Assessment of factors ensuring industrial safety of enterprises of the electric power complex

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Abstract. The presented study is devoted to the issues of industrial safety of workers employed in harmful and hazardous working conditions in the Russian electric power complex. Because of the analysis, it was revealed that about a third of the employees of the electric power complex are employed in harmful and dangerous working conditions, and the number of workers receiving compensation for harmful working conditions is reduced annually and in 2018 reached a minimum. At the end of the study, a model for ensuring industrial safety for working in harmful and hazardous working conditions was proposed, including material incentives, the issuance of special products, social assistance and medical and preventive measures. The implementation of the model will increase industrial safety for employees working in harmful and hazardous working conditions.

1. Introduction

The functioning of high-tech industries in recent years has been associated with the transition to innovative and digital platforms, which, in general, ensure the stability and safety of production, reduce the level of human participation in the production process, increase efficiency, etc [1-3]. However, there remain industries in which the transition to new technologies will occur only in certain elements of technical equipment. At the same time, the process of maintenance, repair and technical diagnostics of equipment, which is carried out with the direct participation of a person, remains unchanged [4-6].

The participation of a person in the production process is not always associated with efficiency and rationality, the human factor that can affect not only the work of the enterprise, but also the person himself, which is expressed in employment in harmful and dangerous working conditions [7-9]. Of course, any labor activity of a person is associated with the influence of noise, sound, light, chemicals and other negative factors of production on him, however, in some conditions, this dose may be within the normal range and not affect the person, and in others exceed the permissible values [10-12].
order to restore human health as a result of the negative impact of production factors on it, the Russian Federation provides for compensation for work in harmful and dangerous working conditions.

In our study, we decided to limit the object of study and consider the electric power complex of the Russian Federation.

In order to retain employees working in harmful and hazardous working conditions and personnel involved in optimal working conditions, electric power companies are developing various programs and projects that can improve the welfare of workers in a particular organization [13-14]. At the same time, in our opinion, it is necessary to assess the compensation of workers employed in hazardous and harmful working conditions and develop recommendations for its improvement.

2. Materials and methods
The purpose of this study is to analyze the industrial safety of enterprises in the electric power industry. The following tasks were formed:

- assess the occupational safety of personnel working in hazardous and hazardous working conditions in power companies;
- propose measures to improve industrial safety at the enterprises of the electric power complex.

The information base of the study was information from state statistical bodies, annual reports of energy enterprises and information from analytical reports on the functioning and development of the electric power industry. In the work, scientific methods were used that made it possible to reveal the goal and solve the proposed research tasks.

3. Results
About 2 million people are employed in enterprises of the Russian electric power industry, some of which work in harmful and dangerous working conditions. Consider the share of workers employed in harmful working conditions and compensation for their work (figure 1) [15].

![Graph showing the proportion of workers entitled to compensation for work in harmful/dangerous working conditions and the proportion of employees of organizations engaged in harmful/dangerous working conditions over a 15-year period.]

**Figure 1.** Share of workers by category.

It can be seen from the presented figure that over 15 years the number of workers employed in harmful and hazardous working conditions is insignificant, but increasing, however, the proportion of employees, receiving compensation is falling. This pattern is caused by two factors - firstly, an increase in equipment wear and tear, and, as a result, the emergence of new centers of danger and harmfulness, and secondly, with a policy to optimize costs, since on June 1, 2008, a significant part of energy facilities transferred to private property.
Imagine the proportion of workers with different types of compensation for work in harmful and hazardous working conditions in the electricity sector (figure 2) [15].

![Figure 2](attachment:image.png)

**Figure 2.** Percentage of the number of employees of electric power enterprises entitled to compensation for work in harmful and hazardous working conditions, as a percentage of the total number of employees.

It can be seen from the figure that about a third of all staff receive higher wages for harmful and dangerous working conditions, one fifth of the annual additional paid leave, one tenth of the workers receive milk, and deserves early retirement. However, despite the fact that the number of workers employed in harmful and hazardous working conditions in 2018 compared to 2017 decreased by 0.4%, compensation for this period in almost all indicators decreased, by more than 0.4%. All this testifies to the optimization of production and a reduction in the cost of compensation for work in harmful and dangerous working conditions [16-18].

Imagine the actual costs of compensation and personal protective equipment in the electric power industry (figure 3) [15].

![Figure 3](attachment:image.png)

**Figure 3.** Actual expenses for compensation and personal protective equipment in 2018, thousand rubles.
In general, it can be seen from the analysis that the number of employees employed in harmful working conditions is more than 30%, and the number of employees receiving compensation over the past fifteen years has been minimal [19-21].

4. Discussion
In the researchers' view, the compensation model for harmful and dangerous working conditions of workers can be represented in the following form (figure 4) [22-26].

