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Legal Measures for Atmospheric Air Protection in Urban Agglomerations as the Most Important Factor in Maintaining Human Health

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Abstract

Over the past decades, the processes of urbanization in this country have led to the isolation of the population from nature, the aggravation of socio-economic, environmental, transport, engineering problems, an increase in the concentration of the population serving certain areas of urban development, and an increase in the territorial needs. As a result, the pressure on the environment and its components, such as atmospheric air, has increased. The article reveals the essential characteristics of legal measures for the protection of atmospheric air within urban agglomerations. The purity of atmospheric air is a constant of human health, so any measures to preserve it are a priority for any country. The current development of legal regulation in the field of atmospheric air protection indicates attempts to solve environmental problems in urban agglomerations, which should be aimed at improving human life in the city through the creation of the multidimensional comfortable living conditions.

Keywords: atmospheric air, urban agglomerations, human health, legal measures.

Full length article **Corresponding Author*, e-mail: *lisina_nl@mail.ru (N.L.), pavvm2000@mail.ru (S.I.)* Doi # https://doi.org/10.62877/10-IJCBS-24-26-20-10

1. Introduction

Environmental protection in urban agglomerations is becoming one of the main challenges of the modern world. On the one hand, people create living conditions in the city and have many opportunities to fulfill various needs (social, cultural, domestic, industrial, etc.), while on other hand, cities have main production and transport facilities, main types of economic and other activities that cause environmental pollution and have a serious impact on natural environment and determine people's health condition. According to the UN, world population in 2024 exceeded 8 billion people and will increase by more than 2 billion people by 2050. More than half of world's population already lives in cities, and number of urban agglomerations is growing [1]. UN forecasts that number of urban residents will increase daily by an average of 200K people and by middle of 21st century, each seventh out of ten people will live in urban areas [2].

The processes of urbanization taking place in recent decades in this country have led to an increase in the urban population, the remoteness of the population from natural nature, the aggravation of socio-economic, environmental, information, transport, engineering problems, an increase in the concentration of the population serving certain areas of urban development, and an increase in territorial needs [3-4]. The spatial expansion of urban territories leads to the emergence of urban agglomerations, intensive industrial, infrastructural, social and economic ties in which accelerate the processes of urbanization and the impact of urban population activities on the environment. As a result, the burden on the environment in general and its individual components in particular increases [5-6]. The purpose of the work was to study the legal aspects of ensuring the safety of atmospheric air, preventing emissions of pollutants by various entities engaged in economic or other activities.

2. Methods

2.1. Objects of research

Environmental and related other social relations that develop in the process of legal environmental protection of urban agglomerations.

2.2. Research methods

The research methodology is based on philosophical, natural-scientific, socio-economic and political views on relations in the field of environmental protection in the city. The research used general methods of cognition (historical, logical, sequential transition from the abstract to the concrete), general scientific methods (analysis, system, comparison, analogy, modeling, generalization), as well as special legal methods (formal legal, comparative legal, interpretation of law, legal modeling, legal forecasting).

3. Results and discussion

Being an indispensable component of the natural environment, atmospheric air performs a life-supporting function, the essence of which is that it is the source of life on our planet, being in biological connection with all living organisms. It also performs an ecological function through interactions with other components of the natural environment, through which it determines not only their condition but also the influence of each of them on the quality of atmospheric air. The socio-economic function of atmospheric air is manifested in the fact that it is a source of oxygen, a means of obtaining energy, a space for the placement (including construction) of various kinds of objects and movement of different types of transport, a receiver of emissions of pollutants formed as a result of economic and other human activities. Along with other components of the natural environment, atmospheric air is beneficial for the improvement of the human body and recreation, especially outside large industrial centers or zones, in resort towns, beyond the concentration of industrial, transport and other sources of pollution.

