Automated systems of ecological control in Norilsk

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Abstract. Nowadays the problems associated with the implementation of environmental control in the Russian Federation are becoming increasingly relevant. Unfortunately, there are a lot of reasons why our country cannot boast of success in resolving issues that could positively affect the preservation of a favorable environment. The problem of automated systems of ecological control in Norilsk is considered in this article. Models of production and public control of the atmosphere are described. The model aimed at the implementation of the constitutional rights of each citizen to reliable information on the state of the environment is proposed. Environmental education acts as a tool for the implementation of the law, an integral part of which is environmental information.

1. Introduction
Norilsk is the northernmost city in the world with a population of more than 150 thousand people. It is the largest industrial center located in the Arctic zone of Krasnoyarsk region. The leading metals and mining company Nornickel, No.1 manufacturer of palladium and refined nickel, and one of the biggest platinum and copper producers, is concentrated on its territory.

In modern times, the organization of “green” production is becoming the most important component of the strategic management of an enterprise. The peculiarity of making strategic environmental decisions is that they are aimed at achieving and maintaining the optimal position of the enterprise in a competitive environment and meet the requirements of legislation that have regularized the establishment of a responsibility limit for the environmental results of the economic activity. These particular results are of great interest to investors, shareholders and employees, as well as to the public.

2. Discussion
In 2004, the metals and mining company Nornickel launched a program aimed at introducing an integrated quality management and environmental management system in the main management and production departments that meets international standards. In this regard, there was a need to determine methodological approaches to the problem of environmental control and process control of a metallurgical enterprise to minimize the negative impact on the natural environment of the region in the severe Arctic conditions and create a workable model for ensuring environmental sustainability in Norilsk.

Taking into account the results of the analysis of the environmental condition of Norilsk and the influence of mining and metallurgical enterprises, the authors have proposed a model for the automation
of environmental control and process control (figure 1): at the points of discharge of sewage waters into surface watercourses, sensors for monitoring the content of harmful chemicals are installed. Transmitting signals pass to the Data reduction center. Information about the state of atmospheric air and mobile control systems is also transferred there. Incoming data are systematized and analyzed for compliance with the accepted criterion. In case of non-compliance with the specified criterion, a signal is sent from the Data reduction center to the automated control system of the offending enterprise about the necessity to change the technical process to prevent exceeding the specified threshold.

Figure 1. The model of automated ecological control and production control: MP and NP – Copper plant and Nickel plant (currently closed); NMP – Nadezhda Metallurgical Plant; 1 – Automated data processing and control center; 2 – permanently installed automated monitoring system; 3 - mobile control systems; dotted arrows – monitoring data flow; solid arrows – technology change signal.

So, in the territory of Norilsk this model allowed the main nature resource user to effectively carry out the industrial environmental control, which is confirmed by legislation in the form of three liabilities:

- development and approval of a production environmental control program;
- implementation of the industrial environmental control in accordance with established requirements;
- documentation of information, storage of data obtained from the results of industrial environmental control, periodic presentation of the results of industrial environmental control and authorized bodies of federal and regional state environmental supervision [1].

M.M. Brinchuk, I. Yu. Bortnik believe that environmental control is one of the most important legal measures to ensure rational use of natural resources and protect the environment from harmful effects. He defines environmental control as the activity of authorized entities in verifying and ensuring compliance with the requirements of the law on the use of natural resources and environmental protection [2, 3].

From January 1, 2019, paragraph 9 of Article 67 ‘Industrial environment protection control’ (industrial ecological control) of the Federal Law on Environmental Protection came into force. It establishes a new environmental protection requirement that demands equipping stationary sources at the objects of the first category with automatic means for changing and recording the volume or mass of pollutant emissions, pollutant discharges and concentration of pollutants, as well as technical means for recording and transmitting information about the volume and (or) mass of pollutant emissions, pollutant discharges substances and on the concentration of pollutants in the state fund of state environmental monitoring data (state environmental monitoring environment).

A list of these stationary sources, including a list of pollutants controlled by automatic means of measuring and recording the volume or mass of emissions, discharges and concentration of pollutants, should be established by the Government of the Russian Federation.
This measure is costly for individual entrepreneurs and legal entities, but it allows you to get data on the volume of emissions and discharges of pollutants in automatic mode and in real time.

Equipping the facilities of the 1st category with automatic measuring and accounting tools will significantly increase the effectiveness of state environmental supervision and monitoring, reduce the latency of environmental violations.

How will citizens be able to exercise their constitutional right to reliable information about the quality of the environment? We consider that the development and implementation of a model of public environmental control will allow citizens and public associations to exercise the right to receive timely, complete and reliable information about the state of the environment in their places of residence, measures for environment protection. It will also give an opportunity to appeal to state authorities, local governments and other organizations with complaints, statements and suggestions on issues related to environmental protection, negative environmental impacts, upon claiming for compensation for environmental damage in the court [4, 5, 6].

The year 2017 was declared the year of ecology in Russia, and Norilsk joined the system of public monitoring of the environment. The launch of the “Ecovisor” project in Norilsk was possible due to the joint work of the Krasnoyarsk regional branch of the Russian environmental movement “Green Russia” and public environmentalists of the city. Norilsk became the fourth city where a stationary sensor was installed. It began to determine the content of fine dust in the air 24 hours a day. Moreover, special mobile equipment was brought to the northern city, with the help of which local ecologists began to carry out route monitoring, that is, to assess the quality of atmospheric air at any place that can be reached by car.

![Figure 2. Examples of how the information from automated atmospheric control systems can be provided.](image)

Each owner of a smartphone can receive data from a stationary post on-line. To do this, you need to download the first Russian environmental mobile application on Google Play or AppStore. The data obtained from the Norilsk stationary observation post on the concentration of fine dust (in micrograms
per cubic meter of air) will be automatically converted by the computer program to the international AQI (Air Quality Index) and show the level of pollution on a scale from 1 to 500, where the green zone (atmospheric air meeting WHO sanitary requirements) corresponds to indicators from 1 to 50, yellow - from 50 to 100, red - over 100. The “Ecovisor” application allows users to know about medical recommendations relevant to a particular area (this is especially important for people suffering from respiratory diseases). In addition, the application has a section “People’s Control”: any smartphone user will be able to independently evaluate the atmospheric air, and this data will be superimposed on a map of the city.

At the moment, on the basis of the Environmental Education Center “Noosphere” (a project of the Norilsk State Industrial Institute) [6], a model of public environmental monitoring of the environment is being developed. It is planned to expand the atmosphere control network and install modern sensors in Talnakh and Kayerkan districts. Today, data from the sensor can be viewed not only in the “Ecovisor” application, but also in the AirVisual application and on the website (figure 2) [7].

3. Conclusion
In conclusion, it should be noted that environmental legislation does not define specific forms of public environmental control, providing for the possibility of public participation in the adoption of environmentally significant decisions when conducting an environmental impact assessment, public environmental expertise.

Speaking about the practical application of the “Ecovisor” system and AirVisual, a constructive dialogue is needed between the management of the Polar Division of Norilsk Nickel and representatives of public environmental control in order to sign a framework agreement that the data of the public ecological network were taken into account when declaring unfavorable weather conditions in Norilsk, and at high levels of gas pollution ecologists and the company will take measures to reduce emissions.

In addition, the system is public, and its tasks do not include state environmental monitoring. The objective of the project is to create its own independent database of pollution data. According to the same data, organizations that control the level of pollution can make their own measurements and issue official instructions.

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