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THEORY OF DEVELOPMENT AND IMPROVEMENT OF THE MATHEMATICAL MODEL OF THE METHODOLOGY OF PUBLIC CONTROL IN THE MANAGEMENT OF OCCUPATIONAL SAFETY AND INDUSTRIAL RISKS

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TECHNICAL SCIENCE
AND INNOVATION

TEXNIKA FANLARI
VA INNOVATSIYA

ТЕХНИЧЕСКИЕ НАУКИ
И ИННОВАЦИЯ

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C O N T E N T S

TEXNIKA FANLARI VA INNOVATSIYA

M U N D A R I J A

ТЕХНИЧЕСКИЕ НАУКИ И ИННОВАЦИЯ

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THEORY OF DEVELOPMENT AND IMPROVEMENT OF THE MATHEMATICAL MODEL OF THE METHODOLOGY OF PUBLIC CONTROL IN THE MANAGEMENT OF OCCUPATIONAL SAFETY AND INDUSTRIAL RISKS

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Abstract: The article develops and analyzes a mathematical model based on a logical flowchart of the methodology of public control in the management of occupational safety and industrial risks and probability theory, according to the model, the results of compliance with the requirements of social cooperation on occupational safety lead to a sharp increase in the probability of reliability, management efficiency becomes higher. Analysis of the mathematical model of the developed logical flowchart based on probability theory has shown that when the parties cooperate to monitor the results of compliance with labor protection requirements, they lead to a sharp increase in reliability and a high level of management efficiency, the right of every person to fair working conditions is ensured.

Key words: labor security, public control, trauma, occupational diseases, risk management, prevention, preventive measures, expertise.

Аннотация: В статье разработана и проанализирована математическая модель, основанная на логической блок-схеме методологии общественного контроля в управлении охраной труда и производственными рисками и теории вероятностей, согласно модели, результаты соблюдения требований социальной кооперации по охране труда приводят к резкому увеличению вероятности надежности, эффективность управления становится выше. Анализ математической модели разработанной логической блок-схемы на основе теории вероятностей показал, что при социальном сотрудничества сторон по контролю результатов соблюдения требований охраны труда приводят к резкому увеличению надежности и высокому уровню эффективности управления, обеспечивается право каждого человека на справедливые условия труда.

Ключевые слова: охрана труда, общественный контроль, травматизм, профессиональные заболевания, управление рисками, профилактика, профилактические мероприятия, экспертиза.

Introduction

The golden rule of occupational safety and industrial risk management, including public control: the public, employees, are obliged to participate directly in improving working conditions at the workplace, in monitoring compliance with labor protection requirements. Development of a mathematical model of the methodology of public control carried out in compliance with the requirements of occupational safety and risk management, and improvement of methods of existing types of control based on the model for injury prevention and occupational diseases at work, as well as to eliminate the causes of their occurrence, adverse events, expand the practice of studying the condition and occupational diseases, dramatically reduce the likelihood of their occurrence.

When developing and improving the mathematical model of the methodology of public control, the laws of probability theory were used, provided that observance of labor protection requirements and the risk management control carried out should be reliable, lead to a decrease in the likelihood of adverse (adverse) and accidents and occupational diseases [1,2,3,4,5,6].

Research Methods and the Received Results

As it is known, dangerous (traumatic and harmful) factors of the production facility, technological processes, technical systems, "man–machinery-production environment" are the causes of accidents, occupational diseases and accidents. In the event of an unpleasant incident (incident) that occurred or occurred at the facility, it is observed that the process is carried out without complying with the requirements of the documentation on occupational safety of a dangerous condition. An increase in the frequency of risk cases is considered an indicator that affects a sharp increase in the probability of a dangerous phenomenon. The greater the frequency of dangerous situations at the facility, the greater the number per unit of time (hour, day, month, year), the higher the probability of dangerous events (accidents with employees, occupational diseases, accidents) in accordance with it. Prevention of dangerous situations at the facility, taking preventive measures, preventing the occurrence of factors caused by dangerous events, is to increase the reliability of monitoring compliance with the requirements of the labor inspection at the facility [7, 8,9,10,11,12,13].

The implementation of three types of control over compliance with the requirements of the labor regulations at each production facility is clearly established by law, regulations and instructions. In addition to the results of each type of control, the elimination of a dangerous situation at the facility is put into practice in three stages. A logical mathematical model of preventing or eliminating a dangerous condition can be expressed in the following series of probabilities. [2, 3,4,5,7]

Here the diagram shows a box labeled "Object dangerous phenomenon dangerous condition" connected to $P_{\text{н}}^{\text{Д}}$, $P_{\text{с}}^{\text{Д}}$, $P_{\text{р}}^{\text{Д}}$.
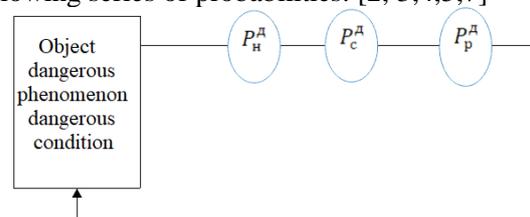
Picture. 1. Block diagram of occupational health and safety management.

