

# Organizational-Legal and Technological Aspects of Ensuring Environmental Safety of Mining Enterprises: Perspective Analysis in the Context of the General Enhancement of Environmental Problem

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**Abstract.** The article is devoted to the analysis of problems of maintenance of ecological safety of the mining enterprises. The aim of the work was the formulation of proposals, the implementation of which, in the opinion of the authors, is capable of raising the level of environmental safety of the mining industry and ultimately ensuring the environmentally oriented growth of the Russian economy.

## 1 Introduction

The study is of an interdisciplinary nature. This approach allowed us to assess the problems of the negative impact of the mining industry on the environment in the context of the global environmental crisis and the need to ensure Russia's environmental security.

The authors note the awareness of the global nature of environmental changes by humanity, while pointing to the irreversibility of many natural processes, which confronts mankind as a whole and Russian society in particular with the task of preserving the environment and taking care of natural resources.

For the Russian mining industry, the solution of this task is complicated by the need to intensify production processes, which is due to the needs of our country's economic development and the place of the mining industry in the overall structure of the Russian economy.

The authors draw attention to the limitations of traditional approaches to solving this problem with a comprehensive assessment of the prospective possibilities to reduce the load exerted by mining enterprises on the environment. In their opinion, the improvement of environmental safety of mining enterprises is possible not only through technological innovations (although this is the main direction), but also through a system of organizational, legal and economic measures. As such measures they indicate: the creation of an effective system of environmental monitoring; strengthening the activities of control and supervisory and licensing authorities; introduction of economic and legal mechanisms

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that induce owners of industrial enterprises to modernize technological equipment; legislative prohibition of the practice of "temporarily permitted emissions of pollutants".

The realization of global changes that occurred in the natural environment under the influence of man-made impact came to humanity not immediately. For a long time man has been destroying the natural foundations of his existence, carrying out his interaction with nature within the framework of the so-called anthropocentric approach, that is, from the standpoint of a being that is the apex of evolution, and therefore having the absolute moral right to use natural resources exclusively at his own discretion, while forgetting about that that he is only part of a single chain of biospheric processes that occur on Earth.

This "forgetfulness" has led to the fact that, for the last 100 years, the concentration of carbon dioxide, one of the main greenhouse gases, has increased by 12-18% in the atmosphere; the dustiness of the atmosphere increased by 10-20%; the illumination of the Earth decreased by 7-10%; The ozone layer, which protects people from the deadly radiation of the Sun, decreased by 2%. The average annual temperature over the past 30 years has grown by 0.6 degrees; if the temperature increase does not stop - scientists predict that by 2020 the temperature will grow by 2-5 degrees - this will lead to the melting of glaciers, a rise in sea level of 20 centimeters, and by 2100 a rise of 1 meter, and the flooding of huge areas. Already, there is an intensive melting of the ice sheet in Greenland, ice shelves in Antarctica, mountain glaciers in the Alps, the Andes, the Himalayas, which leads to a reduction in fresh water supplies, drying up of mountain rivers that feed on meltwater. The area of tropical forests only in the last 10 years has decreased by 20-30%; forests of Siberia, Canada, the Amazon delta are annually reduced by 20 million hectares; arable lands lose 24 billion tons of fertile layer (especially intensively - India, China, CIS countries due to outdated methods of processing); 70-80% of the world's pastures have already turned into a desert. The World Ocean annually receives 3.5 million tons of oil and petroleum products. About 1.3 billion people use only contaminated water. The Earth's atmosphere annually receives 60 million tons of solid particles; Because of the emissions of sulfur dioxide, acid rains fall out [14].

In the Russian Federation, by the end of the 2000s, natural ecosystems were destroyed in 35% of the territory, 75% of water resources were not suitable for drinking, 56% of agricultural lands were subject to soil degradation [11].

The environmental safety of Russia, like any other country, is determined by the degree of its readiness to prevent threats and risks related to the state of the environment and its impact on the population. This includes factors of chemical and biological safety, because it is associated with the potentially dangerous effects of chemical and biological factors on the environment and the population of the country [7]. In a number of ways, the load on nature has reached critical values. As a result, the annual economic damage reaches 6% of GDP, and taking into account the health consequences of people - up to 15%.

The Yale Center for Environmental Law and Policy published the results of a global study of the world in terms of environmental performance in 2016 (The Environmental Performance Index 2016). Russia ranks 32 out of 180 in the ranking - between Azerbaijan and Bulgaria.

Degradation of the environment poses a significant threat to the population. The list of diseases directly related to ecology, including congenital malformations in infants, is increasing. In terms of the number of such cases, the Russian Federation has come close to the threatening 5% line, beyond which social and biological degradation is possible across the country [11].

