Modern problems of Russian enterprises with respect to occupational and industrial safety

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Abstract: In the modern world occupational safety is of great importance in connection with the intensive development of the production sphere. The importance of occupational health and safety at an enterprise and their influence on the resulting effect of production activity has been considered. Legislative documents on labor protection are given. The working conditions and injury rates in various sectors of the economy of the Russian Federation have been analyzed. In terms of the economic activity, the construction industry is leading. The factors affecting the safety of workers at the production site have been considered; the ways of solving the problems of occupational health and safety have been suggested. The perspective ways of improving the occupational safety at enterprises have been shown.

1. Introduction

Scientific and technological progress brings new dangers to the world due to the expansion of the spectrum of negative factors in traditional industries, growth of energy saturation of industries, pressures and temperatures in industrial and transport communications and development of new raw materials sources or production methods. At the same time, an increase in the scale of consequences is accompanied by a decrease in the probability of negative events taken separately. The change in technology and control systems and intensification of technological processes characteristic of technical progress objectively complicate the interaction in the “man-machine-environment” systems and become one of the main causes of accidents, despite the fact that the reliability of technical systems is undoubtedly increasing. The concept of the national security of the Russian Federation (RF) approved by the RF President on December 17, 1997 noted the probability of man-made disasters to grow as a threat to the national security and transition to the economic growth with the lowered level of man-made disasters to be one of the main directions to ensure the national security. At the present time, while discussing the main factors negatively affecting the state of industrial safety, physical deterioration of production facilities and depreciation of equipment are usually highlighted [1-4]. It’s only natural for work on worn-out equipment to entail an increased rate of accidents of varying severity. In this regard, the occupational safety is growing in importance as one of the top priorities of the enterprise development. The growing importance of the workers’ life and health safety at the enterprise leads to the development of the following processes:
- comfortable and safe working conditions as one of the main factors affecting the workers’ productivity, safety and health;
- the effectiveness of activities to improve the conditions and labor safety, which is an economic impact of the social importance of occupational safety as a source of financing the occupational safety and improving the production efficiency and is an essential element of the competitiveness of an enterprise;
- the social importance of occupational safety consists in promoting the rise in the efficiency of social production through continuous improvement of working conditions, increasing its safety and reducing industrial injuries and morbidity; and
- increase in effectiveness as a result of the worktime fund growth due to a reduction in shift downtime by preventing premature fatigue, reducing the number of microtraumas and lowering the lost working day due to temporary disability because of injuries, occupational and general morbidity.

The study and solution of problems related to ensuring healthy and safe conditions, where human labor takes place, is one of the most important tasks for the development of new technologies and production systems. The study and identification of possible causes of industrial accidents, occupational diseases, explosions and fires and development of activities and requirements aimed at eliminating these causes make it possible to create safe and favorable conditions for human labor.

The social importance of the OSH is manifested in its impact on the change of the three main parameters characterizing the development status of social production [5-8]:
- protection of labor forces and increase of workers’ professional activity by improving their health status and increasing the life expectancy, which results in an increase in the length of employment;
- increasing the professional qualification due to the growth of experience and skill conditioned by the increase in seniority; and
- the possibility to apply the residual labor activity, experience and professional knowledge of pensioners on the jobs available for them.

The total national product increases due to the improvement of the above indicators. There is a raise in labor productivity and, consequently, economic effect of the business of the company due to comfortable conditions for the work life, for example, by ensuring optimal parameters of the environment and lighting, taking into account the psychophysiological and ergonomic features of labor and organizing optimal regimes of labor, rest and medical-preventive activities. The working time fund grows due to the time of authorized absence because of injuries and diseases to be reduced. It should be noted that working conditions can substantially affect not only the occupational morbidity, but also the occurrence and duration of common diseases. So, the expenses on social benefits and payment for labor under unfavorable working conditions are saved. The benefits and compensations, such as shortened working day and annual additional paid vacation, result in substantial labor losses and are accompanied by the payment of large sums of money for actually not worked time. The benefits and compensations, such as higher base salary, preferential pensions, preventive nutrition and free milk delivery also need large amounts of money. Therefore, creation of conditions that meet the permissible regulatory requirements allows partial or complete cutting these costs.

