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SPECIAL ISSUE ON "SCIENTIFIC-PRACTICAL INNOVATIVE FOUNDATIONS OF FIRE SAFETY AND PREVENTION OF SERIOUS CONSEQUENCES"

Assessment Of Work Safety Management In The Technosphere System And The Fundamentals Of Creating Its Model

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Abstract:

This article deals with the issues of risk and safety in the management of labor safety in the technosphere system, methods and principles of risk elimination and ensuring safety, their study on the basis of systematic analysis and synthesis, as well as the basics of labor safety management in the "Man-Machine-Environment" system and its structural components. element modeling issues were considered. Proposals and comments on measures to ensure security in the technosphere were also made.

Key words and phrases: technosphere, system, occupational safety management, risk, safety, accident, disaster, accident, natural, man-made, anthropogenic, injury, injury, poisoning, methodology, model, modeling.

Introduction

Enter. The scope of the study. The development of human civilization has led to an increase in the type and frequency of global natural, man-made and anthropogenic risks in the technosphere and environment, along with the worsening of the economic-social-political situation in the global community. According to statistical data, 10...15 percent of the gross domestic product of industrialized countries is spent to compensate for damages caused by injuries among employees due

to accidents and disasters occurring in economic sectors, and as a result of environmental pollution and inadequate safety measures, 20 100% of people die prematurely.

Based on ergonomic requirements, the creation of household appliances and devices from an aesthetic point of view has greatly facilitated human life, but created a complex of damaging and harmful factors for consumers. For example, we can cite many factors, such as electric current and electromagnetic field, increased level of radiation, noise and vibrations in the environment, dangerous mechanical injuries, cases of poisoning with toxic substances.

From this point of view, it is necessary to comprehensively assess the risks in the management of labor safety in a complex distributed technosphere system, to overcome a number of problems, each of which is very complex and important, in order to successfully solve them. For example: the uncertainty of information about the distribution of external negative currents affecting the system to its internal elements or the aging behavior of the elements in the system to such currents requires consideration. From the point of view of this speech, the issues discussed in this research are relevant today.

In the technosphere risk assessment, the issues of production safety, ecological and environmental safety, population and territory safety in emergency situations, as well as socio-political safety of production enterprises are considered. In order to perform these tasks perfectly, it is necessary to carry out on the basis of excellent scientific methodologies that allow comprehensive assessment of dangerous flows. But in recent years, major accidents in the technosphere (Chernobyl and Fukasuma NPP), especially in the field of agriculture, where it is practically impossible to comply with labor safety laws, and in the protection of the labor of employees working on the basis of mutual agreements, in addition to traditional methods, which allow monitoring the implementation of dangerous events in real time and it is required to conduct instrumental studies that do not complicate the implementation of preventive measures.

The relevance of the topic is the author's analysis and improvement of the image-methodical foundations aimed at protecting the population and the environment from the negative flows of the technosphere listed above.

The purpose of the subject is to build a mathematical model of labor safety under the influence of negative factors in the technosphere using traditional methodology.

To achieve this goal, the following tasks were solved.

1. Analysis of existing normative-legal-technical documents and scientific-research works and traditional models in the management of labor safety under the influence of negative tissues in the technosphere.

2. Based on mathematical modeling in the management of labor safety under the influence of negative structures in the technosphere, it solves the tasks of risk assessment in the technosphere and other decision-making tasks.