The environmental safety in Russia is negatively affected by the imperfection of the system of environmental legislation: many normative acts essentially duplicate each other. In addition, there are contradictions in matters of environmental protection and environmental security, even at the constitutional level. [14].

Is it possible then to call the modern "homo sapiens" really a reasonable person? Let's leave this question open, but to date it is obvious that we have moved beyond the economic capacity of the biosphere, as a result of which the natural processes are destabilizing, creating a threat to the life-support of present and future generations[5]. Thus, ensuring environmental security is a common task for humanity. At the same time, the success of solving environmental safety, preserving a favorable environment and preventing the negative impact of economic and other activities on nature depends on the extent to which states take into account mutual interests in the process of developing natural resources and the level of their ecological communication in the global information space [12].

## **2 Materials and methods**

The materials for the study were statistical data of international and state organizations, scientific publications of Russian and foreign authors, official statements of the leaders of states, normative legal acts, and the authors' own empirical materials.

The conceptual position of the authors is that the problem of environmental safety is complex and includes aspects of various branches of knowledge: technological, legal, philosophical, economic, etc. This necessitates an interdisciplinary approach to its study that allows to consider environmental safety and the environment as a single a global system with a large number of relationships.

As the main methods, based on the interdisciplinary nature of the study, the following were used:

- a statistical method used to process data on the state of the environment;
- a systematic method used as a basis for studying the complex interrelationships between the extraction of solid minerals and indicators of the ecological background;
- The method of economic analysis, which made it possible to draw a conclusion about the economic feasibility of using certain technologies;
- a method of socio-psychological analysis, which made it possible to identify the characteristics of human perception and reaction to changes in the surrounding natural environment;
- a formal legal method used in the analysis of regulatory legal acts;
- futurological (prognostic) method, which made it possible to assess the prospects of organizational and legal and technological measures designed to ensure environmental safety of mining enterprises.

All research work of the authors was based on the principles of scientific, objectivity, correctness of the material presented.

## **3 Results And Discussion**

### **3.1 Necessity of ensuring environmental safety: scientific understanding of the problem.**

The situation described above has become the subject of active attention in scientific research since the 1970s. XX century. And quickly enough environmental problems began to be considered in the context of security. In the English-language scientific literature an expression of «environmental security», this means «safe environment» or «environmental safety». [4]. The same concept began to occur in Russian scientific research [2].

Discussion of environmental degradation problems has shifted from scientific studies to an official international level. The Stockholm Declaration, the Convention on Environmental Impact Assessment in a Transboundary Context, the Rio Declaration on Environment and Development, the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters and

others were accepted. The analysis of these documents allows us to speak about the unconditional awareness by the international community of the real threats that man's ill-considered activities in the environment contain, and attempts to formulate conceptual approaches to solving environmental problems. A clear understanding of the global nature of these problems makes them consider them only as problems that threaten the security of all mankind. In turn, assigning an environmental problem to the category of security problems means giving it the highest international priority [13].

In the context of the foregoing, the most depressing is the fact that mankind has sounded the alarm only in the conditions of the global ecological crisis, when the biosphere of our planet has largely lost its ability to support the natural biochemical cycles of self-healing. Perhaps such a belated response to a change in the environment is due to the inability of a person as a biological species to directly perceive dangerous changes in the quality characteristics of the environment in real time. Long-term research of specialists The Institute of Socio-Political Studies of the Russian Academy of Sciences [1] has shown that human communities tend to assess environmental changes solely from the point of view of their real impact on the level and quality of human life. This is the indirectness of our perception of environmental problems: the reaction is caused by their social consequences, and not by problems as such. Given the irreversibility of many natural processes, such an approach is fraught with disastrous consequences for people, since in solving environmental problems, the time factor that can be missed very often plays a decisive role.

In the case of Russia, the situation described above is exacerbated by the fact that the technological processes of most of the resource-extracting industries that form the backbone of our economy were initially built without due regard for their environmental consequences. Throughout the twentieth century, the dilemma of "economics or ecology" was clearly resolved in favor of the former. Moreover, for many decades this issue has not been raised in our country at all. At the same time, the urgent need for the present day in the development of industrial technologies in the direction of increasing their environmental friendliness does not at all cancel the considerations of the economic profitability of these types of industries, which is dictated by the conditions of a market economy. Thus, it is extremely urgent to develop such models of industrial production that would optimally combine the economic and environmental interests of society. To this we are inspired by the consciousness of social responsibility for future generations in the consumption of material and energy resources.