Each stage in this diagram is performed unrelated to each other, and the probability of reliability of their execution is at the stage of control_n^B, at the stage of comparation_c^B, at the stage of adjustment. According to the laws of probability theory, the overall reliability of a flowchart consisting of elements that perform sequentially in terms of reliability, that is, are calculated as follows, since they are independent stages:

$$\mathrm{P_{УМ}} = P_H^Д \cdot P_C^Д \cdot P_P^Д \tag{1.1}$$

The following is considered to be the general reliability in the implementation of the above stages of ensuring compliance with labor protection requirements through civil and collective control in labor protection management, that is, all independent sequential stages have a multiplicity of reliability extremes:

$$\mathrm{P^M_{УМ}} = P_H^M \cdot P_C^M \cdot P_P^M \tag{1.2}$$

Similarly, public control (a representative of a trade union or community, a group) will be equal to the product of the probability of reliability: Similarly, public control (a representative of a trade union or community, a group) will be equal to the product of the probability of trustworthness:

$$\mathrm{P^Ж_{УМ}} = P_H^Ж \cdot P_C^Ж \cdot P_P^Ж \tag{1.3}$$

Compliance with the requirements of the workforce and timely, high-quality implementation of all related activities, the implementation of social cooperation at the stage of public control by the state, civil society and the public ensure that the results of management are likely to be high in reliability. When the participation of government officials and the public in the management of state protection in the management of labor protection is carried out jointly, the control flowchart is formed from the following elements (pic.2) [2].
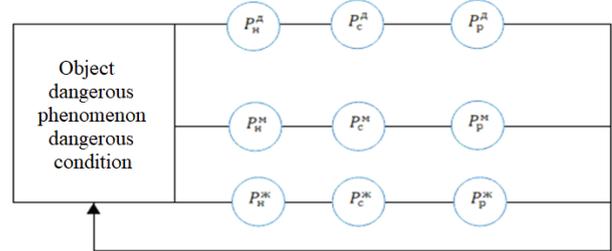
Fig. 2. Block diagram of the implementation of labor force management based on social cooperation (state, company official, public).

This control block diagram consists of sequential and parallel connected elements of control stages with a single purpose, independent of each other, the total value of the reliability probability of the stages is as follows:

$$\mathrm{P^X_{УМ}} = (P_H^Д \cdot P_C^Д \cdot P_P^Д) + (P_H^M \cdot P_C^M \cdot P_P^M) + (P_H^{ж} \cdot P_C^{ж} \cdot P_P^{ж}) - [(P_H^Д \cdot P_C^Д \cdot P_P^Д) \cdot$$
$$(P_H^M \cdot P_C^M \cdot P_P^M) + (P_H^Д \cdot P_C^Д \cdot P_P^Д) \cdot (P_H^{ж} \cdot P_C^{ж} \cdot P_P^{ж}) + (P_H^M \cdot P_C^M \cdot P_P^M) \cdot (P_H^{ж} \cdot P_C^{ж} \cdot P_P^{ж})] + \tag{1.4}$$
$$+ (P_H^Д \cdot P_C^Д \cdot P_P^Д) \cdot (P_H^M \cdot P_C^M \cdot P_P^M) \cdot (P_H^{ж} \cdot P_C^{ж} \cdot P_P^{ж})$$

If we assume that all the elements in this control flowchart (Fig. 2) are equal in terms of reliability probability values, then the mathematical model of occupational safety management developed on the basis of probability theory will have the following form:

$$\mathrm{P^X_{УМ}} = 3 \cdot P_i^3 \cdot 3 P_i^6 \cdot P_i^p \tag{1.5}$$

By analyzing the generated mathematical model, the following results can be obtained, for example, if the probability of reliability is 0.9 of the result of sequentially connected mutually independent stages that are part of the control flowchart (Fig.2)

$$\mathrm{P^D_{УМ}} = P_i^3 = 0.9 \cdot 0.9 \cdot 0.9 = 0.729$$

From this it is worth summarizing that = 0.729 and = 0.729

The introduction of social cooperation in the management of occupational safety and health serves to increase the probability of reliability; the results of management increase the probability of reliability.

From this, that is, from the probability of reliability of the elements of the developed flowchart:

$$\mathrm{P^X_{УМ}} = 3 \cdot P_i^3 \cdot 3 P_i^6 \cdot P_i^9 = 3 \cdot 0.729 - 3 \cdot 0.531 + 3.387 = 2.187 - 1.593 + 0.387 = 0.981$$

As can be clearly seen from the results of the accounting, the probability of social cooperation, that is, the occupational safety management system, in which the participation of the state, officials of enterprises, representatives of the public is provided, increases by 34%. The development of a mathematical model of public control and its improvement, based on this, the introduction of occupational safety management based on social cooperation leads to a 34% reduction in the probability of a dangerous situation, a dangerous phenomenon at the control facility, this result is formed by exchanging for an increase in the reliability of control results.

Analysis of the mathematical model of the developed logical flowchart based on the probability theory of social cooperation, the results of compliance with labor protection requirements lead to a sharp increase in reliability, a high level of management efficiency, and the right of every person to fair working conditions is ensured.

Conclusion

The results of compliance with the requirements of social cooperation on labor protection will lead to a sharp increase in the probability of reliability, management efficiency will be higher. The introduction of occupational safety and industrial risk management in a style based on social cooperation: the state, company officials, public control, allows ensuring safety at the required level, dramatically reducing the likelihood of dangerous cases (accidents, unfortunate workers).

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