![Diagram](image)

**Figure 4.** A model for improving industrial safety for employees of electric companies involved in harmful and hazardous working conditions.

It can be seen from the presented scheme that the model of industrial safety for work in harmful and hazardous working conditions should consist of four components, namely, stimulation, the issuance of special products, assistance and medical and preventive measures.

5. Conclusion
In the framework of the presented study, the industrial safety of employees associated with work in harmful and hazardous working conditions was analyzed. Because of the analysis, it was revealed that about a third of employees are involved in harmful and dangerous working conditions, while the number of employees receiving compensation for such work in 2018 was minimal. Based on the analysis, the work proposed a model for improving industrial safety for workers involved in harmful and hazardous working conditions, containing stimulation and assistance, the issuance of special products and the provision of medical and preventive measures.

References
[1] Repnikova V M, Bykova O N, Skryabin O O, Morkovkin, D E and Novak L V 2019 Strategic aspects of innovative development of entrepreneurial entities in modern conditions *International Journal of Engineering and Advanced Technology* **8**(4) 32-5
[2] Tolkachev S A et al 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **421** 032041
[3] Linnik V Yu and Linnik Yu N 2019 Priority directions of innovative development in oil and gas
complex at the Siberian Federal District *Upravlenie* 7 1 40-9

[4] Bryukhovetskaya S V et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 421 042018

[5] Sadriddinov M I et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 734 012051

[6] Kobtseva O N, Novoselova N N, Novoselov S N, Shichiyakh R A, Morkovkin D E and Sidorchukova E V 2017 Organizational and economic features of import substitution formation and realization in the conditions of spatial restrictions *International Journal of Applied Business and Economic Research* 15(23) 25-35.

[7] Gibadullin A A et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 734 012051

[9] Silvestrov S N, Bauer V P, Eremin V V and Pobyvaev S A 2019 Management of regional economy in the context of the gaps of rationality *Economy of Region* 3 324-36

[10] Yuryeva A A et al 2019 *J. Phys.: Conf. Ser.* 1399 033099

[11] Davnis V V, Tinyakova V I, Blinov A O and Volodin Yu V 2019 Combined Modeling of Projected Evaluation of the Regional Socio-economic Development *International Journal of Economics & Business Administration (IJEBA)* 0 1 348-54

[12] Lopatkin D S et al 2019 *J. Phys.: Conf. Ser.* 1399 033061

[13] Repnikova V M, Bykova O N, Shmanev S V, Kerimov V E and Kozhina V O 2019 Improvement of financial security technologies for entrepreneurial entities *International Journal of Engineering and Advanced Technology* 8(5) 2256-60

[14] Zakharov V N, Linnik V Y, Linnik Y N and Zhabin A B 2019 Classification of coal seams by features of geological structure and characteristics of breaking. *Mining Informational and Analytical Bulletin* 5 5-12

[15] Russian statistical yearbook 2018 (Moscow: Rosstat) 694

[16] Ustyuzhanina E, Evsukov S and Komarova I 2018 Network economy as a new economic system *European Research Studies Journal* 21(3) 77-89

[17] Omarova Z K, Ivanovichnikishov S, Ellaryan A S, Bobryshev A D and Kamchatova E Y 2019 Information technology in logistics systems: Problems, solutions, innovations *Journal of Advanced Research in Dynamical and Control Systems* 10 S10 581-6

[18] Tolkachev S A et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 421 032041

[19] Zinmukhova D I et al 2019 *J. Phys.: Conf. Ser.* 1399 033097

[20] Primak L V, Lyasnikova Yu V, Bykov M Yu, Kamchatova E Yu, Volgin N A and Vysotskaya N V 2018 Labor migration regulation: international practices in the implementation of economic and legal mechanisms *International Journal of Civil Engineering and Technology* 9 13 1075-81

[21] Sozontov A, Ivanova M and Gibadullin A 2019 Implementation of artificial intelligence in the electric power industry *E3S Web of Conferences* 114 01009 (2019)

[22] Gibadullin A A et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 421 032051

[23] Linnik Y N, Linnik V Y, Zhabin A B and Polyakov A V 2019 Integrated estimation of strength properties of complex-structure coal seams. *Mining Informational and Analytical Bulletin* 8 33-41

[24] Yakunina G E 2019 Research of digital communications models within organizations and at the state level in the countries-leaders in the use of digital communication technologies *E-management* 4 2 44 pp 41-50

[25] Lavrinenko Ya, Tinyakova V, Kalashnikov A and Novikov A 2018 Socio-economic features of the regions as a fundamental factor in their long-term development. *E3S Web of Conferences* 110 02138

[26] Romanova Ir N et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 734 012166