Experiment (research) methodology. It should be recognized that the term "Technosphere" is present in the scientific works of many scientists and philosophers and specialists conducting scientific research, and they argue that it is an artificial shell of the earth's crust. So, the technosphere is a synthesis of nature and technology created as a result of human activity. [1]

The concept of risk and security is widely used in technosphere security. The main tool for eliminating risks is security

Safety is a state of operation, which is the elimination of the occurrence of risks with a certain probability. Safety is a human goal. From this point of view, all bodies, society, population and other structures should act together in security management. (Figure 1) [4]

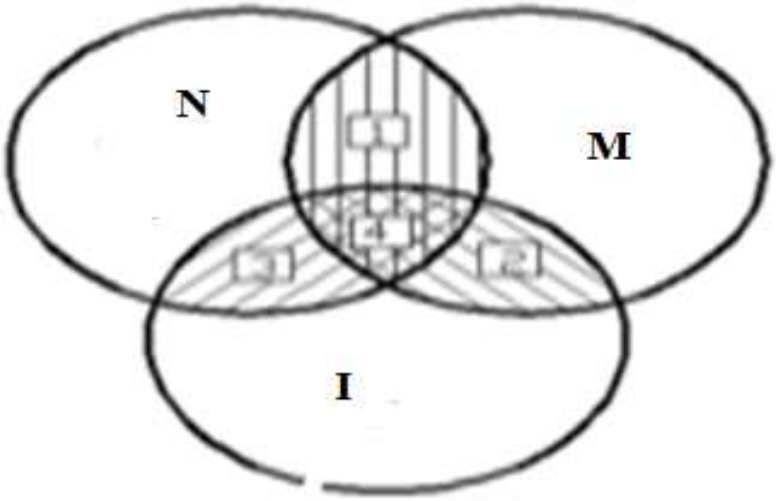


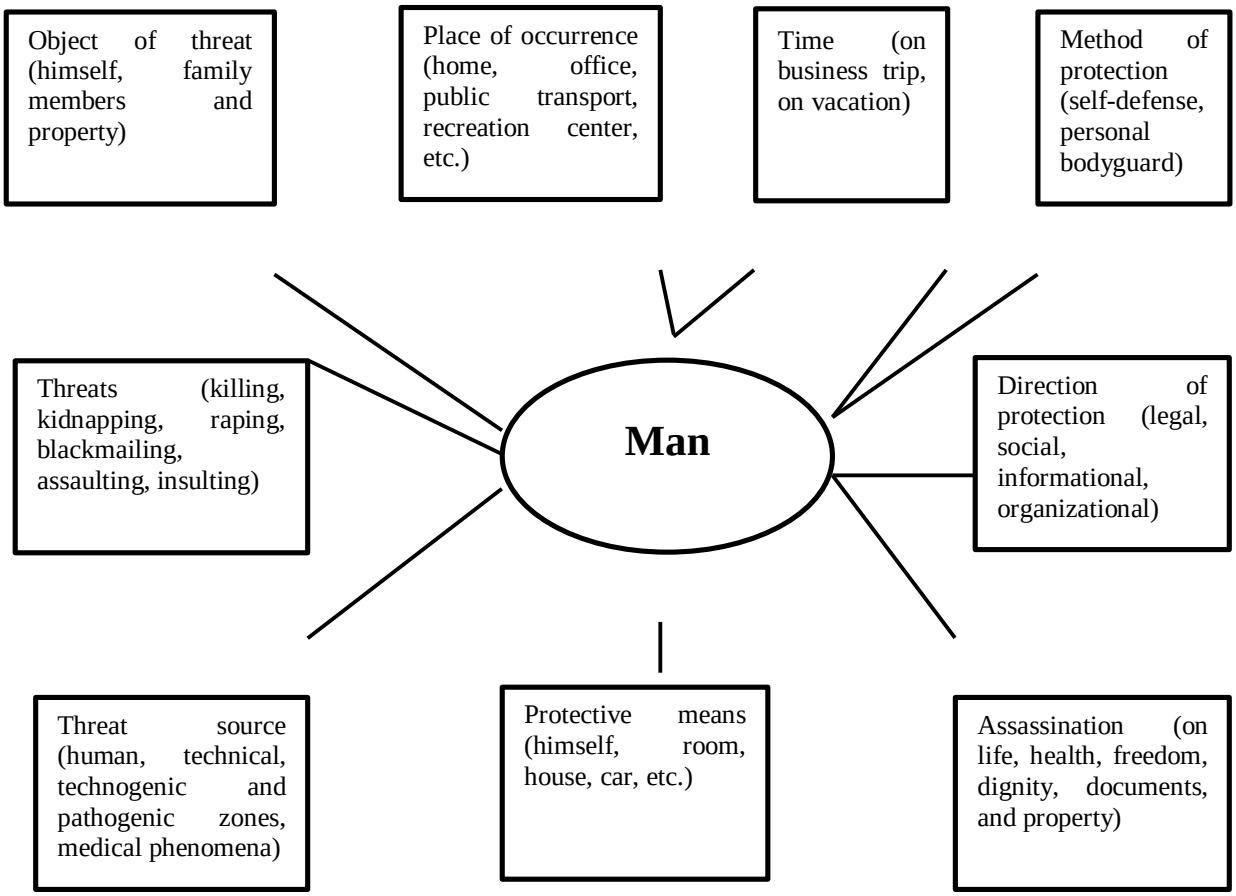
Figure-1. Security management mechanisms: N- normative legal framework; M- administrative mechanism; I- economic and social mechanism.

