

Assessment of the state of the environment of the Russian Far East

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Abstract. Environmental monitoring is a long-term assessment of pollutant levels that helps assess pollution levels and provide information on trends in environmental quality. In addition, the environmental monitoring system supports research by providing scientists with the information they need to conduct long-term studies of the effects of various atmospheric exposures on the population and an overall assessment of the health effects of air pollution. The dynamics and structure of pollutant emissions has changed significantly in recent years. It was revealed that the gross volume of emissions into the atmosphere in 2021 decreased by 0.3% compared to the level of 2015 and amounted to 1592 thousand tons. Emissions from stationary sources in 2021 amounted to 1275.2 thousand tons, increased by 43.7% compared to 2015. The structure of emissions was dominated by CO, the emissions of which amounted to 413 thousand tons (increased by 31.8% since 2015). During the year, there was an increase in emissions of solid substances (by 44%), sulfur dioxide (by 55%), nitrogen oxides (by 56.6%), VOCs (by 77.2%).

1 Introduction

The Far Eastern Federal District is the largest federal district of the Russian Federation in terms of area, occupying 40.6% of its area.

The sanitary condition of the territory was influenced by the consequences of the development of the region and the birth of the Far Eastern cities themselves. In the XIX - early XX centuries. cities in the Far East arose as military posts, then (or simultaneously) they were given an administrative status, and only then economic, economic, social, cultural and other functions were "increased". In the second half of the 20th century, the most favorable period in the formation and development of cities in the Far East was the 1950s–1980s. During this time, their number and the number of people living there increased.

In the process of the formation of cities, their natural geosystem gradually changed and a new anthropogenic one arose with specific features of technogenic influence in its place. [1, 2]. The general trend in the development and growth (functioning) of cities is a progressive deterioration in the state of the components in them and human living conditions [3, 4].

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Technogenic pollution of the cities of the Far East does not allow us to define the vast majority of their territory as favorable for human habitation (46% of the population of the south of the Far East lives in environmentally hazardous conditions (hazard category II)) [5].

The federal district includes 11 subjects: Amur region, The Republic of Buryatia, Jewish Autonomous Region, Transbaikalian region, Kamchatka Krai, Magadan Region, Primorsky Krai, The Republic of Sakha (Yakutia), Sakhalin region, Khabarovsk region and Chukotka Autonomous Okrug.

The general state of the environment is characterized by an imbalance in nature management in almost all regions of the Far East. The ecological situation in each of the constituent entities of the Russian Federation is determined by the specifics of local natural and climatic conditions, as well as the nature and extent of the impact of industry, transport, agriculture and utilities on the environment [6, 7].

The main purpose of the work is to analyze the state of the environment in the Russian Far East.

2 Materials and methods

The background pollution of atmospheric air and precipitation was assessed using the network data.

Integrated Background Monitoring Stations (ICFM) and Specialized Stations of the Global Atmosphere Watch (WMO-GAW). Monitoring of the state of atmospheric air was carried out in 3 cities at 3 observation stations (Table 1).

3 Results

Table 1 presents the main indicators characterizing the Far Eastern Federal District [8-10].

Table 1. Main indicators of the Far Eastern Federal District.

Index	Year						
	2015	2016	2017	2018	2019	2020	2021
Area, thousand km ²	6169	6169	6953	6953	6953	6953	6953
Population, thousand people. (at the end of the year)	6195	6183	8223	8189	8167	8124	8091
Population density, people/km ² (at the end of the year)	1	0.9	1.2	1.2	1.2	1.2	1.2
Gross volume of emissions into the atmosphere, thousand tons	1597.3	1589.1	1634.1	2056.9	1447.22	1442	1592
Total emissions into the atmosphere from stationary sources, thousand tons	887.3	868.2	900.6	1026.4	1098.5	1120.2	1275.2
The specific volume of gross emissions into the atmosphere to BPII, t / 1 million rubles.	0.45	0.42	0.42	0.49	0.24	0.24	-
The proportion of the urban population living in cities with high and very high levels of atmospheric air pollution, %	40	33	18	25	35	21	55

According to the data presented in Table 1, the gross volume of emissions into the atmosphere in 2021 decreased by 0.3 % relative to the level of 2015 and amounted to 1,592 thousand tons. Emissions from stationary sources in 2021 amounted to 1,275.2 thousand tons,

compared with 2015 increased by 43.7% (Figure 1). Polluting is any substance whose concentration in the environment or the amount of which exceeds the natural background values. Pollutants introduce adverse changes of physical, chemical or biological properties into the environment and have a negative impact on the health of the population. Emissions of pollutants are recorded according to their aggregate state (solid, gaseous and liquid), by individual substances (ingredients) and by type of emission sources (stationary and mobile).

The dynamics of emissions of pollutants into the atmospheric air for 2015-2021 is shown in Figure 1.

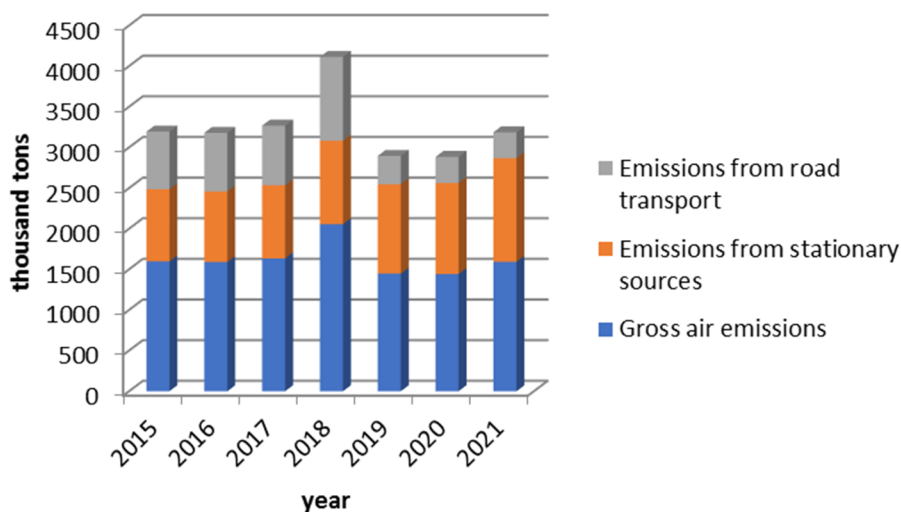


Fig. 1. Dynamics of emissions of pollutants into the atmospheric air on the territory of the Far Eastern Federal District.

