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SYSTEMATIC ANALYSIS OF OCCUPATIONAL SAFETY MANAGEMENT IN INDUSTRIAL ENTERPRISES

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Abstract:
The article presents information on the role of risk in occupational safety management at industrial enterprises, a systematic approach to safety management, life cycle stages, and management functions. Methods for constructing activity decomposition based on systematic analysis and analyzing the “Cause and Risk Tree” system are covered.

Keywords: Industrial enterprise, safety, management, system, decomposition, systematic analysis, component, ergatic system, operator, “cause-risk-effect” tree, man-machine-environment system.

Introduction

Industrial safety is a state of protection of the vital interests of individuals and society from accidents and incidents at hazardous production facilities and their consequences. An accident at hazardous production facilities is a breakdown of structures and (or) technical devices used at hazardous production facilities, an uncontrolled explosion and (or) release of hazardous substances. An accident at hazardous production facilities is a failure or damage to technical devices used at hazardous production facilities, a deviation from the technological process regime, a violation of the requirements specified in the legislation on industrial safety, as well as regulatory technical documents.

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RESEARCH METHODS

The study used analytical, predictive, comparative and statistical analysis methods, as well as empirical methods: questionnaires, observation, test questions, interviews, open-ended ideas, and analysis of experimental test results.

RESULTS AND DISCUSSIONS

The possibility of influencing the level of continuous risk and safety indicates, first of all, the need for safety management techniques and methods. Life safety management is understood as an organizational influence on the "human-environment" system in order to achieve a set result, or to transfer an object from one state (dangerous state) to another, that is, to a state with relatively low risk. Life safety management - requires the need to match economic and technical indicators during management.

A systematic approach to management. The main principles of systematic analysis include:

- efining the ultimate goal and its clear interpretation;
- considering the entire problem as a holistic system;
- studying and analyzing alternative ways to achieve the goal;
- ensuring that the results of the stages in achieving the goal do not affect the final result.

The implementation of these principles must fully meet the requirements of reality, objectivity, quantification, adequacy, effectiveness and control.

Determining the purpose of the activity is one of the most important tasks in safety management. It is necessary to consider the goal as a hierarchical concept, that is, the result of each stage in the activity cycle should not negate (negatively affect) the result of the second stage and the overall result.

Life cycle stage. The stages that must be taken into account in terms of safety requirements must cover the entire period of activity, that is, scientific idea, idea; scientific research work; organization of design work; design; implementation of the project in practice; transportation; operation; improvement; conservation and decommissioning. As noted above, these stages must be carried out sequentially, without negating each other.

Safety management functions. The functions of life safety management are the following and are a process carried out on the basis of certain stages.

- analysis and assessment of the state of the object (system);
- determination and planning of tasks for achieving the goal and management;
- identification and organization of managed and controlling systems;
- monitoring and checking the organization of management;
- determination of the effectiveness of activities;
- stimulation.

The decomposition method, developed for the general state of activity, is widely used in the design of life safety. The stages that must be taken into account in terms of safety requirements must cover the entire period of activity, namely:

- scientific idea, idea;
- scientific research work;
- organization of design work;
- design;
- implementation of the project in practice;
- operation; improvement;
- conservation and decommissioning.

In ensuring the safety of life activities, it is necessary to take into account scientific worldview, physiological, psychological, social, educational, ergonomic, environmental, medical, technical, organizational-operational, legal and economic aspects. For this, a number of tools for managing the safety of life activities are used. These include

- formation of behavior and culture of safe work;
- vocational training;
- psychological influence on management subjects;
- use of collective (technical and organizational) means of protection;
- use of personal protective equipment,
- organization of a system of benefits and compensations, etc.

Activity decomposition. “Man-environment” and “man-production” and others are complex multi-level and multi-component systems. When compiling a risk identification of these systems, decomposition is required, that is, the study of the interaction of all the elements that make up this system and the level of risk of each element for a specific condition of activity is determined. When studying the interaction of all the elements that make up the “man-machine-environment”

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system, the level of risk of each element for a specific condition of activity is determined and an activity decomposition is compiled.

Systems analysis is a set of methodological tools used to prepare and justify decisions on complex problems, including security systems.

A system is a set of interconnected components, as a result of which a certain goal is achieved, that is, work is performed.

