

# Environmental Safety and Sustainable Development of Industrial Territories (on the Example of the Urals)

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**Abstract**—The modern development of society (spiritual, moral, ecological, social, economic, focused primarily on the maximum satisfaction of the growing needs of people, leads, in the opinion of the world community (UN, ECE, UNDP, etc.), to a systemic crisis, (Rio 92, Johannesburg 2002, Rio + 20) Developed countries of the world (King of Sweden Carl XVI Gustav, 1972, Prime Minister of Norway GH Brutland, 1986, French President F. Mitterrand, 1995; Roman Club - 43 report in 2017, etc.) to the speedy transition the water of the world community on the principles of sustainable development that meets the needs of the present, but does not jeopardize the ability of future generations to meet their own needs. The formation of sustainable development of industrial territories begins with a comprehensive assessment of the ecological security of the territory, determining the values of permissible "corridors" of nature management, interests of nature users with public preferences, the search for optimal environmental conditions and taking practical decisions on the management of the territory on the basis of a hierarchy of management levels.

**Keywords**— *ecological safety, sustainable development, industrial territories*

## I. INTRODUCTION

The relevance of this work is due to the growing challenges and risks that arise in the mining territories and the need to counteract them [1]. The aim of the research is to develop a methodology for environmentally safe sustainable development of industrial areas in the conditions of modern environmental changes under the influence of anthropogenic loads. The world community approached (Rio-92, Johannesburg, 2002, Rio + 20) to understand the importance of adjusting the development of society in relations with the natural environment, the need to develop the principles of economic activity in the light of emerging and emerging challenges and risks. Currently, the most obvious challenges and risks are environmental threats (without diminishing the social significance), realized in the form of various negative consequences, first for the environment, and then for various sectors of the economy: subsoil use, forest use, etc.

Environmental threats cause negative consequences due to natural factors and described mainly by the characteristics of global climate change, and anthropogenic (including technogenic) factors in the form of contaminants into environment (air, plants, soil, water), as accumulated industrial wastes in the form of destruction of natural ecosystems. The main environmental risks in the sphere of nature management are an increase in the frequency and intensity of extreme weather and climate events.

## II. STATE OF THE PROBLEM E

Approaches and main provisions of environmental safety were developed in all subjects of the Ural Federal District of the URFO. The work on the formation of the Concept of Sustainable Development in the Urals Federal District was continued with the development of the draft concept of environmental safety of the Ural Federal District under the auspices of the Office of the Plenipotentiary Envoy of the President of the Russian Federation in the Urals Federal District in 2011. A creative team was formed from specialists of the Institute of the Ural Branch of the Russian Academy of Sciences and universities in Yekaterinburg. In the video conference mode, meetings of a working group with the participation of all six constituent entities of the Russian Federation in the Urals Federal District took place on December 26, 2011, April 27, 2012, October 29, 2012, April 11, 2013. A comprehensive analysis of the current environmental situation in the Urals region was carried out, it was recognized that despite the presence of regional plans for environmental safety in many regions of the Urals Federal District, the situation is not improving. All evidence suggests that the most important cause of negative trends in the sphere of human-nature interaction is the low level of environmental consciousness and, most importantly, the managers of the management sphere of various activities. Thus, in an interview with the presidential envoy in the Urals Federal District [2], the ways of innovative development of the Urals Federal District were highlighted, but none of them showed

satisfaction of the basic human needs: in clean air, in clean water, in safe foodstuffs, there were no provisions for improving the health of the population, and without them any economic activity loses common sense. Further development of nature management in accordance with the Concept of Sustainable Development of Territories, the principles of environmental safety of society and the "green" economy should be based on a methodology consistent with the principles that take into account the long-term and multi-purpose importance of land resources.

### III. STATEMENT OF THE PROBLEM AND METHODS OF SOLUTION

The fundamental scientific task is to substantiate the methodology for the formation of environmental safety and to develop scientific and technological principles for the sustainable development of industrial areas.

