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Analysis of typical causes of accidents and injuries at gas supply facilities

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Introduction. The article considers the problems of industrial injuries and accidents at gas supply facilities. Hazardous production facilities are characterized by an increase in accidents and injuries among workers. The article considers the peculiarities of occurrence of accidents and injuries in the operation of hazardous production facilities.

Problem Statement. The purpose of the study is to analyze the statistics data and the materials of investigation of accidents and emergencies in hazardous industries, to determine the characteristic causes of injuries at work.

Theoretical Part. The statistics on accidents and injuries during operation of gas facilities provided by the Federal State Statistics Service are used as basic information.

Conclusion. The results of the analysis show that the main causes of accidents and emergencies are the causes associated with the human factor and equipment malfunctions. In order to improve safety and prevent injuries among workers, it is necessary to introduce an integrated approach and risk assessment, which will take into account all the factors and conditions that contribute to the occurrence of accidents and injuries at gas supply facilities.

Keywords: accidents, emergencies, gas facilities, safe working conditions.

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Introduction. The gas industry is the leading branch of the fuel and energy complex of Russia, the main activities of which are the production, transport and storage of natural gas. Every year, the share of gas pipelines in the gas supply system of settlements and enterprises increases. Natural gas is increasingly used in various industries and utilities. One of the most important tasks of the gas industry enterprises is the transportation and accounting of natural gas.

Russia owns one-third of the world's natural gas reserves. Currently, much attention is paid to the development of the gas industry, as gas is a very valuable cost-effective product that can replace other fuels. The use of gas for industrial purposes makes it possible to achieve automation and intensification of production processes, improve sanitary and hygienic working conditions and improve the air basin of the cities of the Russian Federation. At the same time, the operation of gas supply facilities is associated with the risk of accidents at production facilities. According to statistics, the number of accidents and injuries at the production facilities of the gas industry remains quite high [1, 2]. Over the past 3 years, 149 cases of injuries and accidents were registered during the operation of hazardous production facilities of gas supply. The analysis of the research materials shows that the causes of accidents are always different. Identification of the characteristic causes of accidents and injuries at gas supply facilities is an important and urgent task to ensure reliable and trouble-free operation of gas industry enterprises.

Problem Statement. At the moment, the issues of improving the efficiency of the industrial safety and labor protection management system of gas industry enterprises are relevant. Any production facility is characterized by the occurrence of dangerous situations or accidents.

In order to prevent accidents, injuries and improve safety in the operation of gas supply facilities, it is necessary [3]:

— to create safe working conditions to preserve the life and health of the employees;

— to reduce the risk of accidents and incidents at hazardous production facilities;

— to ensure industrial safety during the operation of hazardous production facilities;

— to develop fire prevention measures.

To achieve this goal, the following tasks were solved:

— statistical data and materials of investigation of accidents and emergencies at hazardous production facilities of gas supply were analyzed;

— the characteristic causes of injuries were identified;

— related causes were identified;

— suggestions were made to solve the identified problems.

Theoretical Part. The analysis of statistics on injuries and accidents at gas supply facilities indicates that the measures taken are not sufficiently effective.

The number of accidents in gas supply organizations over the past 3 years is shown in the diagram (Fig. 1) [4].

