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Analysis Of Environmental Indicators Of The Region

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Abstract: The paper discusses some aspects of environmental safety based on a statistical analysis of environmental indicators. The authors presented a lot of environmental indicators. For the analysis, the following main environmental indicators have been identified, such as the total amount of withdrawn water, including: from surface water bodies, comprising swamps, rivers, lakes; from underground reservoirs, municipal and other water supply systems. In this paper, a statistical calculation of environmental indicators for the controlled organizations of the geographic region of the Far Eastern Federal District (FEFD) is carried out. The dynamics of environmental indicators for the period 2018-2020 has been traced. The sample of indicators was determined based on the statistical data of the RusHydro Group. The main method used: comparative analysis (by year). For this analysis, the

following main phases of the distribution of pollution were selected: water, air, soil. The importance of the issue under study is emphasized by the current trends in the increase in water consumption and the growth of air and soil pollution. Processed quantitative data for the period under study make it possible to assess the quality of the environment. The relevance of assessing the quality of the environment is beyond doubt, since conducted environmental research is based on the study of environmental performance. At present, the priority role should be assigned to environmental protection measures based on international standards.

Keywords: environmental policy; environmental performance; wastewater; volume; water use, pollution, air.

Introduction

To ensure the environmental safety of both existing and newly created facilities in order to minimize the negative environmental impact and enhance the positive effects in the environment, to preserve the cleanliness of the environment, an environmental policy has been developed and approved. Environmental policy is mandatory for all businesses, and in fact, it is the choice of modern society to maintain environmental sustainability.

The human ability to change the environment has become global. In terms of water use, the following examples can be given. The "gigantism" prevailing in Soviet times acquired a catastrophic character. Many "construction projects of the century", for example, the construction of dams and reservoirs were held under the slogan "We take everything from nature, and nothing in return", without taking into account the environmental features of the territory. Millions of fertile areas have been flooded as a result of improperly managed structures.

Water resources, especially freshwater, are of great ecological and economic importance. Revealing the main ecological significance of water, we would also stress that water purity plays an important role in human well-being as an economic value:

– reserves of water resources determine the level of development of the water management;

– it determines the tendencies of rational nature management;

– polluted water, and especially dirty water, increases the cost of its maintenance and purification.

According to the existing water exploitation index, the threshold value between the non-tension and the tension of the water regime is about 20% [3].

The studied environmental indicators determine the extent to which freshwater is consumed, and whether the need to adjust such water use is ripe.

Sources of influence on freshwater resources are their overexploitation and degradation of the quality of the environment. Linking water withdrawals to replenishment of its reserves is one of the central issues in light of sustainable development, which is a major challenge in many countries. The quantity and quality of water resources, especially freshwater, determine the ecological sustainability of the planet, country, region.

The main function of water withdrawal, carried out by both public and private enterprises, is to supply various consumers with water.

Many enterprises are water users (are part of the water management complex of Russia), air and soil pollutants. The use of water bodies must strictly comply with the requirements of the legislation of the Russian Federation.

In terms of land use, we would indicate such large-scale pollution as the use of the insecticide DDT; excessive use of mineral fertilizers and pesticides; precipitation of acids, dioxins and other pollutants. These pollutants strongly affect the biotic component of ecosystems.

As a result of acid rain falling into water bodies, the pH of the water drops to 3.5 and below, fish disappear. The impact of acid rain on forests is more noticeable. Thus, in Australia, 24 kg of sulfur (in the form of acid) per hectare fall out per year. Including sulfur from neighboring countries, the figure rises to 34 kg per hectare. The concentration of sulfur in the winter air often exceeds the permissible limits by 30 times. Acid rain expels soil minerals, releasing toxic aluminum, which expels earthworms, kills soil bacteria and the smallest tree roots.

Another negative example of land use is a massive human attack on swamps (economic benefits are determined by the extraction of peat as electricity). Currently, about 60% of the swampy areas have been drained. This process leads to the occurrence of fire hazardous situations, an example is the emergency fires in the central part of Russia in the summer of 2010. All depleted peatlands are fire hazardous. Causes such as overheating of a peat bog due to solar radiation or as a result of negligent handling of fire by people lead to a peat fire. It is possible to exclude peat fires by soaking them with water, which will require sufficient resources and efforts. In the world, depleted peatlands are given for waterlogging.

Or dioxins ("supertoxicants"), spread over long distances by wind currents, pollute pastures, serve as a process of soil degradation, and enter food and drink along the food chain.

Various categories of generated waste in the form of hazardous, industrial and solid domestic waste strongly exert anthropogenic pressure on soils. Soil is the only component of the environment where people grow most of their products, and the quality of the soil is paramount.