In the process of economic and other human activities, the physical, chemical and biological state of atmospheric air changes, just as the living conditions of humans and other living beings change, respectively. This effect and change occur constantly, accumulating certain substances and their impurities in the air. The World Health Organization (WHO) reports on six major air pollutants, namely: particle pollution, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen, and lead. Air pollution can have catastrophic effects on all components of the environment, including groundwater, soil, and air. In addition, it poses a serious threat to living organisms. In this context, we are mainly interested in focusing on these pollutants, since they are associated with broader and more serious problems in the field of human health and environmental impact. Acid rain, global warming, the greenhouse effect and climate change have important environmental impacts on air pollution [7].

3.1. Studying the influence of atmospheric air on human health is a global practice

Let's turn to research, the main subject of which is the impact of polluted atmospheric air on human health. In the atmospheric air, solid particles containing the smallest droplets of liquid or solid matter enter the respiratory tract when inhaled and, as a rule, cause serious health consequences. Particles with a diameter of < 10 μm can enter the lungs after inhalation and even reach the bloodstream. Table 1 provides information on the penetrability of solid particles in human respiratory organs, depending on their size [8]. Moreover, respiratory diseases and damage to immune system are registered as long-term and sometimes chronic. It is worth noting that people with asthma, pneumonia, diabetes, as well as with cardiovascular diseases are especially susceptible and vulnerable to effects of particulate matter [9], types and sizes of which are shown in Table 2. Effect of high concentrations of air pollutants on human health can be divided into short-term and long-term depending on their degree.

Short-term effects are temporary and range from simple discomfort such as irritation of eyes, nose, skin, throat, wheezing, cough and chest tightness, as well as labored respiration, to more serious conditions such as asthma, pneumonia, bronchitis, and lung and heart problems. Short-term exposure to air pollution can also cause headaches, nausea, and dizziness. Long-term effects lead to chronic consequences that can eventually lead to death. In addition, toxicity of some air pollutants can also cause various types of cancer in long term [10]. It should be noted that mechanisms of development of neurodegenerative diseases include oxidative stress [11], protein aggregation, inflammation and disruption of normal mitochondrial function in neurons, which is clearly shown in Fig 1. Despite difficulty of eradicating problem of anthropogenic environmental pollution, its successful solution can be viewed as close cooperation between authorities, organizations, doctors and lawyers to resolve situation. At country level, reliable information on air condition should be spread, and professionals should be involved in solving stated issues and monitoring processes of solving the problem [12-15].

3.2. Legal measures for the protection of atmospheric air in urban agglomerations of the Russian Federation

In the Russian Federation, the environment in cities and adjacent territories, where more than 70% of the country's population lives, is significantly negatively affected by the operation of industrial facilities, energy facilities, transport, and capital construction. 17% of the country's urban population (17.1 million people) live in cities with high and very high levels of atmospheric air pollution [16]. Excessive air pollution leads to changes in climate and temperature regimes with deviations from the norm throughout the year in many cities, hurricanes, storms, squall winds, endless downpours, or the "black snow" as, for example, in Krasnoyarsk, or the absence of sun for weeks due to smog in the biggest industrial cities of Russia (Cherepovets, Nizhny Tagil, Chelyabinsk, Novokuznetsk, etc.), China, etc., or, conversely, extremely high temperatures or rapid temperature changes in cities [17]. The issues of atmospheric air protection practically go beyond the space of a particular city. The need to carry out measures to protect atmospheric air is no longer a national, but also an international task [18].

An important feature and at the same time the principle of legal protection of atmospheric air in urban conditions is the combination of an object–based approach with an integrated one. Firstly, it follows from the essence of a single natural and social system, the interconnection of all components of the environment, rights and legitimate interests, human life and health. As a result, solving the problem of atmospheric air pollution in cities depends on solving the issues related to soil protection, water bodies, and green spaces, that is, on improving the condition of each component of the natural environment and vice versa. This is due to their ecological interconnection in the environment.