The components of a system include, in addition to materials and objects, their interconnections and the relationships between them. Any machine can be an example of a technical system. If a component (element) of the system is a person, such a system is called an "ergative system". Examples of ergative systems include "human-machine", "human-environment", "human-machine-environment", etc. The main goal of a systematic safety analysis is to identify the causes of accidents and develop measures to prevent these causes in a correct and cost-effective manner.

Any human activity takes place in a certain system, for example, in the "Man-Machine-Environment" system. All elements that make up this system have their own characteristics, character, causes of dangerous factors, and levels of interaction. If any element that makes up this system does not perform its function in order to achieve a guaranteed result as a result of the activity, the system's functioning will be disrupted. For example, "operator-computer-electricity" forms a single system. If any of the elements of this system are missing, the work will not be performed. Just as each element that makes up the system has its own function, the entire system also has a separate function. When a system is analyzed, the causes that cause accidents in each element are first studied.

For example, in this ergatic system: a person controls the computer, monitors the progress of processes, gives the computer appropriate commands. In this case, the operator must have sufficient qualifications to manage this technological process, and must fully know the rules for safe operation of the computer. Therefore, initially the operator must be trained in the rules for safe operation of these technical means, methods of protection against dangerous and harmful factors, and his knowledge must be tested.

The computer carries out the tasks assigned by the operator. For this, it is necessary that the main indicators of the computer correspond to the indicators of the technological process, and that the dangerous and harmful factors in the computer (radiation, noise, etc.) are within the permissible limits. Electric current provides energy to the entire system. It is required that the electric current be installed in a way that is safe for human life, and that measures be taken to prevent the operator from being exposed to electric current. After the causes leading to accidents in all elements are identified, an analysis is made of what risks may arise under the influence of these causes. Then the consequences of these risks are determined, and a “Cause-Hazard-Consequence” tree (table) is compiled. Based on the “Cause-Hazard-Consequence” analysis, a plan of measures is developed to prevent accidents.

In addition to the fact that the elements that make up the system have their own characteristics, the system also has its own characteristics. The characteristic that arises in the system is not present in any of the elements that make up it. For example, “combustible substance - oxygen - fire source” constitutes a single system. If any of these elements is absent, the combustion process will not occur. Here, the combustible substance has the property of burning, oxygen has the property of creating conditions for the occurrence of fire, and the source has the property of starting a fire. Of course, the absence of any of these elements in this system will lead to a breakdown of the system, the result, the goal (in this case, combustion) will not be achieved.

The main goal of systematic safety analysis is to identify the causes that lead to undesirable consequences (accidents) and, on this basis, develop measures to reduce the likelihood of them.

The "Causation and Risk Tree" system. Any risk arises as a result of a specific cause or causes and leads to undesirable consequences. There is no real risk without a cause. Therefore, eliminating or preventing a risk depends primarily on studying its cause, which is explained by the "cause-effect" connection.A risk is a consequence of some cause or causes, which in turn causes another cause, that is, a risk that arises under the influence of a certain cause can cause another risk to arise, which in turn can cause another risk, and as a result this process can take the form of a hierarchical, chained connection or system. The graphic representation of such a connection resembles a multi-branched tree. Therefore, in some literature devoted to security analysis, expressions such as "Cause Tree", "Negativity Tree", "Risk Tree", "Consequence Tree" are often found. Of course, such graphic representations-"trees" contain branches of causes and branches of consequences, which show the full dialectical nature of the "cause-and-effect" connection. Therefore, it is appropriate to call such a graphic representation, built on the basis of the results of the analysis, a "Tree of Causes and Effects". The construction of such "trees" is one of the main stages in identifying the causes of unpleasant events. Since the construction of the "tree" branching is a multi-stage, endless process, it requires the acceptance of certain restrictions. These restrictions depend on the purpose of the research and must be logically justified.

CONCLUSION

The creation of an effective security system for industrial facilities requires a comprehensive approach that covers all the main risks that may arise. Therefore, when creating such a system, it is necessary to create comprehensively generalized protective devices. Naturally, certain limitations are visible in this, taking into account its cost. First of all, it is necessary to consider the main sequential stages of implementing the construction of a security system. The security system should maintain the safe state of the facility, identify measures to eliminate the risk; counteract the risk and eliminate it. Practice shows that in most cases, a separate specialized system or its units should be sufficient to ensure security. A complete solution to this problem can only be based on the technical, resource-intensive technical and legal support of all means of ensuring security, as well as the organization of service activities into a single unified security system. In this case, technical support means the use of physically sensitive devices and equipment, that is, hardware and software tools.

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