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Environmental Engineering: Regional Aspects (on the Example of the Krasnoyarsk Territory)

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Abstract. Environmental pollution has reached dangerous levels in many countries, including Russia. Given the fact that the main source of such anthropogenic impact on nature is production, the question of the impact on the economic sector naturally arises in order to influence the stabilization of the situation with the state of modern ecology. Environmental engineering is such a complex tool. At the same time, several levels of it should be distinguished: national, acting on the whole state and establishing the main, fundamental propositions addressed to all its subjects; regional, taking into account the economic and climatic and natural specifics of a particular region; local, at the level of a specific enterprise. This article reveals some aspects of the regional engineering on the example of the Krasnoyarsk Territory, given that the ecological problem is the most acute for this region, given that the region takes the first places in the Russian Federation (and its individual settlements – in the world) by the level of contamination.

1. Introduction

The role and importance of environmental engineering is currently very important. This is due to the tasks that environmental engineering is called upon to solve: promoting economic development while ensuring compliance with the environmental balance; greening of technological processes; introduction of environmental safety principles at industrial enterprises; assistance in ensuring environmental stability in a particular region, etc. Accordingly, environmental engineering itself is a complex environmental tool used in industrial activities [1]. The purpose of environmental engineering is that it helps to create a feasibility study of the system of actions, measures and activities aimed at environmental modernization of production, within the framework established by law, under state and public control and supervision [2] to promote environmental protection [3]. Accordingly, we are talking about a whole complex mechanism, which includes such blocks as legal framework, organizational measures, economic interests, management decisions, administration, including legal responsibility, etc.

This is specified in such events and activities as environmental monitoring, environmental impact assessment, environmental expertise, environmental regulation, environmental licensing and certification, environmental control and supervision, etc. [4]. Given their diversity, however, we would like to highlight three of them – environmental monitoring, environmental management and environmental control and supervision. Moreover, due to the fact that an individual (in this case, regional, taking into consideration the macro level of the matter, which an environmental issue is) approach allows us to take into account the specific features of the situation and help develop ways to



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improve it, we will dwell on one of the regions of the Russian Federation - the Krasnoyarsk Territory, given that this particular region is one of the most environmentally unfavorable.

In terms of impact on the components of the environment, the Krasnoyarsk Territory takes one of the leading places, both in the Siberian Federal District and in the Russian Federation.

The modern ecological situation in the region, formed under the influence of natural and anthropogenic factors, is characterized by the manifestation of a set of acute environmental problems, and their accumulation.

2. Environmental monitoring

Environmental pollution monitoring is carried out to solve the following tasks:

- monitoring the level of environmental pollution by physical, chemical, and hydrobiological indicators (for water bodies) in order to study the distribution of pollutants in time and space, assess and forecast the state of the environment, and determine the effectiveness of measures to protect it;
- providing government agencies, business organizations and the population with systematic and emergency information on changes in pollution levels (including radioactive) of atmospheric air and water bodies under the influence of economic activities and hydrometeorological conditions;
- providing interested organizations with materials for making recommendations in the field of environmental protection and promoting environmental stability through the efficient use of natural objects, planning the activities of enterprises taking into account environmental requirements in the context of economic interests of enterprises.

In the Krasnoyarsk Territory, environmental monitoring is carried out by monitoring the main four types of observations using the state monitoring network for observation and includes monitoring:

- air quality in urban areas;
- the state of land surface water pollution;
- the chemical composition and acidity of precipitation and snow cover;
- the radioactive contamination of the natural environment.

An important condition for effectiveness is that environmental monitoring should be carried out on the basis of the complexity of measures and the systematic nature of observations. A ground state surveillance network helps provide this [5]. With the assumption that environmental monitoring is facilitated by the establishment of interconnections (and their subsequent implementation in the activities of specific enterprises) between hydrological, climatic, geographical features, meteorological conditions, economic activity and environmental safety.