Total emissions of air pollutants from mobile sources in the Far Eastern Federal District for the analyzed period amounted to 4183 thousand tons. The share of pollutants from road transport amounted to 20% of the total emissions in the district in 2021.

Monitoring of the state of atmospheric air was carried out in 34 cities at 64 observation stations, of which 11 cities were characterized by high and very high levels of atmospheric air pollution. The share of the population living in unfavorable air pollution conditions was 55% (Table 2).

Table 2. Monitoring of atmospheric air pollution in urban settlements.

The number of cities in which				Population in cities with high and very high levels of pollutants, %
API > 7	Q > MPC	SI > 10	GR > 20	
16	28	7	1	55

The structure of emissions was dominated by CO, whose emissions amounted to 413 thousand tons (increased by 31.8% since 2015). During the year, there was an increase in emissions of solids (by 44%), sulfur dioxide (by 55%), nitrogen oxides (by 56.6%), and drugs (by 77.2%) (Figure 2).

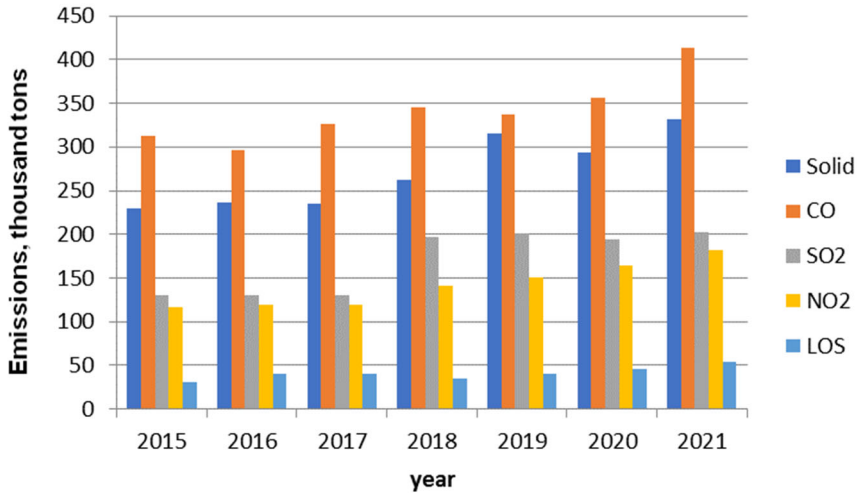


Fig. 2. Structure of emissions of pollutants from stationary sources.

Elevated concentrations of suspended solids, sulfur dioxide, nitrogen dioxide and oxide, carbon monoxide, and specific pollutants characteristic of individual territories have a negative impact on human health and ecosystems.

4 Discussion

Currently, environmental problems are observed in almost all cities and industrialized centers of the world, where the difficult environmental situation suggests the need to study and assess the negative consequences of anthropogenic impact in order to prevent or reduce damage to the national economy and harm to public health. Studying this problem and finding ways to solve it in every city is undoubtedly an urgent task of ensuring sustainable development. The Far Eastern Federal District is one of the largest constituent entities of the Russian Federation and the environmental problems of the district have become very acute and urgent in recent years.

In recent years, the understanding of the role of the state of the environment as the most important factor determining the quality of public health has increased significantly. In the Russian Federation on environment and health, the principles of state policy in the field of ecology and health have been formulated, continuing the strategy of the World Health Organization (WHO) "Health for all".

5 Conclusion

The modern data presented in the work can be used to make a forecast of the level of pollution of the air basin for the period under study. This will reduce the risk of high levels of pollution in certain periods of the year and in certain areas of the Far Eastern Federal District.

References

1. K. V. Filippova, *International Journal of Humanities and Natural Sciences* **2**, 6-8 (2018)
2. E. P. Zharikov, *Asia-Pacific region: economics, politics, law* **19-1**, 21-32 (2017)

3. A. A. Zhuravlev, V. D. Katin, *Ways to reduce emissions of pollutants into the atmosphere of cities of the Far East by the motor transport complex*, In the collection: Environment and health. Collection of articles of the II International Scientific and Practical Conference 26-30 (2020)
4. O. N. Kolbina, N. V. Yagotintseva, T. V. Safonova, A. V. Mokryak, International Scientific Research Journal **5-1 (119)**, 115-119 (2022)
5. N. G. Stepanko, A. A. Stepanko, G. G. Tkachenko, Moscow Economic Journal **12**, 21 (2019)
6. *Environmental protection in Russia* (Stat. sat./Rosstat, 2019)
7. *Main indicators of environmental protection* (Statistical Bulletin, 2021)
8. *Regions of Russia. Socio-economic indicators. 2018* (Stat. sat./Rosstat, 2018).
9. I. N. Shapoval, *Russia in numbers. 2021* (Short stat.sat./Rosstat, 2021)
10. State Report "On the State and Environmental Protection of the Russian Federation in 2017" (2017)