TECHNOLOGICAL SAFETY OF THE OIL AND GAS INDUSTRY

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Abstract

The current trend continues in almost all areas of oil and gas production. The reason is trivial: the lack of interest among the users of natural resources themselves and, as a consequence, the lack of sufficient material resources necessary for the restoration of resource-developed territories. At the present stage, this problem is becoming more and more acute for companies, but the main reason is not in the consciousness of enterprises, but in the tightening of requirements at the legislative level and the deterioration of the profitability of the extracted raw materials. That is, environmental problems continue to grow, but it becomes more and more difficult to regulate them due to their colossal neglect [3]. A decrease in the profitability of deposits, wear and tear of technological equipment and assets lead to a deterioration in the quality of raw materials and a decrease in the efficiency of the work performed, which, together with social problems, only entails an aggravation of the ecological situation. These aspects have a significant impact on the productivity of companies in general - especially in the environmental sense - that are undercapitalized.

Keywords: natural resources, significant impact, environmental sense, material resources, ecological situation.

I. Introduction

The principles of regulating unfair attitude to resource consumption being introduced by the legislation today is considered to be the introduction of penalties, but this, by and large, is not comparable with the damage to the natural environment and does not interest nature users in the modernization of existing production technologies. It is more profitable for companies to pay a fine than to restructure fixed assets and production. The modern penal system is ineffective, since it has not a direct, but an indirect impact on the economic efficiency of oil and gas companies. An illustrative example is the stimulation of the rational use of associated petroleum gas (APG) [5], that is, the introduction of penalties with increasing coefficients for over-limit flaring of APG together with the likelihood of accounting for investments in the gas program for the implementation of APG utilization projects as a share of these payments. Relatively recently, Russia was one of the leaders among the countries with the largest share of APG flaring, but only before the entry into force of the government decree "On the specifics of calculating fees for pollutant emissions" [6]. The existing situation in the oil and gas industry with regard to environmental problems requires a fundamental revision and implementation of the project, the basis of which should be sufficient material and financial supply of the relevant measures. Oil and gas producing enterprises are forced to reduce funding for environmental protection activities. This fact indicates a lack of desire to contribute to a way out of a negative environmental situation.

To establish the sufficiency of material and financial support, an assessment of the environmental damage to the environment is made. At the legislative level, there are many different methods and techniques for assessing the impact of nature users on the environment [7]. But all these methods are scattered and give narrowly targeted indications, which ultimately complicates the assessment of the state of the environment as a whole. To ensure environmental protection measures at a sufficient level, it is necessary to move away from the assessment in the form of direct damage to the environment, and go to the assessment of environmental risks with mandatory introduction at the legislative level. Environmental risk means the likelihood of direct or remote negative changes in the environment as a result of negative impact on it, in this case, technogenic [8]. That is, when assessing environmental risk, not only damage is assessed, as is done everywhere, but also the likelihood of its occurrence. The basis for the environmental risk assessment procedure is the ISO 14000 series standards and numerous regulations, one of which is GOST R 14.09-2005 "Environmental management. Guidelines for Risk Assessment in Environmental Management". But again, the methodology for assessing environmental risks should contain a set of indicators, on the basis of which the appropriate level of environmental risk should be established. And depending on the final value of the risk level, the natural resource user is obliged to allocate an appropriate share of the profit to compensate for environmental damage in a sufficient volume. The purpose of this work is to develop a comprehensive methodology for assessing environmental risks using the example of oil and gas production facilities.

II. Methods

The mechanism for managing the economic security of an oil enterprise is a system that consists of a subject and a management object that use a variety of methods, levers, means, resources to solve a set of tasks in order to protect, maintain and improve economic activity in the face of constant changes in the external environment.

To characterize the safety system of an oil enterprise, the following methodological provisions are important:

- the security system of the enterprise is complex, consisting of a number of security elements (scientific and technical, information, fire and others);
- the security system of the enterprise is unique at each enterprise, as it depends, on the region, the level of technical equipment, personnel qualifications, production relations of the enterprise and the competitive environment;
- the creation of an enterprise security system and the organization of its successful functioning should be based on the methodological foundations of the scientific theory of security and the theory of social management.

Initially, it is necessary to establish which elements of the environment are negatively affected by oil and gas production facilities. Environmental pollution occurs from the initial stage - exploration of the field, that is, during exploratory drilling followed by the construction of a well. During this period, pollution occurs as a result of emissions into the air of exhaust gases from the operation of diesel engines and drilling rigs, drilling degassers, containers with dusty materials, sludge pits with drilling waste. Very often, during this period, environmental protection measures are not carried out at the drilling site, due to which fertile soils and water resources are polluted with oil products and toxic components of the drilling mud. The aggravation of the negative impact occurs as a result of washing away by melt and storm water. As a result, under such an impact, in a zone about 100 m from the borehole, complete destruction of vegetation occurs, and at a distance of about 500–800 m, 70–80% of the flora are degraded.