Hence, the following security systems exist in the technosphere: [3]

- population security system;
- ecology and environmental protection;
- state security system;
- global security system.

In all listed safety systems, labor safety is considered as a separate element. Because occupational safety plays a key role in ensuring the safety of employees (population) and the environment.

Human safety comes first. Human security in a narrow sense - the history of society is a kind of social risk. Human security in a broad sense is determined by his physical, social and spiritual well-being determined by internal and external factors. Humans try to eliminate risks that occur with a certain probability. But in all cases, due to objective and subjective reasons, it is not possible to completely eliminate risks. It can only be delivered and maintained as permitted.



Picture- 2. Conceptual model of human security

There are 3 methods of security in the technosphere, which are[2]:

1) moving the homosphere and the nocosphere away from each other in space and time. This method is implemented through mechanization and automation of the production process, remote control of equipment, use of robots and other control systems.

2) based on the elimination of risks or standardization of the technosphere using safety rules. In this case, the indicators of the homosphere and the noxosphere are closer to each other.

3) based on the protection of workers in workplaces using protective equipment. Various defenses are used to change the characteristics of the technosphere.

Research in the field of security measures and units for any objects is seen as a "subjective - objective - security" system. (Figure 3).

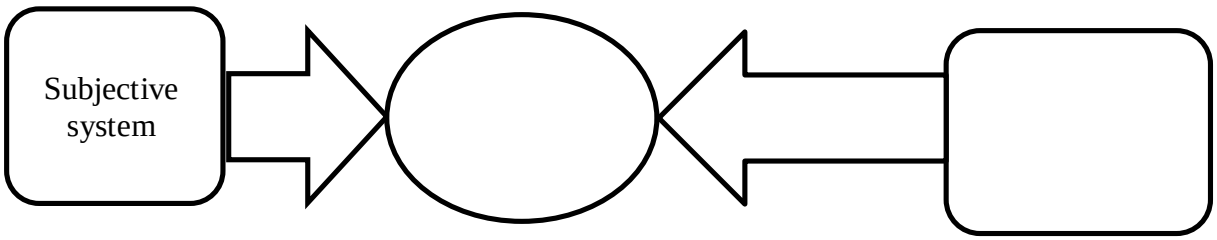


Figure- 3. "Subjective - objective - security" model

Systematic analysis and synthesis of the considered processes in the technosphere is the objective - "Human-Machine-Environment" system, and the subjective is the objective laws of occurrence and prevention of man-made phenomena. This system includes the occurrence of all man-made accidents. (Figure- 4),