It's like the health and life of a person in the city depends on the air quality. Secondly, various types of economic and other activities (in the fields of manufacturing, construction, transport, etc.) are concentrated in the city, having different effects on the air quality, serve as sources of various pollutants in atmospheric air, determining their composition and predominance of those pollutants. The establishment of environmental and legal requirements for only one of sources will not solve the problems of atmospheric air protection. This can improve the indicators for certain types of pollution in the atmospheric air, but generally preserve its unaffordability for the urban environment and the population. Therefore, it is advisable to determine and maintain the quality of atmospheric air in the city based on the total level of pollution. At the same time, environmental indicators of the air quality, the predominance of certain substances in the structure of pollution and certain sources of pollution (stationary or (or) mobile) should determine the priority and types of measures for the protection of atmospheric air. Thirdly, air protection activities in cities require not only legal support, but also scientific and methodological, financial and economic, organizational, architectural and urban planning, technological, educational, etc. solutions often presented in the form of law. Hence, the legal regulation of relations on the protection of atmospheric air is carried out not only by norms of legislation on environmental protection, but also by other branches of legislation. Complexity of legal protection of atmospheric air is expressed in main federal laws regulating activities of participants in environmental relations to ensure protection of atmospheric air. In particular, in Article 4 of the Federal Law "On Environmental Protection", according to which natural components are subject to protection from pollution, depletion, degradation, spoilage, destruction and other negative effects of economic and (or) other activities [19]. According to certain provisions of the Federal Law "On the Protection of Atmospheric Air", atmospheric air is subject to protection from pollution and harmful physical effects on it (Article 1), while public administration is based on scientific validity, consistency and complexity of the approach to the protection of atmospheric air and environmental protection in general (Article 7) [20]. Article 20 of the Federal Law "On Sanitary and Epidemiological Welfare of the Population" stipulates that atmospheric air in cities should be safe and harmless to humans in chemical and biological terms, and should not have a harmful effect on humans [21]. It seems that for purposes of protecting atmospheric air in cities, it is necessary to establish a scientifically based threshold for such "harmlessness" - a threshold indicator of air quality in cities in aggregate for pollutants in a certain area.

In the Russian Federation, there is no regulatory threshold for the harmlessness of atmospheric air for a particular city or part of it (taking into account the specifics of pollution, natural-geographical, meteorological, and industrial and other factors). Through environmental rationing, it is not the environmental quality standard (the threshold for the harmlessness of the quality of air as a component of the natural environment) that is established, but the threshold for affecting it as a result of economic and other activities, which is based on hygienic standards of atmospheric air quality. For example, in some countries, the quality of atmospheric air is ensured through the introduction of quality standards, according to which target (limit) indicators of the air quality re set, which must be achieved by a certain time (as for example, in the countries of European Union) [22-24], or by establishing an index of atmospheric air quality considering ultra-small suspended particles (as in China, for example) [25-27]. In Russian Federation, a method for determining the standard of atmospheric air quality has developed relatively recently, which reflects maximum permissible content of harmful (polluting) substances in it, in which there is no harmful effect on forest ecosystems [28]. We believe that a similar methodology should be developed for territories of urban agglomerations. In accordance with Article 11 of the Federal Law "On the Protection of Atmospheric Air", to determine criteria for safety and (or) harmlessness of effects of chemical, physical and biological factors on people, plants and animals, specially protected natural territories and objects, as well as to assess quality of atmospheric air, hygienic and environmental standards for atmospheric air quality are established and maximum permissible levels of physical effects on it [20]. Currently, atmospheric air quality standards established in accordance with Decree of the Government of the Russian Federation "On the Procedure for Establishing and Reviewing Environmental and Hygienic Standards for Atmospheric Air Quality, Maximum Permissible Levels of Physical Effects on Atmospheric Air and State Registration of Harmful (Polluting) Substances and Potentially Dangerous Substances" dated March 2, 2000 No. 182, taking into account Regulations on Development of, Establishment and Revision of Environmental Quality Standards for Chemical and Physical Indicators of State of the Environment [29-30]. Despite fact that these normative legal acts preserve division of atmospheric air quality standards into environmental and hygienic, dividing powers to establish them between the Ministry of Natural Resources of Russian Federation and Rospotrebnadzor (Russian Federal State Agency for Health and Consumer Rights), continuing trend of a sanitary and hygienic approach to setting thresholds for harmful substances contained in atmospheric air, that is, through hygienic standards, should be noted. In relation to urban settlements, hygienic standards established lists of harmful substances, microorganisms, bacterial preparations and their components with maximum thresholds for their content in atmospheric air, as well as those harmful substances which content in atmospheric air is generally prohibited [31]. Limit values set for each pollutant contained in atmospheric air, hence, according to current hygienic standards, quality of atmospheric air will be favorable if there are no exceedances of MPC for each type of pollutant. Establishment of hygienic standards in accordance with current legal acts proceeds from safe level of their impact on human health, taking into account time interval of their exposure (one-time concentration or average daily concentration). We believe that hygienic standards are appropriate in establishing criteria for harmlessness to human health and life, food, industrial goods, residential premises in terms of area, layout, illumination, insolation, microclimate, air exchange, noise levels, vibration, ionizing and non-ionizing radiation, etc. In turn, environmental standards should cover external form of human living conditions and activities in natural environment. Moreover, setting limits for each type of pollutant does not mean that in their entirety they will remain harmless. Only for certain mixtures of harmful substances, current hygienic standards set maximum permissible