Methodology (the theory of the principles of construction, forms and methods of scientific knowledge [3] the formation of environmental safety and sustainable development of the industrial region is based on:

- the primary consideration of the natural factor in the conduct of economic activity as the basis of favorable conditions of society, implemented by maintaining the biotic regulation of the environment and

- the formation of an appropriate hierarchy of levels of governance (environmental security and sustainable development (conceptual, ideological, political and economic.

Scientific and technological principles of environmental safety and sustainable development of industrial territories include:

- selection of strategic priorities and indicators,
- a comprehensive assessment of the natural resource potential,
- defining the boundaries of the "corridors" of permissible nature management,
- coordination of individual interests of nature users and public preferences,
- multi-criteria optimization of the sustainable industrial region system.

### IV. METHODOLOGY OF ENVIRONMENTAL SAFETY AND SUSTAINABLE DEVELOPMENT

#### 4.1. Accounting for the natural factor

The natural factor is taken into account on the basis of the theory of biotic regulation of the natural environment (OPS), which relies on biology and physics and does not contradict their basic laws [4,5]. The theory of biological regulation from a single position makes it possible to explain natural phenomena and processes in industrial areas.

#### 4.2. Hierarchy of Management Levels

The conceptual level is a fundamental link in environmental safety and sustainable development, since it sets the main targets for a long period of time [8]. They are managed by the economy within the boundaries of the justified "corridors" of the permissible withdrawal of its resources from the natural environment [9] and the permissible degree of negative impact on it (atmosphere air, vegetation, soil, natural landscapes. [10] The ideological level determines the main direction and ways of implementing the conceptual guidelines - the ecologization of public consciousness (primarily in the business community), expressed in a conscious duty to comply with the requirements of environmental security in the region [11]. The political level of governance, based on conceptual attitudes and ideological level, presupposes the formation of an appropriate legal and regulatory framework. The economic level of governance is the link where conceptual ideological and political attitudes are realized in the economic sphere.

##### 1. Strategic priorities and indicators

The set of strategic priorities and indicators is divided into a group of individual indicators and groups of integrated indicators [12]; This differentiation and the order of the indicators of environmental safety and sustainable development make it possible to enter the system of international ratings and objectively assess the stages of environmental formation of environmental security in the regions. The largest income index in the Tyumen region (GRP of the Tyumen region for 1 person is 4 times higher than in Sverdlovsk), the largest indices of longevity and education in Moscow; in the end, the HDI in Moscow is the highest, and in the Tyumen region is approaching the index in Moscow.

##### 2. Integrated Assessment

A comprehensive assessment of the natural and resource potential of the territory of the industrial region is based on the values of natural indicators of natural ecosystems and their economic equivalents using discounting the future significance of natural goods. The proposed principles of discounting (forecasting) allow us to conduct scientifically valid comparisons (analysis) of the different-time environmental management effects; the specific values of discount rates and discounting factors are justified by stages to environmental safety and sustainable development. Methodological tools for environmental and economic assessment of natural resources, both component and complex, are made on the basis of natural characteristics (biometric and bioproduction), technological and technical parameters, economic equivalents to these indicators, and the definition of a complex criterion, taking into account broad-spatial (land transformation under anthropogenic and natural impacts) and long-term changes (environmental education processes, the impact of accumulated damage), as well as the risk the emergence of various situations due to climate change.

##### 3. Definition of "corridors"

"Corridors" of permissible nature management in industrial regions are described by the sets of parameters: environmental, social, economic, technological [14,15] the necessity and importance (including scientific novelty) of the "corridors" of permissible nature management in comparison with the traditional justifications for the permissible values of the influence parameters on the environment lies in the systematic nature of the socio-economic factors under consideration, in accounting for buffer zones of interaction between natural and anthropogenic (typical for the old developed mining territories), taking into account the large-scale (the mining complex of the Urals affects even the ecosystems of the Arctic Ocean) and the long-term consequences (the disturbed hydrological regimes of the regions with flooded mines, mines, quarries).