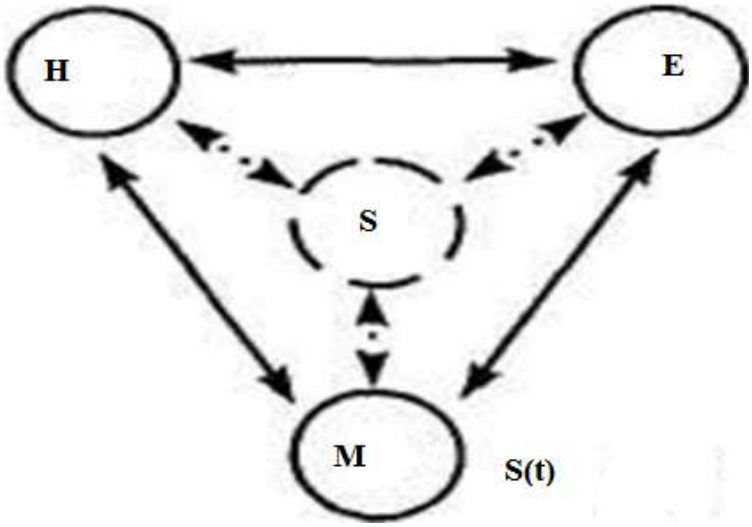


Figure -4. "Human-machine-environment" system

The human-machine-environment system is a source of danger and a potential source of damage. Its activity is determined by the performance of its tasks by employees in a certain technosphere environment. Embedded technologies (T) in a system include human, machine, and external environment that interact with each other.

Their connection is indicated by arrows: input and output actions, S(t) – events. Their influence is studied on the basis of the methods of scientific analysis and synthesis as a whole or in parts of the population. The main goal is to ensure the accuracy, precision and impartiality of the results, which adequately reflect the events and processes taking place in the field of security.

Thus, Technosphere security is a complex discipline that studies the problems of identifying, preventing and protecting against risks. Many foreign and local scientists have conducted research in this field. Including V.V. Vlasova, V.I. Keilis-Borok, A.I. Lurie, A. Lyava, A.A. Samarsky, I.N. Sneddon, G.A. Mavlyanov, R.A. Niyazov, A.S. Tokhtaev, E.V. Kadirov, O. Kudratovlar. Among the Uzbek scholars who lived in the Middle Ages - Abu Ali Ibn Sina, Abu Raikhan Beruni, Mahmud Kashgari Zakhriddin. Babur, Al-Khorezmi cube, the issues of protecting the labor of workers related to production were considered in the scientific works of great scientists and they did many positive things.

Research results and their discussion. According to the author, the most appropriate method for achieving the goal of development of computer technologies and applied mathematics, analysis of the situation in the technosphere, and prediction of the development dynamics of certain situations is modeling and should include the following models.

- ecomodel of technosphere objects and environment;
- model of man-made processes such as various geomechanical, hydrogeological;
- a model of harmful gaseous, liquid mixtures and other industrial waste;
-models of cleaning technological processes;
- existing substance interaction model;

- measurement and management and content descriptive model;

- information model

- reference model of the "normal" state of natural objects and systems;

- a model defining the possibility of using different research methods in specific natural and technical conditions;

- model of analysis of accidents and occupational diseases.

Flows that occur in technosera all have in common that their occurrence causes one another and forms a common "causal chain" and the following factors and events result in a sequence of effects:[6]

a) as a result of human error or equipment failure or other negative external influences;

b) the appearance of dangers in an unexpected place and at the same time;

c) improper use or lack of safety equipment or improper use (behavior) of employees in this situation;

d) people touching protected parts of technological equipment;

e) influence of natural or artificial environment (atmosphere, climate, gasification, etc.).

The following should be taken into account when modeling man-made accidents, conditions, accidents and injury factors:[5,7]

a) internal factors:

- insufficient reliability and ergonomic aspects of technological equipment;

- imperfection of professional training in the selection of engineering and technical personnel;

- the need for people to stay in potentially dangerous areas and the conditions for protection are poorly organized;

- unfavorable working conditions;

- general and personal protective equipment is not provided, or it is insufficient or not provided based on established standards and norms;

-low performance of utility and technical services, etc.

b) external factors:

- the presence of natural emergencies and the level of preparedness against them (earthquakes, floods, floods, etc.)