concentration values (MPC) (for example, with combined presence of hydrogen fluoride and poorly soluble salts of fluorine, nitrogen dioxide and sulfur dioxide, hydrogen fluoride and sulfur dioxide and others in atmospheric air) [32]. Despite fact that Russian hygiene standards for certain harmful substances stricter than those established, for example, by the World Health Organization, in the USA and the EU, level of atmospheric air pollution in many Russian cities as a whole is high, comparable to parameters of pollution of a certain component of environment in foreign cities. In addition, unlike in the EU, in the Russian Federation, hygienic standards for quality of atmospheric air in cities do not set a quantitative possible limit for exceeding them per year (3 times a year, 18 times a year, 24 times a year, etc.). In recent years, Russia has seen a gradual decrease in threshold values of concentrations of substances in atmospheric air for some of them. For example, for formaldehyde, average daily limit concentrations increased from 0.003 mg/m^3 to 0.01. Therefore, what considered an excess of MPC in 2003 is now considered norm. At same time, harmful effects of this substance on human health are undeniable. Such changes, in our opinion, unacceptable. As follows from national goals and strategic objectives of development of Russian Federation, as well as national Clean Air project, it is currently relevant to develop consolidated calculations of air pollution in cities, which should serve as basis for calculations on emissions of pollutants. The Federal Law "On Conducting an Experiment on Quotas for Emissions of Pollutants and Amendments to Certain Legislative Acts of the Russian Federation in Terms of Reducing Atmospheric Air Pollution" provides that in twelve cities of experiment, a quota system for emissions of pollutants into atmosphere based on summary calculations of atmospheric air pollution is introduced to determine priority pollutants [33]. The latter are necessary to determine the quota objects. As a result of application of provisions of this law, it is expected to reduce the level of atmospheric air pollution in the experimental cities to target indicators by end of 2026. Since September 1, 2022, urban settlements and urban districts with high and very high atmospheric air pollution have added to experimental territories in addition to initial 12 cities. However, in order to implement this provision of federal law, it is necessary to develop criteria and procedures for classifying urban settlements as cities with high and very high atmospheric air pollution. The effectiveness of standards as an indicator of the threshold state or impact on atmospheric air, its harmlessness to other components of the environment and human health, is influenced by different conditions (for example, for which substances and which particle sizes they are established, what measurement technique used, whether regional and local characteristics of environment and public health are taken into account, as well as meteorological conditions, speed of response to their changes, whether specifics of accumulated pollutants by components of natural environment taken into account, construction density of industrial polluting facilities and standards for emissions of pollutants established for them, etc.). The hygiene standards that exist today do not take into account the specified features of a particular territory, as well as the cumulative harm of pollutants in the atmospheric air within a certain territory. In accordance with Paragraph 28 of the Regulation on the Development, Establishment and Revision of Environmental Quality Standards for Chemical