2. Rationale and scholarly importance
Despite a number of progressive decisions in the OSH made in recent years, the situation with the level of occupational diseases and injuries, including fatalities, remains tense in our country. Therefore, clarifying the reasons for the current situation is extremely urgent. The OSH is one of the most important aspects of any activity. The relevance of the OSH issues in Russia is even higher than in the West and is explained by the fact that more than 80% of the fixed assets of Russian enterprises have long exhausted their performance potential. This puts the issues of labor protection on the agenda as priorities for the development of an enterprise.

3. Purpose
Analysis of working conditions and level of employment injuries in the Russian Federation. Development of proposals to solve problems in the OSH and industrial safety.

4. Materials and methods
The OSH issues are very important and relevant for any enterprise in Russia. The OSH is the most important element of the social policy in a modern state. Effective industry development is impossible with the OSH regulations not to be observed and measures to ensure safe working conditions at enterprises not to be modernized. The struggle for the growth of the OSH culture is a key to ensure the workers’ life and health safety. In the European Union countries, the issue of the OSH culture, which is one of the main elements of the enterprise management, is being raised [5].

Russian occupational safety and health legislation is based on the Constitution of the Russian Federation and consists of the Fundamentals of occupational safety and health, other federal laws and normative legal acts of the Russian Federation, as well as laws and other normative legal acts of federal subjects. In accordance with the OSH Fundamentals and in order to introduce uniform state regulatory OSH requirements, the RF Government adopted the Resolution of May 23, 2000 "On regulatory legal acts containing national statutory OSH requirements." This document states that in Russia there is a system of regulatory legal acts containing national statutory OSH requirements. This system includes cross-industry and industry regulations and standard OSH instructions; construction and sanitary norms and regulations; safety manuals and regulations; safe operation rules; codes of practice for design and construction; and exposure standards and federal standards of occupational safety. The requirements included in the documents above should be observed by federal executive authorities and organizations of all forms of ownership while designing, building and operating of facilities; constructing of machines, machinery and equipment; developing of technological processes; and organizing of production and labor. The same Resolution of the RF Government approved a list of forms of legal acts that contain federal regulatory OSH requirements in Russia. These acts include national standard of the OSH standards system; construction norms and regulations; state health and hygiene rules and standards; hygienic standards; sanitary code; and health standards.

The new OSH management system in accordance with the national standards GOST 12.0.230-2007, GOST R 12.0.007-2009 and GOST R 12.0.010-2009 developed on the basis of international standards and recommendations of the International Labor Organization (ILO) provides for individual accident insurance. But not an individual worker or even his workplace is insured, but the enterprise as a whole. Assuming that the RF Ministry of Public Health and Social Development recommended a special assessment of working conditions as the main instrument for assessing occupational risks, one may state that there is insurance of working conditions that depend on the influence of unfavorable physical, chemical and biological factors. But a special assessment of working conditions does not consider the risk of accidents, production and technological conditions, and most importantly, the human factor. Consequently, the risks that depend on the human factor (this is at least 70%) are not paid by the insurance. In addition, a special assessment of working conditions is mandatory once every 5 years, but the situation needs to be monitored at least once a year in accordance with the insurance conditions [9].