The inhibiting effect of pollutants on human health and ecosystems, leading to corrosion of technical facilities, on monuments, etc. has long been proven and is beyond doubt.

The amount of emissions of such a pollutant as nitrogen oxide could tell about the degree of pressure on the air, with an assessment of the impact of economic sectors: energy, transport, agriculture, etc. Environmental policy can be implemented, in this case, through a review at the state level of environmental standards and the issuance of licenses for those activities that have an extremely negative effect on the air. To solve this problem, it is also necessary to improve the applied environmental instruments.

Revealed relevance of the study allow us determining the objective.

The purpose of the paper and this study is linked to the conduct of a statistical study of the environmental indicators of water use, air and soil emissions, to analyze the solution to the problem.

Let us present the object of interest for our study – environmental indicators.

Environmental indicators are a tool for assessing the ecological state of the environment. This tool, included in the environmental policy, reflects the trends of changes in environmental conditions in the country (region), thereby allowing timely response to these trends, taking various environmental measures.

Environmental indicators are classified in the following areas:

1) subject (environmental problem/economic sector), for example, emission effects on air, water, soil;

2) general assessment framework proposed by the UN;

3) functions of indicators linked to specific decisions in the security policy.

Let's highlight the variety of applied environmental indicators, assessed in terms of quantity (in the form of maximum permissible concentrations and levels, loads, etc.):

- concentration of pollutants in atmospheric air;
- concentration of pollutants in water when discharging waste water;
- concentration of pollutants in soil during waste disposal;
- levels of various radiations: noise, vibration, infrasound, ultrasound, energy fields, etc.;
- disturbance of ecological systems;
- area of degraded land;
- volume of economic damage from pollution;
- morbidity rate of the population;
- etc.

Most of the indicators are measured, calculated, statistically accumulated, systematized, etc. Environmental reports are compiled on several such indicators.

The object of the study of this paper is the environmental indicators of water use, emissions of pollutants, waste disposal. Summarizing the initial data of environmental indicators, we obtain that information with the help of which it is possible to assess the level of harmful effects (direct or indirect) on the environment.

It should also be taken into account that pollutions are interrelated (we will designate it as a paragenetic relationship), and pollution of one component (air) will inevitably cause pollution of other components (water, soil, plants, etc.), as well as the fact that most substances can have a summation effect, which makes these substances more toxic, be ubiquitous, persist for tens and hundreds of years, etc.

The scientific foundations of the study are represented by the following works. [1] presents a statistical analysis of environmental indicators, calculated for cities in Russia, with the highlighting of cities with average, minimum and maximum values. A collection of environmental indicators with their detailed description and an assessment of the role of the indicator in the form of driving force, pressure, state, impact, response is considered to be unique [3].

Materials and methods

The materials for the writing of the provided paper were studies in this area of knowledge, analysis, methods of induction and deduction, statistical data.

During this study, we used statistical tools; objective comparison of the data obtained.

Results and discussion

According to RusHydro Group [2], the volume of withdrawn water for the period of 2020 is 728.07 million m3, while almost all of this water is used for production needs. Let us examine the total amount of withdrawn water in Table 1, where the data on the amount of withdrawn water were the data [2]. The pollution characterization linked to the environmental assessment is based on emission and volume data. The main environmental indicators of water withdrawal for statistical processing were:

- the total amount of withdrawn water, incl.;
- water of surface water bodies, including waters of swamps, rivers, lakes;
- water from underground reservoirs and other water supply systems.

Table 1. Initial environmental data for the FEFD, thousand m^3

Sources of water supply	years			Change (+,-)	Growth rate, %	
	2018	2019	2020	2020/2018	2019/2018	2020/2019
Total, including:	696 510	709 027	683 416	-13094	101,80	96,4
from surface water bodies	668 037	591 135	555 155	-112882	88,5	94
from underground reservoirs and other water supply systems	28 472	117 891	128 261	99789	414	109

Let us display the calculated data in Figure 1. Water withdrawn from such water supply sources as surface water bodies decreased from 591 135 (2019) to 555 155 thousand m^3 (2020) over the entire period under consideration; from underground reservoirs and other water supply systems increased from 117 891 (2019) to 128 261 thousand m^3 (2020). The water withdrawn from underground reservoirs and other water supply systems is significantly lower than the withdrawn surface water, where the difference is 426 894 thousand m^3.

