An anthropogenic impact on the atmosphere and measures taken to protect it in 1988-2017: data from the industrial Kemerovo region (a historical aspect)

A Kovalevskiy¹, Ye Luchnikova¹ and V Ilyashenko¹

¹ Kemerovo State University, 6 Krasnaya str., Kemerovo 650000 Russia

E-mail: passer125@yandex.ru

Abstract. The development of industry in the Kemerovo region was accompanied by a significant increase in anthropogenic pressure, including in the form of air pollution, which ultimately leads to a decrease in the quality of life of the local population. Due to environmental legislation adopted at the federal level, a favorable trend in reducing emissions of pollutants into the atmosphere can be traced. However, in practice, the measures taken did not lead to a noticeable improvement in the quality of atmospheric air in large cities of the region. On the positive side, we should note that the environmental legislation and the centralized system for monitoring and controlling the quality of the environment were laid towards the end of the USSR existence. In the Russian period of history, financial incentives for the transition to cleaner production technologies began to be applied. The right to a favorable environment is enshrined in the Constitution of the Russian Federation.

1. Introduction

In accordance with Article 42 of the Constitution of the Russian Federation, “Everyone has the right to a favorable environment, reliable information about its condition, and to compensation for the damage caused to its health or property by an environmental offense” [1]. Consequently, atmospheric air protection is one of the pressing problems facing public authorities, especially in industrialized regions. Due to their peculiarities, various substances emitted into the atmosphere can be spread over many hundreds and thousands of kilometers, leading to negative consequences in territories that are far beyond the borders of an industrial region. At the same time, in residential areas adjacent to industrial facilities, concentration of various pollutants reaches such values that living here becomes unsafe. Constant stay in conditions of high levels of air pollution leads to increasing incidences of respiratory organs, blood systems, cancer pathology. Ultimately, it increases mortality rates and contributes to the decreasing life expectancy, constantly increasing the burden on medical health authorities [2, 3].

In connection with the states above, the research purpose is to study the measures taken with a purpose to improve an atmosphere in an industrialized region on the example of the Kemerovo region.

2. Materials and Methods

The study is based on a retrospective and chronological analysis of statistical, scientific, and legislative sources related to the Kemerovo region. Also, the paper presents unique own data on assessing the state of the environment based on the level of asymmetry of a birch by Betula pendula.
Roth. The quality of the environment is its condition, which is necessary to ensure the health of humans and other species [4]. The chronological scope of the study is limited to 1988, since it was precisely this year when the Decree of the Central Committee of the CPSU and the Council of Ministers of the USSR No. 32 “On the Fundamental Restructuring of Nature Conservation in the Country” was published on January 7 [1]. The research is also limited by the year of 2017 for which statistical data on the state of the environment has been published [3]. Geographically, the study is limited to the administrative boundaries of the Kemerovo region.

3. Results

Stability of development as an ability to develop normally (without disturbances and errors) is a sensitive indicator of the state of natural populations and allows to estimate the total value of anthropogenic load. Our studies in the city of Kemerovo in 2013-2017 indicate the critical state of the environment within the entire city. To assess the quality of the environment, we used a birch tree, according to the methodological guidelines [4].

When considering dynamics of the total volume of polluting emissions into the atmosphere of the Kemerovo region, the general trend of their gradual increase is traced from 1,475 kilotons (kt) in 1990 to 1,719 kt in 2017 (Fig. 1) [2, 3].

In the dynamics of the analyzed indicators, we find that in the 90s of the twentieth century, there was a decrease in the volume of coal production, industrial and chemical production by 60-80% if compared to 1990 [5, 6]. Consequently, the amount of pollutant emissions in the atmosphere dropped by about 20%. The technical deterioration of equipment, coupled with the failure to implement the planned measures for the construction of wastewater treatment plants against the background of an acute social and economic crisis, did not lead to the expected proportional reduction in emissions.

Analyzing the structure of emissions of pollutants by sources of pollution, we can note the general trend of reducing emissions from mobile sources from 320.0 kt in 1990 to 227.8 kt in 2016. In the Kemerovo region, the main mobile source of pollution is motor transport.

