Interdependence of Professional Expertise and Occupational Risk of Oil and Gas Field Workers

N V Gorlenko¹ and M A Murzin¹

¹Industrial Ecology and Life Safety Department, Irkutsk National Research Technical University, Lermontova str., 83, Irkutsk, 664074, Russia

E-mail: hope1907@istu.edu, misha0009@mail.ru

Abstract. The article considers the interdependence of professional expertise and the risks of workers engaged in the development of oil and gas fields. The gradual automation of processes and the introduction of high-tech equipment requires enterprise personnel to have ever-increasing knowledge, unique competences and skills, as well as certain personal qualities or professional expertise. The aim of this work is to determine the influence of the workers’ professional expertise on the occupational risk and to introduce the “human factor” in the procedure for assessing occupational risks. A possible way of assessing a worker and his professional expertise is the so-called System for Assessing and Controlling Occupational Risks, the main purpose of which is to preserve the health of enterprise personnel. To implement this system, we chose Irkutsk Oil Company LLC, namely, the development site of the Yarakta field located in the Irkutsk Region. Based on the analysis and evaluation, it was found that a worker with a high level of professional expertise was able to perform tasks in particularly hazardous production working conditions at the proper level. This approach allows giving an objective assessment of the knowledge, skills and competences of each worker in a particular workplace.

1. Introduction

The current global trend in the development of production in recent years is aimed at increasing the quality and volume of products, raw materials and supplies. The result of this direction makes a significant contribution to the development of modern society; more modern technologies and equipment appear that were considered impossible in the past decade. The systematic development of production processes, the modernization of production and the introduction of the best available technologies leads to the acceleration of most existing production rates and the added complexity of technological processes. However, running the production process is still not possible without human guidance. The gradual automation of processes and the introduction of high-tech equipment requires enterprise personnel to have ever-increasing knowledge, unique competences and skills, as well as certain personal qualities or professional expertise [1].

The modern system of higher education in Russia is aimed at the formation of students' professional expertise necessary for further work. An employee who has mastered and possesses a full range of necessary competences is able to successfully fulfill his/her duties and increase his/her level of professional growth. On the other hand, a person who has not mastered the necessary competences will be a weak link in the “man - machine” production system. The consequences of weakening the leading role of man in the ergatic system are expressed in a decrease in productivity, disruption of work and...
unplanned breakdowns of equipment and, most importantly, in the occurrence of emergency situations and personnel injury [2, 3].

According to the Federal State Statistics Service, over the past year in Russia 23,597 cases of occupational injuries were recorded, 1,072 of them were fatal. It has been established that the predominant cause of injuries is the incompetent performance of their duties by the worker or the immediate supervisor [4].

In accordance with Art. 22 of the Labor Code of the Russian Federation, the employer has a number of responsibilities; the main in this case are the following:

- To ensure the conditions and safety of labor in accordance with state standards and labor protection requirements.
- To compensate for the harm caused to the worker in the workplace, provided that it is associated with the performance of his/her labor duties, as well as to compensate for moral damage and pay benefits.

In the above responsibilities, the main principle is “ensuring labor safety” by the employer, but the employer is able to fulfill this obligation only if the employee has knowledge, competences and the necessary skills to safely and competently fulfill both the labor protection requirements and job duties and is able to protect himself/herself from the effects of adverse production factors [5]. The combination of harmful and hazardous production factors and the severity of the consequences of their impact on the health of workers is the basis of occupational risk [6]. There is a certain procedure for assessing occupational risk, based mainly on assessing the working conditions of a particular workplace [7]. However, as a result of the assessment, workers being in equal conditions and having the same level of occupational risk have different actual indicators of injuries and occupational morbidity [8, 9]. The reason for such a difference is workers themselves. Incompetent workers become one of the factors affecting occupational risk [10].

The aim of this work is to determine the influence of the workers’ professional expertise on the occupational risk and to introduce the “human factor” in the procedure for assessing occupational risks.

2. Study objects and methods

To date, there are a huge number of methods for assessing occupational risks that are different in the range of the factors being evaluated, having various advantages and disadvantages [11]. Assessment methods differ in their essence and interpretation of the results [12, 13]. In our work, from a variety of state approved and developed by various enterprises and scientific societies methods, we have chosen a method of assessing the individual occupational risk level.

The method was developed in 2009 by the Scientific Research Institute of Occupational Medicine of the Russian Academy of Medical Sciences in conjunction with the Klin Institute of Occupational Safety and Working Conditions. In connection with the adoption of the Federal Law “On the Special Assessment of Working Conditions” dated December 28, 2013 No. 426-FZ, in 2015 the method was adapted to the results of the special assessment of working conditions [14]. The method for determining individual occupational risk is based on a combination of factors in the work environment, taking into account the individual parameters of the workers being evaluated, namely age, state of health and period of work under harmful conditions, as well as identified cases of work-related injuries and morbidity in the workplace [15].

The choice of this method was based precisely on the consideration of this set of indicators, coupled with the ease of application and interpretation of the results. But, like all of the existing methods today, the methodology of the Klin Institute does not take into account the expertise of workers, that is, it only evaluates the effects of harmful and hazardous factors on a person, but does not consider a person as a source of danger [16].

A possible way of assessing a worker and his professional expertise is the so-called System for Assessing and Controlling Occupational Risks, the main purpose of which is to preserve the health of enterprise personnel. The introduction of such a system will give an impartial and reliable assessment
of the worker’s expertise in the relevant workplace and will allow, based on the data obtained, establishing the level of occupational risk for a specific worker [17].