The result of the state environmental monitoring network is to obtain information on the degree of environmental pollution. This is done in accordance with regulatory documents of the Federal service for Hydrometeorology and the resolution of the administration of the Krasnoyarsk Territory dated 20.07.1997. No. 451-p "On the procedure for collecting and exchanging information in the Krasnoyarsk Territory in the field of protecting the population and territories from natural and man-made emergencies of an intermunicipal and regional character" [6], taking into account the principles of state policy in the field of environmental development of the Russian Federation for the period up to 2030, the Charter of the Krasnoyarsk Territory, laws and other regulatory acts of the Krasnoyarsk Territory, and the documents of long-term strategic planning of the Russian Federation and the Krasnoyarsk Territory.

However, the regulatory legal support for environmental protection and environmental safety needs to adopt new and improve existing legislative and other legal acts of the Krasnoyarsk Territory, since it does not have a structurally coherent and consistent system. This concerns the implementation of state policy in the field of environmental protection and rational use of natural resources, increasing responsibility for violations of the regional legislation on environmental protection and the inevitability of punishment for environmental crimes, etc. (Despite the fact that there are draft normative legal acts based on the use of an integrated approach and reflecting the results of scientific

research, modern realities and features of the region, for example, the draft Concept of environmental policy of the Krasnoyarsk Territory until 2030 [7]).

Environmental monitoring of how anthropogenic impact on the environment is carried out by enterprises of the Krasnoyarsk Territory is a part of national environmental control. Accordingly, environmental monitoring and environmental control should be in constant and close interconnection, thereby providing a solution to the challenges facing each other. In the Krasnoyarsk region, it is implemented by the branch of the federal state institution "Center for Laboratory Analysis and Technical Measurements in the Siberian Federal District" - CLATM for the Yenisei region. Thus, in order to collect information about the level of negative impact of wastewater discharges from industrial enterprises on the ecology of water bodies, different water samples are taken, both in discharge sites, and above and below these places.

Sampling of atmospheric air is also carried out. This is performed in the territories where waste and other industrial activity results are located. The task is to assess the degree of their impact on the environment. If necessary, soil samples are taken.

The radiation situation in the region is assessed through radiation hygiene monitoring. But in addition to such monitoring, the authorities also carry out supervisory activities to assess the quality of radiation safety of both industrial enterprises and the natural environment.

However, it is very important to have a unified information system for environmental monitoring that combines data from observations received by federal and regional authorized bodies and economic entities to provide state and local authorities, legal entities and the population with information on the state of the environment, among other things in emergency situations, and this needs to be improved in the Krasnoyarsk Territory. In addition:

- there is an imperfection of legal regulation;
- there are virtually no effective economic mechanisms;
- there are shortcomings in the management system and the formation of separate directions of regional policy [8];
- there is a lack of clarity in the division of powers between different levels of government and local self-government;
- there are not enough environmental monitoring networks to gather the necessary information;
- there is no unified data bank of environmental information to improve the effective activities of public organizations with an environmental focus [9].

Accordingly, these problems should become the tasks for the relevant authorities to find ways to resolve them.

3. Environmental management

Environmental management is the management of environmental activities and natural resource use. The object of environmental management research is the practice of using the natural environment and natural resources by mankind. The local result of a properly built environmental management is that through it specific recommendations are formed on the use of natural resources in different areas of production, but based on environmental principles. The overall result will be that at the regional level the concept of sustainable environmental and economic development will be created and implemented [10], which is part of the concept of sustainable development of territories in general. Thus, the application of scientific and applied developments of environmental management in the activities of industrial enterprises of the Krasnoyarsk Territory allows you to:

- reduce the generation of waste and other polluting objects;
- organize a process for a more rational and efficient use of energy and resources of the enterprise;
- minimize the risks of industrial accidents having environmental consequences [11].

From this perspective, the use of environmental management ideas and developments in individual enterprises of the Krasnoyarsk Territory is an important element of its environmental safety system.

However, in the Krasnoyarsk Territory, the economic interest of enterprises that implement high technologies to improve environmentally disadvantaged areas, including rehabilitation, use of secondary resources, sorting and recycling of waste, production of environmentally friendly products, etc., is poorly stimulated. The main disadvantages of the economic mechanism of environmental protection and nature management are:

- lack of effective incentives to reduce the negative impact on the environment, rational use of natural resources and the use of resource- and energy-saving technologies;
- a clear lack of payments for emissions, discharges, waste disposal and use of natural resources to finance environmental activities and the reproduction of renewable natural resources on the required scale;
- gaps in legislation, etc.