- availability of infrastructure (railway, highway and other utility-technical facilities)

- dangerous objects in the immediate vicinity and their level of influence;

- nearby settlements and their population density.

Since all modeling methods known to science are used in predicting the state of the technosphere, mathematical models in analytical, graphical, schematic or algorithmic form can be used in the construction of the model, and the following formulas can be used.

- model of independent or unconnected factors: y=f(0,z,u)

-connected factor model y=f(x1,x2,x3) including:

- the linear model y= a0+a1x1+a2x2+…..+anxn is widely used due to its simplicity in calculations.

-level model: y= a0·x1a ·x2a…….xna

-logarithmic model y= a0+a1lgx1+a2lgx2+…+anlgxn

where,, y- indicator forecast x1,2,3 – the influence of connected factors, 0,z,u – the influence of independent (unconnected) factors a0,2,3,n – with the main parameter in its influence.

The technosphere security system considered from the point of view of security usually includes three components: "man", "machine" and "environment" (Fig. 3).

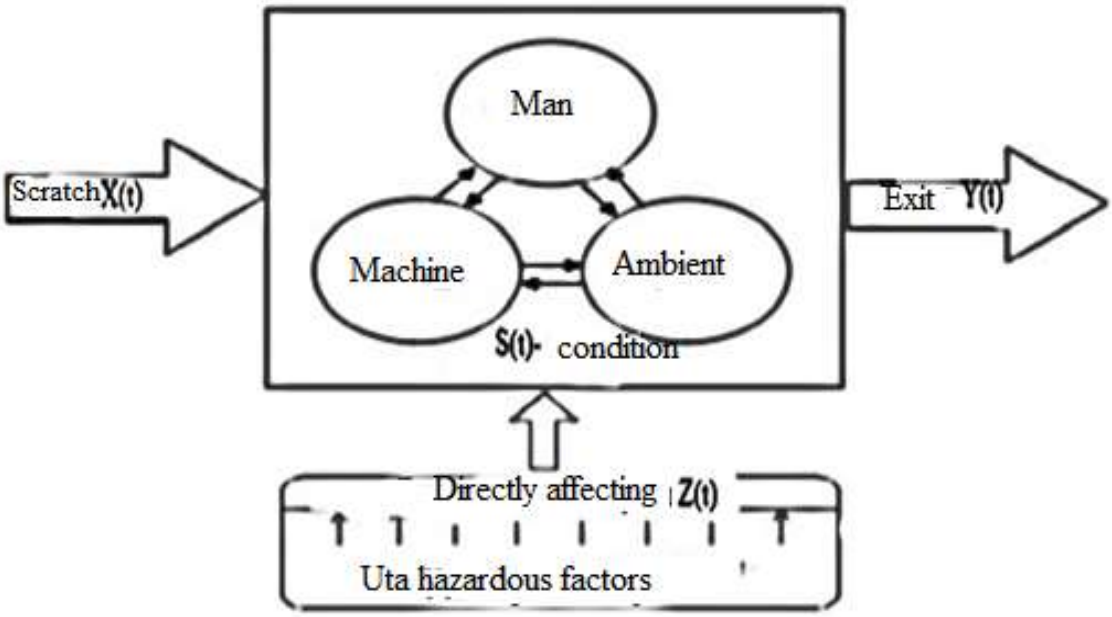


Figure-5 is a model of the "man-machine-environment" system

Scratch Man Machine Ambient condition Exit Directly affecting Uta hazardous factors

Input effects X(t) are interpreted as given goals and functions, defined time intervals, and allocated resources. This is reflected in the performance of the system.

The output effect Y(t) is manifested as beneficial or harmful results in the "man-machine-environment" system; influencing factors Z(t) - influence of negative factors, S(t) - conditions in the system in a certain period of time.