The system is based on state regulations in labor protection and industrial safety, and the results of the assessment of working conditions. Based on data on the state of working conditions, they are ranked and categorized in order to establish the level of risk associated with violation of the labor protection requirements by the worker and the absence of measures introduced by the employer aimed at eliminating the negative impact of production factors. This classification distinguishes the following risk levels:

- low - optimal (1) and permissible (2) classes of working conditions;
- moderate - harmful classes of working conditions, degrees 3.1 and 3.2;
- high - harmful classes of working conditions, degrees 3.3 and 3.4, and hazardous (4).

In accordance with the system, for each occupational risk level, we proposed requirements for the professional expertise of workers (Table 1).

Using the presented table, it is possible to determine the degree of violation by the worker of labor protection requirements, which can be classified as:

- significant violations leading to severe impairment of body functions;
- moderate violations leading to health damage of moderate and mild severity;
- minor violations potentially leading to short-term health problems.

A clear pattern follows from the description of the system under consideration - the higher the level of occupational risk in the workplace, the higher the level of professional expertise of the worker should be. The lack of expertise in the conditions of a high risk level poses tremendous consequences for all involved.

To assess the expertise of workers, the system provides for initial and periodic testing [18]. All employees of the enterprise are to be tested. Test questions are graded by the importance of the consequences of the choice. The more serious the severity of the consequences, the more points are awarded for the correct answer. Based on the test results, the total number of points for incorrect answers is estimated and a decision is made on the expertise of the worker according to the following classification:

- unqualified (total score more than 30) - the worker is not able to fulfill the requirements and duties in compliance with labor protection and is a constant source of danger in the workplace;
- insufficiently qualified (total score from 5 to 30) - the worker partially owns the necessary competences, is able to fulfill the simplest requirements and duties in compliance with labor protection;
- qualified (total score less than 5) - the worker fully owns the necessary competences, is able to fulfill complex high-risk requirements and duties without negative consequences, both for himself and for those around him and the enterprise in general.

Based on the test results, workers recognized as unqualified are required to stop working and pass certification, i.e. a full examination of qualifications and qualities, determining the level of professional training and the suitability for their position.

Risk assessment should be conducted continuously. Newly hired persons, employees when changing job functions, when performing high-risk work - in each situation, an assessment of the expertise is mandatory in order to avoid the realization of the hazard. This problem is especially acute for enterprises which are classified as hazardous production facilities. Oil and gas production companies fall under the classification of hazardous production facilities [19].

The probability of a hazardous situation at oil and gas production facilities exists constantly, but if unqualified personnel are involved, it is possible to realize terrible consequences in the form of an environmental catastrophe and group accidents [20, 21]. The remoteness of facilities from large settlements only aggravates the consequences of injuries in view of the untimely provision of qualified medical care [22].
Table 1. System of correspondence of occupational risk levels. Requirements for professional expertise of workers.

| Occupational risk levels | Working conditions | Consequences of the lack of measures and failure to comply with labor protection requirements | Requirements for the professional expertise of workers and employers |
|--------------------------|-------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| High risk                | Harmful (3.3, 3.4) and hazardous (4) | Severe and moderate health damage, death                                                     | The ability of the worker (employer) to independently perform (to manage the performance of) work associated with high risk |
|                           |                    |                                                                                             | The ability of the worker (employer) to independently perform (to manage the performance of) work associated with moderate risk |
| Moderate risk            | Harmful (3.1, 3.2) | Minor harm to health                                                                      | The ability of the worker (employer) to independently perform (to manage the performance of) work associated with low risk |
| Low risk                 | Optimal (1) and permissible (2) | Microtraumas                                                                               |                                                                                                                             |

To implement this system, we chose Irkutsk Oil Company LLC, namely, the development site of the Yarakta field located in the Irkutsk Region.

3. Results and discussion
Initially, for the main workers involved in the development of the field, the levels of occupational risks were determined in accordance with the method considered above. The assessment results are presented in Figure 1.

![Figure 1. Occupational risk for workers of the Yarakta field.](image)
It has been established that for most positions, occupational risk corresponds to the “medium” level, except for workers in the position of “assistant driller”. For them the risk level is “high”, that is, it requires corrective measures in order to preserve the health of workers.

Simultaneously, we carried out work to assess the professional expertise of the personnel of this facility in accordance with the considered system in the form of testing. For this, we developed test tasks that simulated certain job tasks. The number of tasks averaged from 15 to 40, depending on the area of responsibility of the employee.

According to the test results, it was found that the general level of professional knowledge, skills and competences of workers corresponded to the characteristic “qualified”. However, about 12% of respondents showed the result “insufficiently qualified” (Fig. 2), which may lead to the realization of negative consequences.

For these workers, training was held followed by repeated testing. The results corresponded to the “qualified” level. Based on the analysis and evaluation, it was found that a worker with a high level of professional expertise was able to perform tasks in particularly hazardous production working conditions at the proper level. This approach allows giving an objective assessment of the knowledge, skills and competences of each worker in a particular workplace.

4. Conclusion
It should be noted that the assessment of the workers’ expertise is carried out within the framework of the existing procedures in the company and without unnecessary costs for additional organization. Such a system allows uniting the assessment of knowledge and the consequences of violations in a single component of occupational risks. The personnel is aware that incorrect answers are not just check marks in the test sheet, but a possible accident or injury. In our opinion, the introduction of such a system will serve as the basis for a system of prevention and management of occupational risks caused by the human factor.

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