UDC 502.3:504.6:669

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DEVELOPMENT OF MEASURES TO IMPROVE ATMOSPHERIC AIR QUALITY IN THE ZONE OF ACTIVITY OF A METALLURGICAL ENTERPRISE

The current state of the environment in industrial cities of Ukraine requires a systematic approach to solving the problem of atmospheric air pollution. Large metallurgical complexes, the activities of which are accompanied by emissions of nitrogen oxides, sulfur dioxide, dust and heavy metals, pose a particular danger. In this context, the city of Kamianske, Dnipropetrovsk region, is one of the most striking examples of a region with increased technogenic load. The main source of atmospheric pollution is "Dnipro Metallurgical Combine", namely: blast furnaces, steelmaking, sintering and coke chemical workshops, the activities of which significantly affect air quality, the state of ecosystems and the health of the population.

The relevance of the topic is due to the need to ensure the environmental safety of territories adjacent to industrial enterprises, as well as reduce risks to human health. The purpose of the research is to conduct a comprehensive environmental assessment of the state of atmospheric air in the area of operation of the metallurgical enterprise of Kamianske and develop scientifically based recommendations to reduce the negative impact of industrial emissions.

To achieve this goal, a set of research methods was used: analysis of statistical data from air monitoring, laboratory and instrumental measurements of concentrations of major pollutants, mathematical modeling of processes of the distribution of impurities in the air environment, as well as assessment of risks to public health. The methodology for determining the hazard coefficient HQ and the air pollution index IZA was applied [1].

The results obtained indicate that in Kamianske there is an excess of the MPC for dust by 1.6–2.4 times, nitrogen dioxide – by 1.3 times, sulfur dioxide – by 1.2 times. In 2025, a case of mass deposition of graphite dust was recorded, which led to a deterioration in the sanitary condition of the city and numerous complaints from the population (Fig. 1).

Figure 1 – Photographic recording of graphite dust fallout in the territory of Kamianske

The risk calculation established that the HQ hazard coefficient exceeded 1, which indicates a potential threat of respiratory and cardiovascular diseases among city residents.

The paper proposes a number of practical measures to improve the quality of atmospheric air, namely:

1) Implementation of modern gas purification systems - "smart" technologies that will automatically regulate process parameters depending on the composition of emissions. The combination of electrostatic precipitators with bioreactors or plasma-chemical plants can provide multi-stage purification with minimal energy consumption.

2) Installation of an automated emission monitoring system, which will allow for prompt response to changes in the composition of atmospheric air, reduce risks to public health and improve the environmental situation in the city.

3) Creation of green protective plantings around industrial sites, which is an important component of the environmental safety system. Properly selected green spaces can reduce the concentration of dust in the air by 20–40%, and carbon dioxide by up to 15%. The most effective are tree species with a large leaf surface area capable of absorbing and retaining pollutants. These species include: poplar, birch, linden, maple, chestnut, ash, as well as coniferous species - pine and spruce [2].

4) Improving organizational measures for environmental control. Involving the public in environmental initiatives contributes to the formation of a culture of responsible environmental management and ensures sustainable development of the city [3].

The conducted ecological and economic calculations have proven that the implementation of the proposed technological solutions will reduce the total volume of dust emissions by 35–40%, and gaseous impurities by 20–25%.

Studies confirm that the modernization of purification systems and improvement of atmospheric air monitoring are not only environmentally appropriate, but also economically beneficial for the enterprise and the community. The implementation of the proposed measures will contribute to improving the environmental situation in the city of Kamianske, reducing the incidence of the population and creating a safe, sustainable living environment.

The results of the research have applied value and can be used in the practical activities of local governments, environmental inspections, as well as the management of industrial enterprises to improve the system of environmental monitoring and management of atmospheric air quality. The proposed recommendations should be taken into account when developing city environmental protection programs, plans for environmental modernization of production and measures to reduce man-made loads. The implementation of these proposals will contribute not only to reducing the level of air pollution in the city of Kamianske, but also to improving the quality of life of the population and ensuring sustainable development of the region.

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