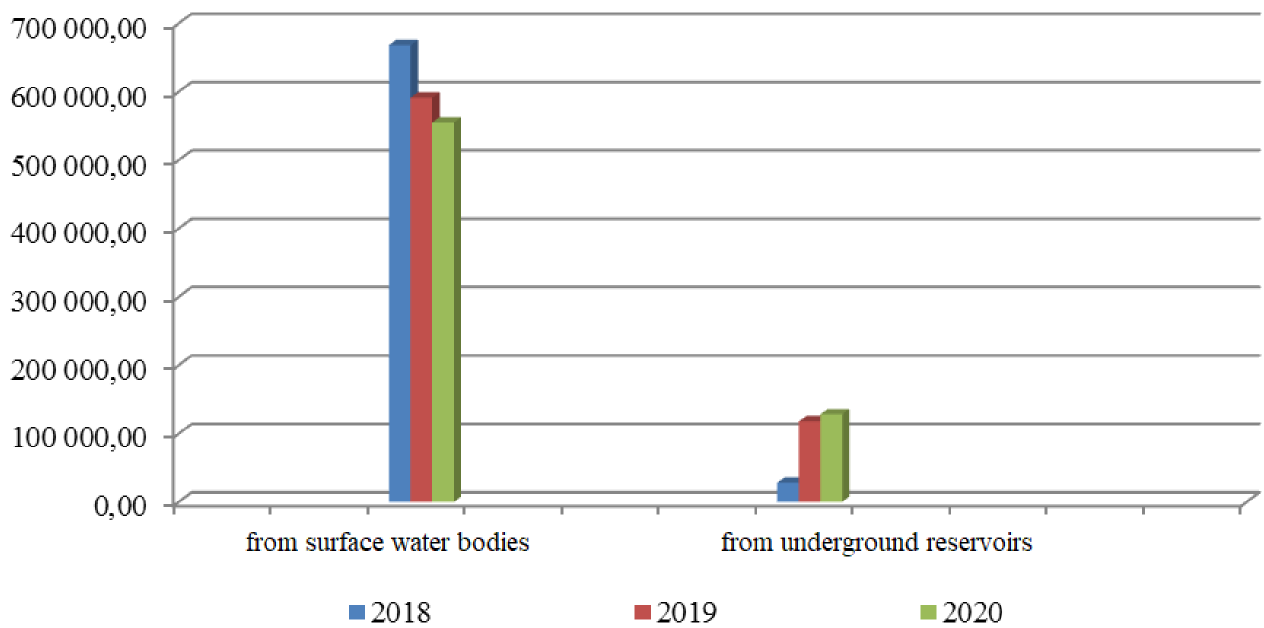

Figure 1. The volume of water withdrawn from various sources for the period 2018-2020, thousand m^3

Let us investigate the dynamics of the total volume during wastewater discharges with the treatment method and present it in Table 2 and Figure 2.

Table 2. Total volume during wastewater discharges with the treatment method, thousand m^3

Sources of water supply	For FEFD			Basic index, 2020/2018	Chain indices, %	
	2018	2019	2020		2019/ 2018	2020/ 2019
Without purification	212 779	201 438	215 402	101,2	94,7	106,9
Insufficiently purified	22 132	33 600	10 658	48,2	151,8	31,7
Clean to applicable standard	286 842	298 810	264 422	92,18	104,2	88,5
Purified to applicable standard at facilities	5 377	3 634	416	7,7	67,6	11,45

It should be noted that for the basic index of the volume of wastewater discharges:

– without purification – increased from 201 438 thousand m^3 in 2019 to 215 402 m^3 in 2020 by 1.2%;
– insufficiently purified – decreased from 33,600 thousand m^3 in 2019 to 10,658 thousand m^3 by 51.8%;
– clean to applicable standard – decreased from 298 810 thousand m^3 in 2019 to 264 422 thousand m^3 by 2.18%;

– purified to applicable standard at facilities – decreased by 77%.