As a result of drilling operations, drilling waste is generated, which accumulate on special land structures - sludge storage facilities. An important aspect in this case is the initial correct

organization and preparation of the territory for the sludge storage in order to avoid the likelihood of contamination of groundwater by toxic waste [9]. In addition to the oil products themselves, the drilling mud itself is a strong contaminant, containing a significant amount of various chemical constituents. The period of well construction with the accumulation of drilling waste is characterized by the territorial dispersion of drilling facilities, the heterogeneity of the generated waste itself and temporary changes in their indicators. During the operation of the drilling rig, significant areas of fertile soils are alienated. In a number of cases, companies use outdated models of machinery and equipment, technological processes aimed at obtaining maximum benefits without taking into account environmental consequences, exacerbate the already deplorable environmental situation. When carrying out repair work as a result of a violation of the technology for flushing downhole equipment, the site area may be contaminated with significant concentrations of oil products that require disposal. This can become one of the causes of fire on the territory of the drilling rig [10, 11].

III. Results

In the course of assessing environmental risks, we used information that includes a description of the conduct of technological processes and the natural and climatic conditions of the objects of study, the results of an environmental impact assessment, data from periodic monitoring and control of the state of the environment, the results of environmental audits and examinations, reporting documents and independent direct measurements. and research on the territories of the objects. In connection with the differences in the annual volume of minerals production for each of the objects under consideration, for comparing indicators with each other, the final value of the complex indicator of environmental risk is expressed as a ratio to 1000 m3 of extracted raw materials. Based on the results of the assessment, it was found that, in general, for all the studied objects, the level of risk corresponds to the average level, but the highest value of the integrated indicator of environmental risk was found at the Yarakta field. The next stage of risk assessment should be a risk management procedure, the meaning of which is in establishing the best ways out of the current negative situation and monitoring its development, assessing the effectiveness and correcting environmental protection measures. The risk management procedure itself is based on the unity of economic, social, political structures, potential costs for the implementation of technological solutions to improve the current environmental situation, various management decisions and measures.

Energy Strategy 2035 does not mention technological safety. Its focus is timely response to challenges and threats to energy security and creation for this a risk management system in the field of energy security, the main tasks of which are: monitoring, assessment and forecasting, including in the long term, the state of energy security; determination of the resources necessary and sufficient to prevent threats to energy security, reduce the likelihood of their implementation, as well as to minimize the consequences of their implementation; defining the tasks of the subjects of energy security and planning measures to ensure it; control over the implementation of measures to ensure energy security and assessment of their effectiveness.

IV. Discussion

The considered complex methodology will allow comparing environmental risks of various oil and gas companies. Also, the application of the technique gives a clear visio to the management staff of enterprises about the components of the environment most susceptible to negative effects. But the technique, unfortunately, has a number of disadvantages, such as the need to process and compare huge amounts of data for the assessment and the lack of accounting for the impacts as a result of emergency situations in the form of man-made accidents. With the further development of the methodology, these aspects will be taken into account, which will make it possible to apply a similar methodology in any of the oil and gas producing enterprises and bring them one step closer to the status of innovative. An innovative oil and gas production company needs to specialize in the full implementation of the best available technologies and equipment. One of the priority areas of its activity should be the constant reduction of harmful effects on the natural environment, an increase in the level of industrial safety, the organization of healthy and safe working conditions for employees. The advanced nature of the projects being implemented serves as an effective alternative to existing methods of oil and gas field development, which require large investments. The introduction of the best available technologies and the modernization of fixed assets increase the level of production reliability and environmental safety from the consequences of oil and gas production, make it possible to implement efficient and safe field development and reduce the negative impact on the natural environment as a whole.

The level of technological safety is closely related to the innovative potential of the industry. And here, the global oil and gas industry has not been doing well lately. A recent study by the Boston Consulting Group shows that of the world's 50 most innovative companies, the oil and gas sector is represented by only one company, Royal Dutch Shell, which has moved from 30th to 40th place in a year. It is possible to relate differently to this analysis and the places occupied by individual companies, but one cannot fail to notice the general trend - the oil and gas industry is no longer a technological locomotive of the world economy. The solution could be a higher level of integration with high-tech industries, including in the development of new business models. In this regard, it can be mentioned that the rapid development of shale production in the United States was the result of not only a technological breakthrough and extremely favorable financing conditions, but also the use of the principles of a networked business model instead of the traditional vertical hierarchical model for the industry. The search for new optimal business models is important for the industry, since the need for them dictates a change in the general paradigm of the development of the world economy. The sharp rise in the price of oil in the early 2000s, associated with the growth of the Chinese economy, created the idea of an imminent and imminent oil shortage. The consequence was the dominance of national oil companies. By 2007, these (including those privatized shortly before that) were 14 of the world's 20 largest energy producers.

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