#### 4. Coordination of interests

One of the difficulties in the formation of environmental safety and sustainable development in industrial regions is the need to combine individual interests with public preferences, which often do not coincide. It is important here to effectively combine the absolutization of the effect in the limited time intervals of individual interests and the increasing role of the ecological and social aspects of public preferences in the long term. Scientific approaches to the harmonization of interests of individual subsoil users with public preferences in theoretical and practical sense is based on taking into account the factor of the depletion of underground resources [16]. Its peculiarity is that in a market economy, competing subjects of the mining complex in specific periods are not in a position to form their production in an optimal way; they are not able to provide the resources of future generations. The coordination of individual interests and public preferences consists in [16,17]: consistent ecologization of subsoil use; optimal distribution of subsoil resources between generations through justification of the public discount rate to justify (determine) concessions to the interests of individual subsoil users and public preferences on the basis of analysis of the dependence of criteria on options for field development.

#### 5. Multi-criteria optimization

Search for optimal environmental safety and sustainable development

(effective) variants of multicriter solutions at the stages is carried out: at the beginning, the definition of optimal variants for all particular criteria with the disclosure of the uncertainty of solutions, and then in relatively simple situations using the method of lexicography and in more complex cases by the method of successive concessions. [18, 19]. The novelty of this approach is to obtain really optimal solutions in complex economic systems "economics - ecology - sociology" on the basis of rigorous mathematical methods.

### V. CONCLUSION

Environmental safety and sustainable development in industrial regions is based on the highest priorities for taking into account the natural factor in the management of

territories. The improvement of the concept of environmental safety is based on the distribution of biological energy flows between natural and anthropogenic channels in the region, the regulation of the flow of biogenic information elements in natural ecosystems. Applied importance of the improved concept of ecological security of the region is to justify and form the sphere of conscious public duty to comply with environmental safety requirements on the basis of understanding that without clean air, clean water, safe food, any economic activity loses its meaning. the issues of methodological provision of land use should become one of the priority areas of environmental, social and economic policy. A practical solution to the methodological support of sustainable land management should be decided on the basis of a fundamental scientific basis and the latest achievements of science and practice. Thus, consideration of modern challenges and risks (the accumulation of environmental damage-increasing frequency of the intensity of extreme weather and climate events) in sustainable management in mining areas is the condition of the proposed methodology for implementing sound scientific and technical principles for sustainable nature management. Planning and management of natural resources should be carried out on the basis of a hierarchy of levels of management of sustainable land use within the framework of the concept of biotic regulation of the environment and landscape planning of the territory within the administrative boundaries [20]. The evaluation stage of landscape planning allows obtaining an objective assessment of the state of the existing natural conditions of the planning territory. The criteria recommended for such an assessment should meet the following requirements:

Be oriented towards the main goals of using the territory in conditions of equal priorities for maintaining ecological balance and sustainable social and economic development;

reflect the current state of the natural environment in both natural and modified ecosystems under the impact of economic activity;

to give an idea of possible changes in the state of individual natural components in the implementation of the main areas of use of the territory and the permissible level of such use

Requirements are embodied in the categories "values" and "sensitivity" of individual components of the natural environment. As a result of processing all information, a set of maps of the sectoral use of the territory is created at the exit, where the zoning of the territory was carried out according to the types of use targets. There are three types of goals:

preservation,  
development,  
improvement.

Further, based on the analysis of socio-economic problems (including maps of real use of the territory), a map-concept of the use of the territory is created. It identifies areas

recommended for the preservation of the natural environment and socio-economic development; Identify areas with the most acute environmental problems for which specific measures are planned for restoring the landscape; specify the direction of development of the territory. All the complexes disrupted in the process of use are combined into one zone in order to improve and restore them. The duration and technology of landscape restoration may vary depending on the nature and extent of their degradation.

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