and Physical Indicators of the State of the Environment, approved by Decree of the Government of the Russian Federation dated February 13, 2019 No. 149 "On the Development, Establishment and Revision of Environmental Quality Standards for Chemical and Physical Indicators of the State of the Environment and on Approval of Regulatory Documents in the Field of Environmental Protection that Establish Technological Indicators of the Best Available Technologies" the executive authorities of the subjects of the Russian Federation have been granted the right to establish environmental quality standards not lower than those established at the federal level taking into account the environmental situation in the region [34]. In some countries, for example, in China, such regulations are submitted for public discussion before their official approval.Until 2019, the fact that the subjects of the Russian Federation can set environmental quality standards did not affect the number of decisions they made to establish environmental quality standards, taking into account special ecological state of regions. It is possible to find only isolated cases of adoption by subjects of the Russian Federation of resolutions in this area (for example, in the Krasnoyarsk Territory in 2012, regional environmental quality standards for radiation pollution approved [35], and in the Republic of Tatarstan, regional standards do not directly relate to pollutants in the atmospheric air, but only establish permissible residual content of oil and its byproducts in soils [36]). It is obvious that state of atmospheric air is determined not only by concentrations of harmful substances contained in it, but also by volume and types of harmful substances emitted into it by stationary and non-stationary sources in cities, as well as other factors determining its harmlessness to other components of natural environment and human health. Therefore, another legal measure for protection of atmospheric air in cities is establishment of standards for permissible environmental impact. The establishment of standards for permissible impact on atmospheric air is based on hygienic standards and not environmental ones, which cannot fully ensure the protection of atmospheric air and the environment as a whole. On the one hand, the stricter they are, the more appropriate it is for environmental protection, but the more difficult it is for subjects that have a negative impact on atmospheric air to comply with them. On the other hand, Clause 4 of Article 12 of the Federal Law "On Atmospheric Air Protection" provides for the possibility to carry out economic and other activities on the basis of temporarily permitted emissions for the period of phased achievement of maximum permissible emission and (or) technological emission standards [20]. The lack of adequate financing and economic interest of business entities in compliance with legal requirements on standards of permissible impact on atmospheric air reduces the effectiveness of the latter. Moreover, according to Article 22 of the Federal Law "On Environmental Protection", the burden of calculating standards for permissible emissions of pollutants is assigned to legal entities and individual entrepreneurs who plan to build facilities of categories I and II, as well as those engaged in economic and (or) other activities at facilities of category II [19]. Accordingly, the impact on the atmospheric air by other objects has been removed from the sphere of legal regulation, which, being "harmless" from the point of view of the law, nevertheless, in aggregate, with prolonged exposure, can harm both the environment in the city and human health.