The OSH in the modern world is of great importance in the face of intensive development of the production sphere and emergence of new types of activities. Observance of its principles allows solving a number of tasks that include:
- guaranteed protection of employees from harmful and dangerous factors affecting their health or health of their offspring;
- cutting expenses for the production process;
- prevention of serious economic losses due to lost working days;
- prevention of claims and financial sanctions of controlling bodies designed to monitor compliance with the labor requirements; and
- human performance and quality improvement.
At present, the OSH management in Russia is experiencing considerable difficulties. Fairly high absolute indicators confirm an unfavorable situation in the OSH management. So, according to the Federal Service for Labour and Employment Rostrud, over 3,000 workers a year die per infortunium at production site. One of the main causes of the accidents is the unsatisfactory industrial management. With respect to the economy sector, the construction industry, manufacturing, agriculture and communications are the leading economic activities in the list. However, up to 40% of diseases from the total number are directly or indirectly caused by unsatisfactory working conditions. The number of workers employed in conditions that do not meet sanitary and hygienic requirements increases every year and approaches 30% [10].

In view of the foregoing, it should be noted that the OSH belongs to the system of preserving the workers’ life and health in the process of labor activity that includes legal, socio-economic, organizational, technical, sanitary and hygienic, therapeutic and preventive, rehabilitation and other measures [11,12]. The RF legislation establishes the employers’ responsibility for occupational safety and health engineering. According to Article 22 of the RF Labor Code, the employer must, in particular, comply with labor legislation and ensure safety and working conditions that comply with the regulatory requirements.

Furthermore, the current government's action program for occupational safety and health is aimed at achieving the following strategic objectives:

• reducing the risk of work accidents and occupational diseases;
• improving the quality of workplaces and working conditions;
• reducing the number of fatalities from preventable causes; and
• increase of longevity and improving health of the working population.

In general, safe working conditions is one of the basic human rights and an integral part of the notion of "decent work" with the following economic factors that determine the changes in parameters for assessing the OSH management effectiveness to be distinguished:

1. Increase in labor productivity and consequently economic performance of activities by creating comfortable working conditions. Among the measures improving the labor productivity we can note improving the OSH management system; introducing a certification system for the OSH management and a special assessment of working conditions; and purchase of modern equipment for the personal and collective protection of employees and devices for monitoring harmful and dangerous substances in the work area.

2. An increase in the working time fund due to a reducing the time of authorized absence because of injuries and diseases. The loss of working time due to work-related injuries causing disability has a considerable impact on the efficiency of economic activity.

3. Saving the expenses on social benefits and payment for labor under unfavorable working conditions. The benefits paid in Russia and compensations for workers engaged in heavy work and work with harmful, dangerous or other special working conditions need large monetary funds, and creating conditions that meet the permissible regulatory requirements allows partial or complete reducing these costs.

4. Cost cutting because of staff turnover with respect to working conditions. Unfavorable sanitary and hygienic working conditions and routine and hard work quite often become the reasons for the dismissal of workers by their own volition. The labor turnover results in substantial economic damage to the organization, as it needs the explicit costs for the processes of dismissal, hiring processes, training, adaptation and internship of the new employee.

The research methods included the analytical generalization of scientific developments, theoretical research studies in the OSH management and official statistics.

5. Results and discussion
The amount of work-related fatalities, injuries and illnesses in Russia has been considered for the period of last 40 years [13,14]. From the mid-1970s to the beginning of the perestroika, the number of victims in industrial accidents (mainly in construction, transport, industry and agriculture) was
declining relatively sharply; at about the same pace, both in absolute and relative terms for general industrial injuries (Figure 1).

During the perestroika period, the indices of general industrial injuries in the country either did not change, or decreased slightly. For the first 10 years of the reform, there was a discrepancy in the rates of decrease in absolute and relative general injuries at the workplace, which indirectly indicated qualitative changes in both sources of danger and tools to prevent occupational injuries. However, during the years of the reform, the total number of industrial injuries decreased in absolute terms by more than 12 times (In 1990, 432,000 and in 2013, 356,000 injured were registered.), and in relative terms almost 4 times (in 1990, 6.6 injured per 1,000 workers; and in 2013, 1.7 injured per 1,000 workers).