The human-machine-environment system model determines the safety and the ability to maintain its stability, in which negative events are eliminated with a sufficiently high probability, so that the damage does not exceed an acceptable level. In other words, the man-made safety model can be interpreted as not exceeding the limits allowed by the internal and external environment and human factors.

The "Man-Machine-Environment" system consists of the following structural elements.

1. "Human":

- a human-1 mobile robot controlling a "machine" or a person simulating a work environment;

-person-2 is a person who is considered from the point of view of the impact of psychophysiological factors on him during the work process.

-Indirect repair person to human-3 system.

"Car":

- machine-1 element performing the main technological function (PC);

- an element that performs the function of protection against machine-2 emergency situations.

Machine-3- an element that affects the environment.

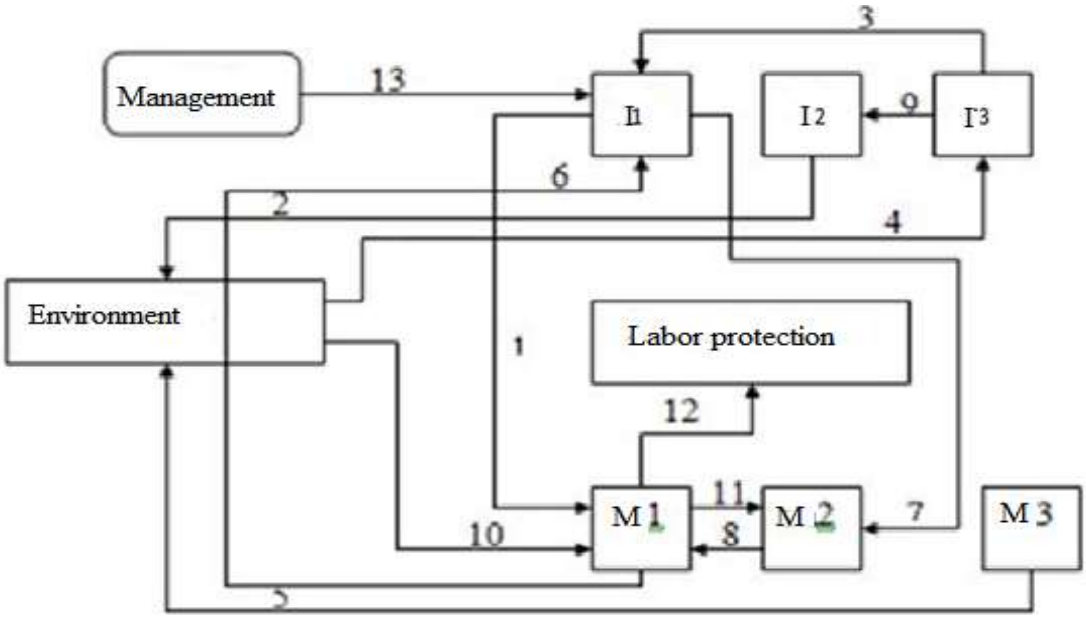


Figure -6 is a structural model of the Human-Machine-Environment system

Table-1

Interdependence in the "Human-Machine-Environment" system

	Communication direction	Contact description
1	I1-M1	Human control of the machine
2	I2 – environment	Human impact on the environment as a biological object (oxygen consumption, changes in air humidity, temperature changes due to the use of electrical equipment
3	I3 - I1	The effect of the psychophysiological state of a person on another (people's influence on each other).
4	environments - I3	The influence of the environment on the psychophysiological state of a person (temperature, humidity, atmospheric composition, light, etc.).
5	M3 - environment	The effect of the machine on the environment (noise, vibration, temperature, etc.).
6	6 M1 - I1	Effects of harmful factors produced by machines on the psychophysiological state of a person.
7	I1 - M2	Application of methods of protection against the effects of dangerous production factors).
8	I1 - M2	Information needed to develop emergency control measures
9	I3 - I2	The psychophysiological state of a person and its influence on the level of metabolic intensity and energy output between the organism and the environment