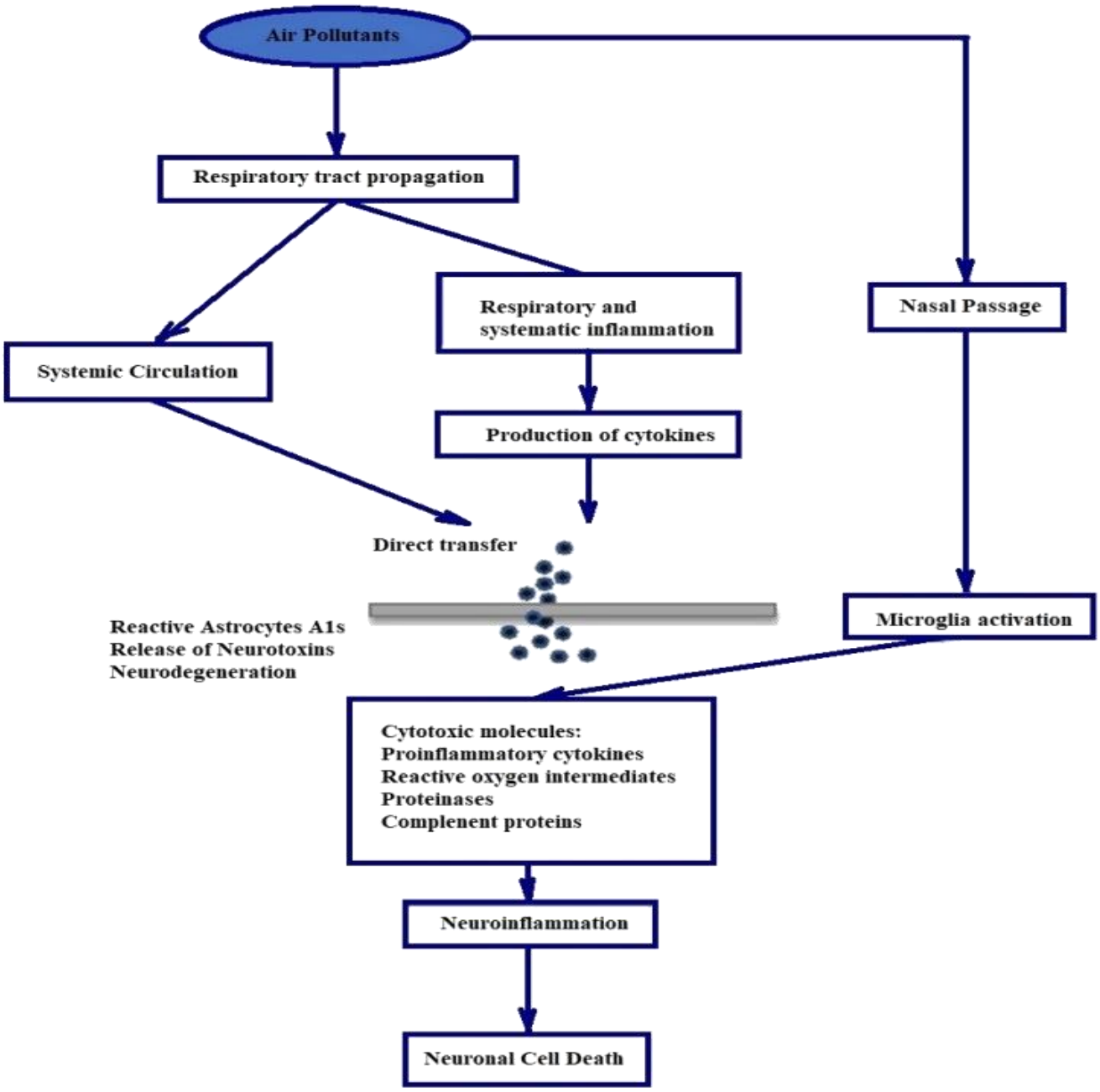

Figure 1. Impact of air pollutants on the brain

Table 1. Penetrability according to particle size

Particle size	Penetration degree in human respiratory system
> 11 µm	Passage into nostrils and upper respiratory tract
7 – 11 µm	Passage into nasal cavity
4.7 – 7 µm	Passage into larynx
3.3 – 4.7 µm	Passage into trachea-bronchial area
2.1 – 3.3. µm	Secondary bronchial area passage
1.1. – 2.1. µm	Terminal bronchial area passage
0.65 – 1.1. µm	Bronchioles penetrability
0.43 – 0.65 µm	Alveolar penetrability

Table 2. Types and sizes of particulate Matter (PM)

Type	Specifications	PM diameter (μm)
Particulate contaminants	Smog	0.01 – 1
	Soot	0.01 – 0.8
	Tobacco smoke	0.01 – 1
	Fly ash	1 – 100
	Cement Dust	8 – 100
Biological contaminants	Bacteria and bacterial spores	0.7 – 10
	Viruses	0.01 – 1
	Fungi and molds	2 – 12
	Allergens (dogs, cats, pollen, household dust)	0.1 – 100
Types of Dust	Atmospheric dust	0.01 – 1
	Heavy dust	100 - 1000
	Settling dust	1 – 100
Gases	Different gaseous contaminants	0.0001 – 0.01