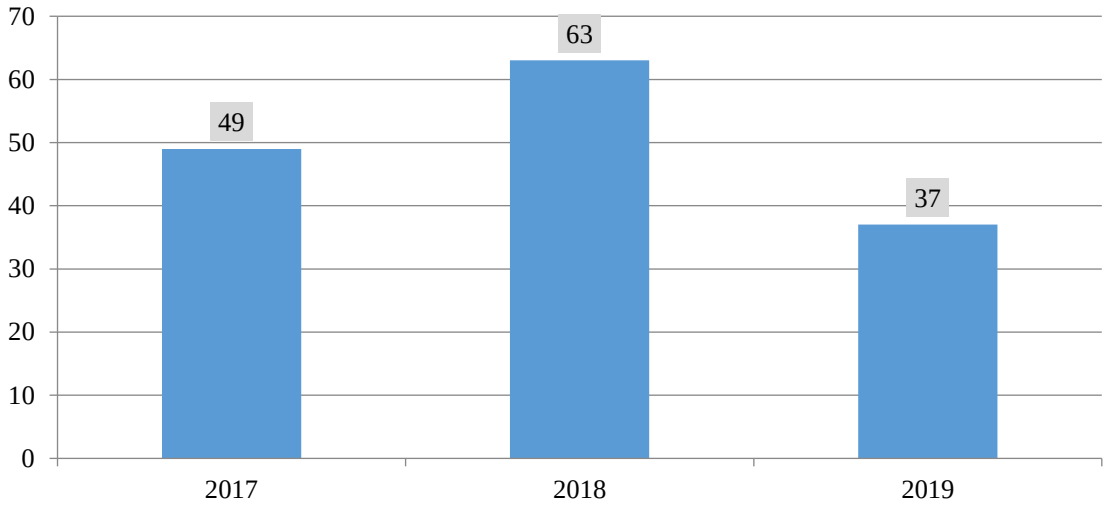

Fig. 1. The number of accidents in gas supply organizations from 2017 to 2019

Over the past 3 years, the lowest number of accidents was observed in 2019, the highest — in 2018. The analysis of the materials of the investigation of these accidents showed that the main causes were [2, 4, 5]:

— deviations from the regulatory requirements of industrial safety in the production of works in the protected zone of gas pipelines;

— insufficiently high level of organization and performance of work to the requirements of safety and labor protection;

— low labor discipline of industrial personnel in the operation of gas supply facilities;

— violation of the requirements of the instructions and safety rules by employees;

— poor quality of training sessions;

— permit-to-work without prior training and verification of knowledge of the requirements for industrial safety in the operation of hazardous production facilities.

There are cases of accidents at gas supply facilities due to aging and wear of equipment, as well as accidents that occur not due to human fault, but due to natural phenomena [6, 7].

The analysis of statistical materials allowed us to determine the characteristic causes of accidents and emergencies at gas supply facilities and to identify the following interrelated groups of causes [8]:

— about 50% of cases are caused by equipment failures (aging and wear);

— the reasons related to the negligence of a person or his inexperience account for more than 43% of cases;

— about 7% of cases are related to external natural causes.

The diagram of the distribution of interrelated groups of causes of accidents and emergencies at gas supply facilities is shown (Fig. 2).

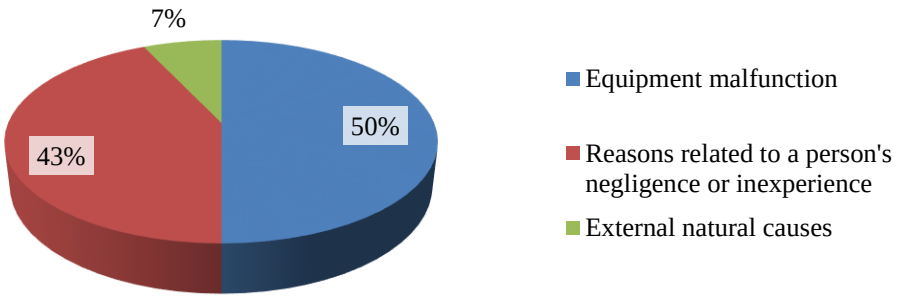

Fig. 2. Interrelated groups of causes of accidents and emergencies at gas supply facilities

Fig. 3 shows the dynamics of the number of fatal accidents from 2017 to 2019. The data analysis shows that 6 people died in 2017, 3 people died in 2018, and 7 people died in 2019. There is an increase in the number of fatal injuries [4, 6].

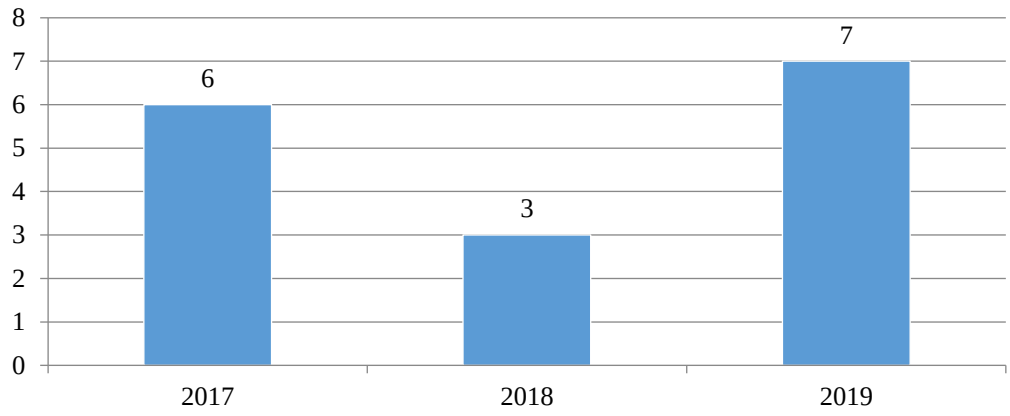

Fig. 3. Number of deaths due to accidents

In 2019, an increase in the number of accident victims was recorded (Fig. 3). At the same time, the number of fires significantly decreased compared to the previous period. The diagram of the number of fires at gas supply facilities is shown in Fig. 4 [1, 4].