![Figure 1](image1.png)

**Figure 1.** Number of accident victims at work site that caused disability for one or more working days and resulted in death in the Russian SFSR and the Russian Federation: ‘000 people (left scale) and per 1,000 workers (right scale).

The assessment of the contribution of reducing the production hazards due to deindustrialization to lowering of the overall injury rate can be performed in terms of the number of fatally injured reduced to the volume of output (to simplify, let us take only the production of goods in the national economy of the RSFSR and Russian Federation, Figure 2).

![Figure 2](image2.png)

**Figure 2.** Indices of the ratio between the number of fatal accidents at work site and volume of production of goods in the RSFSR and Russian Federation (in 1990, the index = 1).
In the years of sharp drop in industrial output (in 1990-1995, almost 2 times), the specific number of injured reduced to the output volume on the contrary grew by 40% (the number of fatalities by 77%), and only by the mid-2000s, there appeared a trend similar to the pre-reform decline. Thus, a sharp drop in the total number of injured in the early 1990s (Figure 1) was mainly caused not by success in occupational safety and health, but by a reduced potential of industrial hazards because of large-scale deindustrialization. The potential of industrial hazards and the number of workers’ injuries caused by them lowered. Closed industrial enterprises made their former employees be traumatized in other areas of the technosphere, i.e. out of production.

The contribution of preventive measures to the decrease observed in overall occupational injuries can be estimated according to the dynamics of the frequency coefficients and the severity of accidents (fatalities) in the workplace. In fact, the total number of injured considerably changes with the change in the recording technique of occupational injuries, whereas the number of fatalities in production is less dependent on the way of their registration.

The dynamics of the frequency and severity of occupational injuries is shown in Figure 3.

![Figure 3. The number of victims in industrial fatal accidents in the RSFSR and the Russian Federation: per 100 injured (left scale) and 100,000 employees (right scale).](image)

During the perestroika period, lowering of the coefficient of the fatality frequency factor (the number of fatalities per 100,000 workers) was replaced by a growth that lasted for more than 20 years, until the early 2000s. Then this trend changed dramatically, the recession began at about the same rate as in the 1970s and 1980s in the RSFSR.

In other words, in the early 2000s, some reasonable steps were taken to reduce industrial injuries. Undoubtedly, the change in the production structure of goods and services had also an effect on it. As far as they were sufficient, we can judge from the dynamics of the severity rate (the number of fatalities per 100 injured). After beginning of the reforms, the severity rate in production sharply began to grow and by 2007 exceeded the pre-reform level by 2.3 times—in 1990, there were 1.98 deaths and in 2007, 4.52 fatalities per 100 injuries. In the late 2000's, this negative trend was managed to slow down, but in 2013, the Russian Federation is 2.5 times behind the RSFSR with respect to this parameter. All other things being equal, this meant that in Russia they stopped watching at least half of the incidents of trauma, the consequences of which are latently overcome directly by workers on risk. Their work became less secure, although threats decreased. The tragic valuable knowledge of industrial hazards was lost for observation and research study, did not update the safety rules and did not enter the accumulated arsenal to prevent occupational injuries.

Figures 4 and 5 show the study results of injuries at enterprises of different forms of ownership and distribution of injuries according to the branches of production cited in [15,16]. The most unfavorable
trend was observed at the non-state-owned enterprises; construction belonged to the most dangerous sectors of the economy. In the structure of injuries by types of economic activity, the share of the construction industry was quite high and tended to outstrip growth in comparison with other sectors.

![Figure 4. Accidents at the enterprises of different forms of ownership.](image)

Statistics shows that accidents and injuries in construction occurred most often for organizational reasons, resulting from incorrect actions (mistakes or failure to act) of workers, engineers and technicians, formal approaches and relaxation in the requirements for OSH management systems in building organizations.