10	Environment - M1	The effect of the environment on the operation of the machine
11	M2 - M1	Emergency control action
12	12 M1 - labor subject	The impact of the machine on the object of work
13	The impact of the machine on the object of work	The impact of the machine on the object of work

We can give a generalized expression of the model as follows:

$$M = \{X, Y, Z, S, T, q, h\}, \quad (1)$$

where, $X = (x_1, x_2, ..., xn)$; $Y = (y_1. y_2,....., yn)$; input, output field and $Z = (z_1, z_2, ..., zn)$; influencing factors; $S = (s_1, s_2, ..., sn)$ is a state in space at a certain time t=T; $T=(t_1, t_2, ..., tn)$ – set at a given time; q-transition operator reflecting the change in the state of the system under the influence of risk factors; The output operator describing the mechanism of creating an output state as a reaction to internal and external changes of the h-system. [8.9]

The state of the system can be evaluated as a dynamic equilibrium, in which integral indicators are in homeostasis. The goal of such systems is determined by the pursuit of stability. Since the range of external influences on the system is limited, its number should also be very limited. In addition, the limitation of these states is determined by the ratio between the external vibrational energy and the self-energy capacity of the system. According to the nature of the factors affecting them:

- low - the state where the energy does not exceed the threshold values - the risk has a minimum value (N);

- acceptable - manifests itself in the form of small changes that do not leave the equilibrium state - the risk has a low value (M);

-dangerous - takes the system out of the crisis mode while preserving the system properties with small damage - has an average risk value (S);

- dangerous - due to the radical restructuring of the system, it leads to a catastrophic situation with a significant change in integral indicators. (B);

-emergency - leading to complete destruction or shutdown of the system - has a catastrophic risk value(K).

It can be seen that each component of the system is a man-made source of risk, while the considered models have systemic properties. (structure hierarchy, stochasticity, set of states, etc.).

Based on the information discussed above, we conclude the following.

The methodology of labor safety management is determined by the function, economic-social-political stability, internal and external sources of risk performed by each country, including economic objects. Because it requires a large amount of money to improve working conditions for employees. At the same time, each employer should set the main task of bringing the working conditions of the employees to the "permissible" level. For this, if he relies on scientific-theoretical knowledge and organizes work based on it, he will achieve his goal.

According to the purpose of the article, the principles of mathematical modeling of the "man-machine-environment" system, which is one of its main elements, were considered.

LIST OF USED LITERATURE:

1. Holbayev B.M., Rakhimov O.D., Makhmatkulov N.I. Life safety. Textbook (Part 1). - T.: "VORIS-nashriyot", 2020. 304 p.
2. Ibragimov E.I., Gazinazarova S, Yuldashev O.R. Labor protection special course. - Tashkent, 2014. - 535 p.
3. Karimova V. Zaynutdinova M. Nazirova E. Sadikova SH. Fundamentals of systematic analysis // Tashkent University of Information Technologies, 2014.- 180p.
4. 4 Makhmatkulov N.I. Assessment of technosphere security based on mathematical modeling. Monograph T.: "VORIS-nashriyot". 2022, 166 – p.
5. Samarskaya N.A., Elin A.M. Okhrana truda v sistemnoy metodologii // Ekonomika truda.- 2023.- Volume 10.- No. 4.- S. 615-634.
6. Pustovit A. E., Kozlov V. I. Okhrana truda: system approach to solution of problem bezopasnosti proizvodstvii. Vestnik scientific and technical journal No. 2-2013
7. Zvonarev, S.V. Z 42 Osnovy matematicheskogo modelirovaniya: uchebnoe poso bie / S.V. Zvonarev. — Ekaterinburg: Izd-vo Ural. un-ta, 2019. — 112 p
8. Yusupova A., Mathematical modeling. Study guide T. "New Generation" 2001
9. Safaeva. Q. Mathematical programming. Textbook "Ibn Sino" - 2004, 324-6.