |
| Insufficiently competent (3 points)                         |      |                |                |                  |
| Incompetent (2 points)                                      |      |                |                |                  |
| Dangerously incompetent (1 point)                            |      |                |                |                  |
| Basis                                                       |      |                |                |                  |
| Knowledge testing protocols, testing lists, instruction logbooks, etc. |      | Excellent knowledge of labor protection to perform duties in the ORMS | Knowledge of labor protection standards, incidents and / or emergencies are not allowed | TCA (points) + ACA (points) / 2 |
| Basis                                                       |      | Knowledge of labor protection is not enough to perform duties in the ORMS | Violation of labor protection standards, incidents and / or emergencies are allowed for good reason |                  |
| Basis                                                       |      | Knowledge of labor protection does not meet the requirements for safe performance of duties in the ORMS | Irregular violation of labor protection standards, incidents and (or) emergencies |                  |
| Basis                                                       |      | Lack if knowledge of labor protection to perform duties in the ORMS | Violation of labor protection standards, incidents and / or emergencies are often allowed, including without good reason. |                  |

Labor protection motivation is a model of behavior which encourages an individual to safe actions, involvement in solving labor protection problems.

Assessment of motivation indicators in the ORMS is based on the results of the analysis of information on identified hazards, incidents and (or) emergencies, minor injuries, working conditions, occupational safety provided by employees.

Assessment of the level of employee motivation involves analysis of information on hazards and proposals for improving working conditions and labor protection which are based on negative and positive experience, labor protection requirements in the labor protection rules and instructions, technological documentation, etc. Development of positive attitudes towards safety issues is one of the most important components of the ORMS which can prevent accidents and help identify their causes.
Table 2. The form for assessing the level of labor protection motivation

| FULL NAME of the employee, profession (position), department | Date | Motivated (3 points) | Insufficiently motivated (2 points) | Not motivated (1 point) |
|---------------------------------------------------------------|------|----------------------|------------------------------------|------------------------|
| Motivation assessment | Constructive, active, makes optimal decisions on occupational safety and achieves results in difficult situations when performing complex works; able to put forward non-standard ideas to improve working conditions and occupational safety in a department, to identify DHPFs in the ORMS. | Regularly provides information on improvement of working conditions and safety protection and analysis of the DHPFs in the ORMS | Does not provide information on improvement of working conditions and safety protection and analysis of the DHPFs in the ORMS; needs guidance, unable to provide information on improvement of working conditions and labor protection in the department and OVPF |
| Basis | Information on identification, minimization or elimination of hazard zones, microtraumas, incidents, improvement of working conditions and occupational safety, administrative notes, etc. |

4. Conclusion
When assessing motivation and competence indicators, the ability of an employee to identify, evaluate and manage occupational risks, knowledge of occupational safety requirements, personal characteristics, skills, and experience in occupational safety are analyzed. For effective regulation of labor protection and ORMS efficiency, employees have to be stimulated for high motivation indicators on a regular basis.

Today, it is necessary to understand that due to further development of the technosphere, motivation and competence indicators in the ORMS become a key factor determining the individual occupation risk level.

The development of scientific and methodological recommendations for competence and motivation development as well as effective methods for their monitoring and evaluation will allow the ORMS to be informative, simple, objective and understandable, reduce the number of injuries caused by dangerous human actions. This will contribute to the widespread use of the ORMS by managers, specialists and workers and help solve scientific and practical labor protection tasks.

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