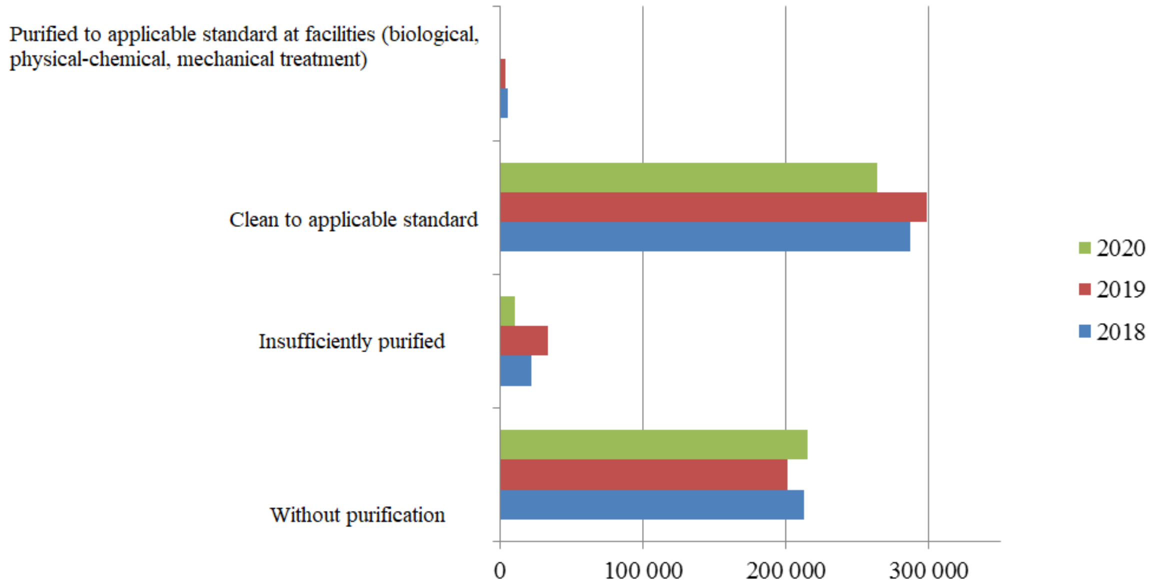

Figure 2. The total volume of wastewater discharge, with purification for the period 2018-2020, thousand m^3

Examining data on emissions of pollutants for the study period 2018-2020, let us point out that they amounted to 490 727 tons, of which: solid substances – 153 785 tons, gaseous and liquid substances – 336 943 tons, which is 183 158 tons more than solid ones, which is presented in Table 2. Total emissions by the following indicators were:

– sulfur oxides – 1333 102 tons.
– carbon oxides – 77153 tons.
– nitrogen oxides – 120 293 tons.

During this period, a total of 490,727 tons of pollutants were emitted into the atmosphere.

Table 2. Emissions of pollutants into the atmosphere, tons

Indicators	For FEFD			Basic index, 2020/ 2018	Chain indices, %	
	2018	2019	2020		2019/ 2018	2020/ 2019
Solid substances	87 461,43	66 323,22	95 325,30	109	75,83	143,73
Gaseous and liquid substances	187 434,99	149 507,62	187 483,50	100	79,77	125,40
Including from gaseous and liquid substances:						
sulfur oxides	81 118,79	51 983,65	81 541,00	100	64	156
carbon oxides	39 346,02	37 806,98	42 451,00	107	96	112

nitrogen oxides	62 962,22	57 331,18	59 970,00	95	91	105
Total pollutants emitted into the atmosphere	274 896,42	215 830,84	282 808,80	102	78	131

Table 3. Waste, tons

Indicators	For FEFD			Basic index, 2020/2018	Chain indices, %	
	2018	2019	2020		2019/ 2018	2020/ 2019
Waste of I and II hazard classes	0,045	0,050	0,041	91,11	111,11	82,00
Waste of III, IV and V hazard classes	29 599	23 807	1 894	6,40	80,43	7,96
Total	29 596,9	23 807,7	1 894,5	6,40	80,44	7,96

According to the data presented in Table 3, the generated waste is classified as I-V hazard class.

Environmental safety management plays an important role at the present stage of development of society. It includes the following:

1) water protection works carried out at production facilities in the form of:

- shore protection hydraulic engineering works and repairs;
- repair of anti-erosion hydraulic structures;
- repair of regulatory structures;
- regulation of dredging clearing of water bodies;
- clearing the water area of the reservoir, sections of river channels and canals;
- construction and repair of regulatory structures.

2) the most significant measures to reduce emissions of pollutants into the atmosphere are represented by the following types:

- reduction in electricity generation,
- reduction of fuel consumption of electricity and heat generation,
- improving the quality characteristics of fuel,
- implementation of measures to reduce emissions.

3) The generated waste decreased over this period due to the reduction of hazard class V waste due to the release of one of the hazardous facility of the economy in 2020.

To summarize the above, a statistical study of environmental indicators showed the following

1. Improvement of the studied indicators presupposes a unified approach to improving environmental indicators to minimize the negative impact of economic sectors on the environment.

2. It is necessary to create circulating systems to preserve the water basin of the region, modernize local treatment facilities, and, in general, introduce advanced environmental technologies.

3. A society striving for sustainable development should strive for objectivity and the importance of reliable information for making environmental decisions.

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