It is necessary to make more active use of modern achievements and results of scientific research, referring to the experience of other regions as well. Thus, in the Chelyabinsk region of the Russian Federation, a number of projects and developments to ensure environmental protection were presented at the Ecoengineering forum, for example, the Ecomonitor environmental monitoring and forecasting complex. The complex is a system of control and measuring equipment combined with software. Ecomonitor measures the level of polluting emissions from pipes of enterprises equipped with automatic monitoring sensors, and then in real-time mode, creates a map of the environmental situation, taking into account the features of the terrain, urban development and weather conditions. The system can also make short- and long-term forecasts of the pollutants spread based on the data obtained. Ecomonitor can become an effective tool for calculating the contribution of a specific source to the overall environmental pollution, both in real-time mode and in the form of forecast indicators [12].

4. Environmental control and supervision

The management system in the field of environmental protection and environmental safety requires improvement, first of all, in the sphere of action coordination of the region state authorities and local self-government bodies; restoration of state and public environmental expertise for projects of environmentally dangerous objects and strengthening of its role at the regional (territorial) level; implementation of territorial planning based on regional and / or local urban planning standards with mandatory consideration of air pollution and other natural environments; improvement of the system for financing environmental projects. The main task in this area is to ensure effective state management of environmental protection and the use of natural resources in accordance with the democratic system and market economy, as well as a clear division of powers and responsibilities between federal and regional public authorities and local authorities in the field of control over the use of resources and the state of the environment. Moreover, of course, there is an effective system of control and supervision: state [13], municipal [14] and public [15]. Although, it is necessary to distinguish between environmental control and environmental supervision [16], nevertheless, they perform a single security function for compliance with environmental legislation and the activities of subjects of relations affecting the sphere of environmental safety.

However, there are a number of problems with the implementation of these activities, the content of which allows us to note that in order to eliminate them, it is necessary:

- to improve the division of powers and coordination of actions of the regional state authorities and local self-government bodies in the field of environmental protection and environmental safety;
- to improve the effectiveness assessment of executive bodies of state power and local self-government in the field of environmental protection and environmental safety [17];
- to improve the effectiveness of regional state environmental supervision [18] and control [19];
- to restore the state and public environmental expertise for projects of environmentally dangerous objects and strengthen its role at the regional (territorial) level [20];
- to expand the scope, forms and methods of public control [21];

- to use positive experience, including other states [22, 23, 24, 25].

5. Conclusions

Solving problems of national importance by resolving them at the regional level seems to be the most optimal way to achieve the desired result. The economic stability of the state and the well-being of the population can become possible when implementing economic tasks in a specific legally separate territory, through the use of various mechanisms, but taking into account the territorial specificity. Natural and climatic factors, geography of the area, city-forming and other large-scale industries - this is what matters from the point of view of the economy. However, environmental interests should still be primary. And it is the creation of a balance between these two seemingly incompatible interest groups that will be able to realize the very maximum result of ensuring the well-being of the population that the state takes upon itself as a political institution. For this, in particular, it is necessary:

- to include the natural environment in the system of socio-economic relations as one of the most valuable components of the national heritage;
- to create an ecological environment in the state by creating it at the regional level, taking into account the socio-economic features and natural and climatic uniqueness of a particular region;
- to develop cooperation with other regions to solve the problem of interregional transport of substances that pollute atmospheric air and surface water bodies;
- to develop the socio-economic directions of the regions, taking into account the specifics of both regional economic policy and environmental policy, since the health, social well-being and environmental safety of the population are inseparably united;
- to develop science, engineering and technology as priority areas in the field of environmental protection, nature management and environmental safety within the framework of the Russian Federation participation in international agreements;
- to form an environmental culture and an environmentally responsible worldview, to develop pro-environmental education (and definitely, a system of professional training and retraining of managers and specialists responsible for decision-making in the field of environmental management, environmental protection and environmental safety), legal awareness and ecological upbringing.

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