### 3.2. Ensuring Environmental Safety of Mining Enterprises: Opportunities and Prospects

Everything that has been said before is fully applicable to the mining industry. For this industry is characterized by a significant load on the environment, which manifests itself in the change in the natural landscape and other negative consequences. Carrying out seismic exploration and blasting operations, mechanical destruction of rocks by cutting is accompanied by noise, shaking, the formation of a large amount of dust and the emission of gases. In addition, some technological processes involve the use of large volumes of water, which significantly reduces the reserves of this critical resource. All these activities are associated with high consumption of materials and energy, the production of which, in turn, also harms nature. In the end, mining processes often lead to the destruction of natural ecosystems, or to negative changes in the habitat.

Soil erosion, disturbance of physical and chemical properties of soil, the same changes in water, air, drainage of lakes and marshes, reduction of biodiversity (both at the level of an individual species and at the level of the ecosystem as a whole), the destruction of biocenoses, their loss of self-regulation and self-recovery, harm to human health - this is an incomplete list of environmental damage that may be caused by mining enterprises. In this regard, we note that in the near future the impact of the mining industry on the environment

is likely to increase, which is due to the ongoing intensification of production processes [10]. Of course, this cannot but affect the overall state of environmental security in Russia.

It seems to the authors of the article that the need to solve the above problems requires the rapid development and introduction of alternative technologies into the ore mining and enrichment process, as well as the use of new schemes for the development of deposits that allow to combine economic and environmental interests with maximum effectiveness. For example, experts have long been paying attention to the need to sort the ore to be enriched, depending on the mechanical characteristics of the latter. Of course, this complicates the production process a little, because it forces us to consider, in addition to the mineralogical composition of the rock, its texture and structure, the granulometric composition of the rock and its strength. However, taking into account the given qualities of the rock when it is loaded into the crusher can reduce energy costs and loss of enrichment (provided that the optimal ore dressing option is selected). At the same time, a certain reduction in the harmful impact on the environment is achieved. Despite the obvious advantages of this innovation, this and similar technologies are still not widely used in the mining industry.

An important direction in optimizing the mining industry both from the point of view of profitability and from the point of view of ecological safety is the development of technologies that make it possible to use the full potential of the field being developed. This involves the inclusion in the production process in addition to the main product - ores with a high content of useful component, associated and by-products, that is, ores with a low content of the useful component, as well as other materials of the deposit. At present, huge areas are occupied by dumps of poor and off-balance ores, as well as by storages of other breeds that are not included in the technological chain of mining and processing production and that are harmful to the environment, because they are sources of constant dusting of the atmosphere, are located on territories that could be used in agriculture and forestry, etc. Reducing the burden on the environment in this situation could be facilitated by the more active use of low-waste technologies, the introduction of which, apart from the environmental effect, would undoubtedly have an economic effect. Moreover, in a number of cases, both of these effects are fully interrelated - it is enough to recall the use of mining waste to improve the quality of land during reclamation, as well as the possibility of using as mineral fertilizers slurry enrichment of phosphorescent ores, which in addition to phosphorus contain a long list of necessary in agriculture of chemical elements.

It should be noted that significant shortcomings for the environment result in shortcomings in the planning and organization of development systems for mining deposits, as well as inattention to indicators of environmental safety of production materials. All this causes an urgent need to change traditional approaches to the organization of development of deposits and development of alternative production management schemes in mining enterprises, which allow to reduce the negative load on the environment. As an example, we note that even a simple reduction in production losses can significantly improve the state of the environment. And the speech in this case is not only about the savings that can be used for the subsequent reclamation of the deposit. The maximum full utilization of the potential of the developed deposit postpones the beginning of the operation of a new field in time, which, taking into account the environmental consequences of such operations, and taking into account the limited natural resources, reduces the overall negative environmental load.

Of course, innovative technological solutions based on a different perception of the surrounding nature and human place in it play the main role in the processes of increasing the "environmental friendliness" of mining enterprises (like any other). However, it is already impossible to solve problems related to the state of the environment, relying only on the development of engineering thought [6]. A comprehensive approach is needed,

based not only on improving industrial technologies, but also on a wide range of economic, legal, ideological, organizational and managerial means.