According to the data [17-20], since 2000s, there has been observed an increase in fatalities in production in Russia (Table 1). The main reasons for this phenomenon were technogenic accidents in the coal mining industry, hydroelectric engineering and an increase in the number of fatalities in building. This trend was interrupted only by a sharp drop in production. At the same time, the growth in work-related fatalities in construction became systemic in nature. There was an increase in both the total number of deaths in building and the number of deaths per 1,000 workers.

![Figure 5. Distribution of injuries by industries.](image)

**Table 1.** The number of victims in fatal accidents in the Russian Federation

| Year | Number of victims in fatal accidents (people) according to Federal Service for Labour and Employment Rostrud | Number of victims in fatal accidents (people) according to Social Insurance Fund | Number of victims in fatal accidents (people) according to Federal State Statistics Service |
|------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 2003 | 5,185                                                                                                       | 5,180                                                                        | 3,536                                                                                           |
| 2004 | 4,924                                                                                                       | 3,684                                                                        | 3,292                                                                                           |
| 2005 | 4,604                                                                                                       | 4,235                                                                        | 3,091                                                                                           |
| 2006 | 4,520                                                                                                       | 3,591                                                                        | 2,881                                                                                           |
| 2007 | 4,583                                                                                                       | 3,677                                                                        | 2,966                                                                                           |
| 2008 | 3,235                                                                                                       | -                                                                             | -                                                                                               |
The building industry belongs to the production characterized by an increased danger to workers. In the building and building materials industry, about 30% of the working staff is employed in heavy work and harmful and/or hazardous working environments. More than 9% of them work in conditions that do not meet sanitary and hygienic standards (increased gas and dust contamination and enhanced noise and vibration).

A high level of accidents can be explained by the construction work specifics, i.e., the need to perform works of increased danger, at heights, in difficult climatic conditions, etc.

6. Conclusions
The following solutions [6] can be indicated to the above problems:

1. The main activities to prevent occupational injuries and diseases are the purchase of personal protective equipment, special assessment of working conditions and health resort treatment of workers affected by production. Moreover, the transition from responding to insurance cases to managing the risks of damaging workers' health should be an integral task of implementing the OSH management at the enterprises.

2. One of the main ways to reduce the injury rate and cut the inefficient occupational safety costs is to increase the effectiveness of the OSH management, including its economic part. Furthermore, it is important to develop the OSH economic basis and evaluate the measures taken to improve the labor conditions and safety based on modern research methods, justify the adequacy and appropriateness of expenses on these purposes, on the one hand, and the analysis of damage caused, on the other.

3. An important factor in the OSH management at modern enterprises is the employer’s responsibility. It should be emphasized that managers must comply with the labor legislation and other regulations that contain labor law norms. The employer (organization) or his authorized representative—the head of the organization is responsible for any violation. Moreover, the consequences for the manager can be quite serious; a repeated violation of the OSH legislation can cause the court’s decision on his/her disqualification.

4. One of the most important areas for improving the OSH management system should be the improvement of the quality of the relevant educational services with modern teaching technologies to be applied.

The management of the OSH as a system for ensuring the workers’ life and health in the course of working life cannot be considered separately, since it is correlated with the state of the economy and fixed assets, environmental protection, technical level of production, preventive treatment and ensuring the workers’ collective and individual protection. In addition, the unsatisfactory situation in the OSH has a direct impact on the workers’ health, needs substantial economic costs that complicates the demographic situation, development and formation of human resources in Russia.

The core of any OSH management system is the identification of hazards and the prevention of emergencies or other negative consequences. A practical tool is the assessment of working conditions at each workplace with the harmful and dangerous production factors to be identified. To assess the health status of personnel occupying these working sites is of great importance; the results of the measures should cause the activities to adjust the working conditions in line with state regulatory requirements, as well as prevent occupational diseases of workers.

In modern conditions, the improvement of the OSH management should be carried out in the following areas:

- improving the legislative and regulatory framework;
- enhancing the organizational management methods;
- creating of economic management methods;
- improving of social partnership;
- upgrading the information support; and
- improving of teaching systems for all categories of employees.
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