In relation to stationary sources of air pollution, the general trend of increasing emissions is traced. However, over the past three decades, in the structure of the volumes of pollutants, the share of hydrocarbons, which are mainly represented by methane, has increased to 55% of the total emissions of pollutants (Fig. 2). The main supplier of methane is coal mining enterprises. At the same time, the volume of emissions does not depend on the volume of coal mining, but it depends on the methane content of coal seams.

![Figure 1. Dynamics of polluting emission into the atmosphere in the Kemerovo region in 1990-2017.](image-url)
4. Discussion

In general, characterizing the situation on the protection of atmosphere, it should be noted that in 1978 was adopted the State Standard of the USSR GOST 17.2.3.02-78 “Environmental Protection. Atmosphere: Rules for Establishing Permissible Emissions of Harmful Substances by Industrial Enterprises” (approved by the USSR State Standard Resolution of 24 August 1978 N 2329). Subsequently, this GOST was repeatedly modified. Also, various technical requirements were introduced to the newly created objects. The USSR Law No. 2353-X on the Protection of Atmospheric Air was adopted on June 25, 1980. A little later, the Law of the RSFSR on the Protection of Atmospheric Air was adopted on July 14, 1982 [1]. However, these requirements were introduced by directives, without taking into account the scientific and technical potential and economic capabilities of the country. Moreover, the failure to comply with environmental protection measures did not bear substantial responsibility, as a result of which the implementation of treatment facilities was implemented according to the residual principle [2]. In 1999, the Federal Law on the Protection of Atmospheric Air was adopted. Unlike Soviet legislation, it contains an article establishing a charge for the emission of pollutants into the atmosphere [1].

In the Criminal Code of the Russian Federation, in accordance with Article 251, air pollution that caused harm to human health can be punished for up to 2 years of imprisonment, and up to 5 years for causing death [1]. However, according to the report of Roman E. Erygin from the Main Directorate of the Ministry of Internal Affairs of Russia in the Kemerovo Region, 2 criminal cases under Article 251 of the Criminal Code of the Russian Federation were initiated as of November 16, 2018. At the same time, not a single conviction has been pronounced in the entire history of this article.

Estimating the impact of motor transport on the state of atmospheric air, we find that relative to 1990, the number of cars was 297% as of 2017 [2, 7], and the amount of emissions was 71%. Thus, with the increase in the number of cars almost in 3 times, the amount of pollutants emitted from them decreased by 29%. This situation became possible due to a number of measures taken by the Government of the Russian Federation on the phased introduction of environmental standards regulating the content of harmful substances in motor vehicle exhaust gases. In 2005, on the basis of these resolutions, the Euro-2 environmental standard was adopted. It pushed domestic automakers to stop producing carburetor cars since 2006. Since 2016, the Euro-5 standard is valid in Russia, according to which the standards for polluting emissions into the atmosphere are significantly tightened.

According to some publications in the media, local governments “turn a blind eye” to a number of environmental offenses. So, at the press conference on the issue of environmental pollution from the Belovo Zinc Plant and the health problems of the local population caused by this circumstance, the
position of the deputies was formulated as follows: “Yes, production is harmful, but you really want to lose another enterprise?” [8].

5. Conclusion

In sum, in the history of atmospheric air protection, two main development stages should be distinguished:

- In the Soviet period, the legal basis for environmental protection and a centralized system of monitoring the quality of the environment had been founded.
- In the Russian period, financial incentives for transiting to environmentally friendly production technologies began to be actively applied. Much more publicity on ecology and environmental protection one could observe, which also contributed to the growth of public activity.

At the same time, despite the presence of positive trends in the field of atmospheric protection for three decades, in large industrial cities of the Kemerovo region, such as Kemerovo and Novokuznetsk, air pollution is rated as “high” and “very high,” respectively. The current criminal article on air pollution is not applied in practice. On the part of state authorities, there is a fear that a more stringent environmental policy will lead to stagnation of production and, consequently, an increase in unemployment.

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