For objects of hazard category III, there is no obligation to calculate permissible exposure standards, although entities operating such facilities are required to comply with them and send reports on pollutant emissions to the Rosprirodnadzor authorities on a notification basis. Objects of hazard category IV are considered low-risk and the persons operating them do not provide any declarations or reports on emissions of pollutants. Legal entities and individual entrepreneurs who carry out economic and other activities at category I facilities develop technological standards, which, according to Article 23 of the Federal Law "On Environmental Protection", are established on the basis of technological indicators that do not exceed the technological indicators of the best available technologies, by an integrated environmental permit (IEP) [19]. This rule also applies to persons who carry out activities at category II facilities in the case of obtaining IEP. The procedure for the development of technological standards was approved by the order of the Ministry of Natural Resources of the Russian Federation [37].

It is important to note that despite existing regulatory legal acts, system of technological regulation has not yet been formed, far from all technological processes have methods approved in accordance with established procedure for determining technological standards, which prevents interested parties from obtaining IEP. National standards, guideline documents, and methodological guidelines also play a significant role in the protection of atmospheric air. They cover various aspects of the legal protection of atmospheric air, both general [38] and special (establishment of permissible industrial emissions taking into account environmental standards for atmospheric air quality [39], calculation of emissions of pollutants from stationary diesel installations [40], calculation of the amount of emissions of pollutants by motor vehicles [41], methods of pollution measurements [42-45], the sphere of the best available technologies [46-47]). The legal nature of these federal regulations is controversial. As a general rule, the adopted national standards are instructive and methodological in nature and are applied, according to Article 26 of the Federal Law "On Standardization in the Russian Federation", on a voluntary basis.

As for guideline documents and methodological guidelines, the analysis of judicial practice in cases related to the fulfillment (non-fulfillment) of legal requirements to reduce emissions of pollutants into the atmosphere shows that the use of guideline documents and methodological guidelines, approved in accordance with the established procedure by authorized federal executive authorities, is mandatory [48-52]. The share of pollution from mobile sources (cars, aircraft, watercraft, etc.) in the total volume of environmental pollution in cities is increasing every year. The difference is that in some cities, for example, the contribution of motor transport to the volume of atmospheric air pollution reaches 80% or more (for example, Moscow), while in others it is less, but this is already a matter of priorities for the city's environmental development policy. In the Russian Federation, there remains a need for accumulation and targeted spending of funds for environmental protection [53]. In terms of the formation and allocation of funds from budgets of all levels for improving the air quality and other measures in the field of environmental protection, the legislation requires detailed processing.

Even the recycling fees charged for manufacturers and importers of wheeled vehicles do not go to the specialized funds for improving the air quality, but serve the purposes of ensuring safe waste management [54-55]. Systematic monitoring of the air quality in cities and compliance with legal requirements in the field of atmospheric air protection by entities engaged in economic and other activities is an important condition for achieving a high air quality in cities. Currently, along with the transition to the best available technologies, it is advisable to introduce mechanisms for economic stimulation of environmentally oriented behavior of subjects, organization of urban development on the basis of territorial planning documents, urban zoning, ensuring balanced development of the city, compliance with the legal regime of sanitary protection zones, including resettlement of the population from sanitary protection zones, landscaping, as well as the use of innovative approaches, advanced technologies, and equipment.

4. Conclusions

The effectiveness of legal protection of atmospheric air is reduced by defects in the institution of legal responsibility for violation of established requirements for its protection. We propose to differentiate the compositions of offenses depending on the physical and chemical effects on the atmospheric air, as well as to establish the multiplicity of excess concentrations of harmful substances in the atmospheric air, total concentrations of pollutants, their hazard class, frequency of emissions and their duration, disregard for complex meteorological conditions as qualifying signs for creating administrative and criminal liability. At the same time, special attention should be paid to the assessment of the environmental situation at the time of the commission of the offense and meteorological conditions, the circumstances of the adoption of all measures to prevent and (or) minimize emissions into the atmospheric air by the entity engaged in economic and other activities.

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