Some main lines of activities designed to improve the state of the environment and ensure environmental safety of Russia's economic development are named in the Concept of Long-Term Social and Economic Development of the Russian Federation for the period up to 2020. Such areas are: 1. Establishment of a developed waste recycling industry and 2. Expanding the use of renewable energy sources. However, these areas of activity are more closely related to the technological side of the issue. As for other measures, first of all organizational and legal, then, in our opinion, they should assume the following:

1. creation of a modern system of environmental monitoring. The absence of such a system in Russia significantly complicates the possibility of implementing a single state environmental policy stipulated in the Environmental Doctrine of the Russian Federation No. 1225-r of August 31, 2002 and the Basics of State Policy in the Field of Environmental Development of the Russian Federation for the period up to 2030 from 30.04.2012, The lack of a complete and objective, and most importantly - constantly incoming information on the ecological condition of the territories does not allow for the effective planning of environmental scale of the country. It seems that there is no need to say that given the characteristics of the biosphere, these activities should be carried out within the framework of a single plan;

2. Strengthening the activities of control and supervisory and licensing bodies. Particular attention should be paid to the mandatory environmental impact assessment of production projects, environmental auditing, certification and licensing of industrial activities. These measures are largely capable of preventing environmental damage, and it is always better than compensating for this damage;

3. Introduction of economic and legal mechanisms that induce owners of industrial enterprises to modernize technological equipment. As the simplest and most effective measures could be even more significant fines for environmental pollution and tax incentives in the transition of the company to clean technologies;

4. Legislative prohibition of the practice of "temporarily permitted emissions of pollutants".

It seems to the authors of this article that a skilful combination of the above measures and promising technological solutions will ensure a higher level of environmental safety not only for the mining industry, but also for other industries of Russian industry.

## **4 Conclusion**

The conducted research allowed the authors to draw the following conclusions:

1. The global environmental crisis that hit the planet did not bypass Russia. This complicates for our country the task of economic growth and encourages society to develop a new strategy for its interaction with nature based on saving resources and taking care of the environment;

2. Improving the environmental safety of mining enterprises is part of the overall goal of preserving the environment that is conducive to human life and health. This implies a comprehensive approach to solving the problem, which includes not only technical modernization, but also systemic changes in the entire process of development and mining of deposits;

3. The mining industry is one of the most significant factors of the negative impact on the environment. This is due to significant changes in the natural landscape, as well as other negative consequences of this type of industrial activity, which are both direct and indirect. At the same time, the mining industry is one of the foundations of Russia's economic development, which implies an inevitable intensification of the processes of mining of solid

minerals. Given the severity of the environmental problems that arise and the threat of significant increase while maintaining traditional approaches to the development of ore deposits, the urgent need of today is the improvement of mining processes based on the use of innovative technologies that reduce the burden on the environment;

4. The organizational and legal measures that can ensure the environmental safety of mining enterprises are: the creation of an effective system of environmental monitoring; strengthening the activities of control and supervisory and licensing authorities; introduction of economic and legal mechanisms that induce owners of industrial enterprises to modernize technological equipment; legislative prohibition of the practice of "temporarily permitted emissions of pollutants".

The implementation of these measures in combination with technological developments creates the prospect of an environmentally oriented growth of the Russian economy.

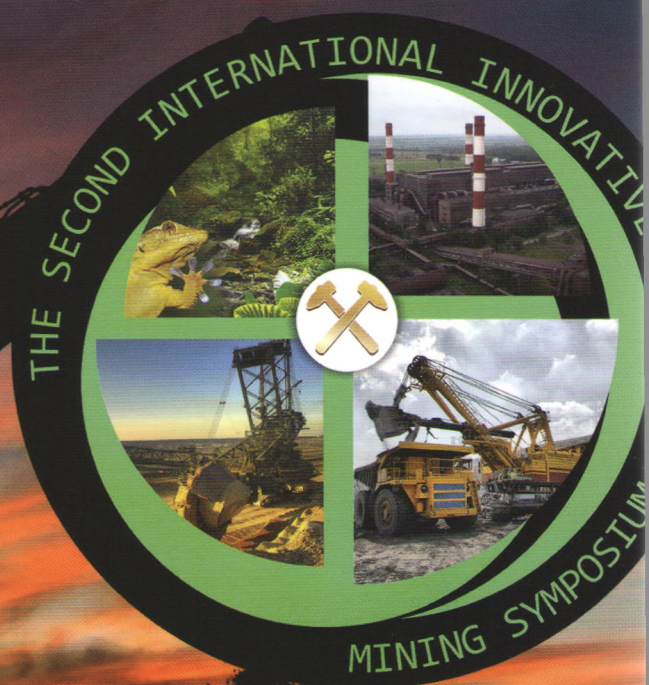
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The sustainable development of mining regions requires synchronous impetus of innovations in mineral resources extracting and processing, environment protection technologies, mining machinery and social-and-economic activities. The whole industrial complex of the region including subsoil use, modernization of mining equipment and the development of human capital should become a platform for sustainable development. The aim of The 11nd International Innovative Mining Symposium (Devoted to Russian Federation Year of Environment) is to create a workshop for international discussion of urgent issues of resource sector's environment-friendly development worldwide by specialists, experts and researchers. The leading role in this discussion belongs to the mineral resource universities – the centers of innovative development of the mining regions.

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