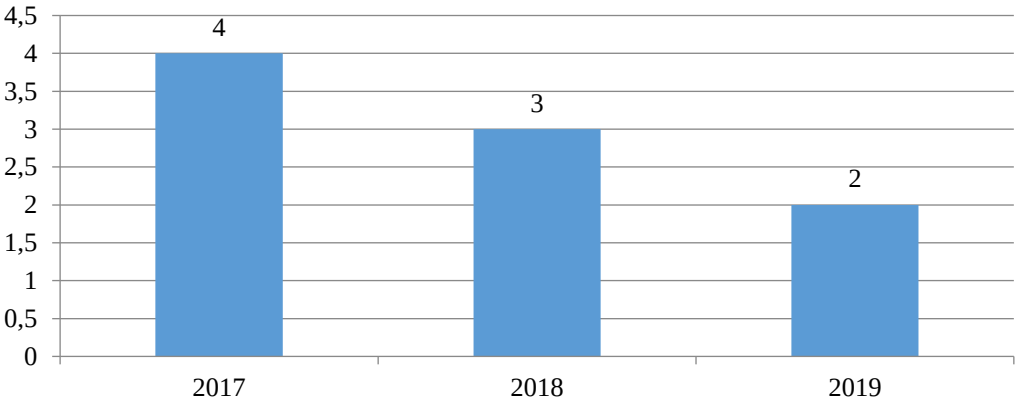

Fig. 4. Number of fires at gas supply facilities

Conclusion. The paper analyzes the statistical data and information on the basis of which the characteristic causes of accidents and injuries at gas supply facilities are established. It also provides the distribution graphs of accidents and emergencies at hazardous production facilities of gas supply.

Based on the analysis, it can be concluded that the causes of injuries and accidents in most cases are of a mixed nature. At the same time, about 50% of accidents occur due to aging, wear and malfunction of equipment, and in 47% of cases, the influence of the human factor is evident. These groups of causes have almost equal shares in their impact on the occurrence of accidents and injuries. Moreover, the issues of timely repair due to malfunctions, analysis of the state of working equipment are solved by the management and maintenance personnel, that is, the influence of the human factor is present everywhere.

Thus, the cause of accidents and injuries is the person himself, as well as the low level of knowledge, poor training, negligence in work or non-compliance with safety measures at work. All this in one way or another leads to an increase in the number of deaths at work [7, 8].

To solve the problems of accidents and injuries at gas supply facilities, it is necessary to develop preventive measures aimed at reducing the influence of the human factor [7]. In this regard, in the authors' opinion, the main thing should be to increase the role of production control, the effectiveness of the training system, and the verification of knowledge of safety and labor protection requirements among workers and specialists [9-10].

It is necessary to change the formalist approach to the training system. The well-coordinated work of the labor protection services of enterprises and specialized training centers, testing of knowledge on labor protection contributes to improving the level of knowledge among employees. It is aimed at reducing occupational injuries.

In order to improve safety and prevent injuries, it is necessary to introduce new forms and methods of organization, conduct production control aimed at timely accounting of all malfunctions and violations in the operation of equipment. It is important to track down all errors in the work of the personnel of the hazardous production facilities of the gas supply system. It is proposed to introduce new technologies, for example, the development of a mobile application that will have all necessary important information, such as routes of safe service passages, a directory of personal protective equipment. In the same application, training and knowledge testing can take place, as well as videos, posters, and slides can be placed. The system should provide for: the possibility of testing knowledge; publication of schedules for medical examinations, current regulations, rules and instructions; the results of a special assessment of working conditions. It is necessary, depending on the specifics of the enterprise, to provide for the possibility of changing the configuration of this application [6, 7, 10]. This will increase the level of awareness of the employees and reduce the impact of the human factor.

As a preventive measure, in order to solve the tasks set, it is necessary to introduce a systematic approach to the development of measures to reduce injuries, including: analyzing and summarizing the results of the investigation materials of both serious accidents, incidents, and all violations of labor safety requirements. In addition, it is important to use an analysis of the state of labor conditions and labor protection based on a risk assessment, which will result in the preparation of risk maps and a summary statement of the state of labor protection of the enterprise. In accordance with them, a set of preventive measures should be developed to improve labor protection and reduce injuries in all identified areas of violations [7-11].

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E. V. Staseva — scientific supervision, analysis of the research results, revision of the text, correction of the conclusions; A. M. Sazonova — preparation of the text, conclusions formulation; V. A. Tukov — formulation of the main concept, goals and objectives of the study, calculations; P. V. Zadorozhnaya — specification of goals and objectives of the study, calculations.