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Problems of Reducing Air Pollution from Industrial Enterprises in the Arctic Regions

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Abstract. The Arctic zone of the Russian Federation (Arctic) is a unique region which ecosystems have low resilience and recovery. The exploitation of natural resources in the Arctic in particular mineral and raw materials as well as oil and gas complexes can lead to negative impact on the environment which consequences of are often irreversible. In this regard, scientifically based proposals to ensure the technosphere safety of the Russian Arctic are required in order to maintain the ecological balance during industrial exploitation which is the most important not only for the Arctic but for the entire planet. The aim of the work is to study the amounts of emissions of pollutants and greenhouse gases into the atmosphere by enterprises that directly operate in the Arctic and develop proposals to reduce the negative impact. The analysis of the largest resource companies as: PJSC NOVATEK, PJSC Severstal (Division Severstal Resources), PJSC “MMC “Norilsk Nickel” and PJSC ALROSA was carried out for the period 2015-2019. The analysis showed that there is no reduction in emissions at PJSC NOVATEK while at the enterprises of other companies there is a decrease associated with a reduction in production volumes or the withdrawal of certain enterprises from the company rather than the implementation of new environmental technologies in sufficient quantities. Despite the measures taken by the enterprises for environmental safety the considered indicators do not always demonstrate stable positive dynamics indicating the insufficient effectiveness of the current environmental policy and the need to develop and implement effective innovation resource-saving technologies.

1. Introduction

The Arctic zone of the Russian Federation (hereinafter referred to as the Arctic) is a unique region that requires the development of scientifically based solutions for environmental safety problems. The exploitation of the Arctic is one of the most important tasks of the socio-economic policy of the state. There are various regulatory documents for strategic planning in the sphere of environmental safety including: Basics of state policy in the sphere of environmental development of the Russian Federation for the period up to 2030, Environmental Safety Strategy of the Russian Federation for the period up to 2025, Energy Strategy of the Russian Federation for the period up to 2035, Strategy of Scientific and Technological Development of the Russian Federation as well as federal laws, regional state programs and other official documents related to environmental protection of the Arctic regions of the Russian Federation [1-4].

The Arctic plays an important role in ensuring the dynamic development of the Russian Federation since this region produces more than 25% of the gross domestic product. The industrial sector of the



Arctic and northern regions of Russia forms more than 40% of the gross value added in industry exceeding the national average (31%) [5]. The dominance of industrial production in the Arctic is largely determined by a significant resource base and will continue in the future. In the Arctic operating various industrial enterprises associated with the exploitation of natural resources primarily mineral which due to the technologies used emit a significant amount of pollutants into the atmosphere. This affects not only the state of the environment but also the people working on the enterprises and living in industrial regions. [6].

The problems of sustainable development of the Arctic industrial complexes are considered by many scientists. However insufficient attention is paid to the influence of industrial enterprises primarily the ones associated with the exploitation of mineral resources on the environmental safety of territories. [7, 8]. It should be noted that in the Arctic the rate of global warming is two times higher than in the Russian Federation and is almost four times higher than the world average. [9]. In addition, due to climate change industrial enterprises are forced to pay special attention to the development and implementation of innovation projects aimed at reducing greenhouse gas emissions using renewable energy sources such as solar, geothermal, wind energy and others, improving energy efficiency when exploiting mineral deposits and producing related products which are directly linked to innovation transformation. The fuel and energy sector of the Arctic is one of the most important components of the production process and a key link in ensuring the normal life of the population. [10].

Irrational and non-innovation exploitation and processing of natural resources in the Arctic can lead to negative impact on the natural environment and irreversible consequences. Ecosystems of the Arctic are very sensitive to external influences and remove polluting emissions from industrial enterprises much more slowly than in other territories of the planet which increases the probability of the transformation of regional environmental problems of the Arctic into global ones. [11].

The environmental safety of industrial enterprises is directly related to the organization and implementation of control which is defined by the Federal Law of 10.01.2002, No. 7 "On Environmental Protection" as follows: "it is a system of measures aimed at preventing, detecting and suppressing violations of legislation in the field of environmental protection, ensuring that business entities and other activities comply with requirements, including standards and regulations in the field of environmental protection" [12]. Thus, the enterprises of the Arctic macro-region are faced with the primary task of developing and implementing innovation technologies, modernizing production as well as improving the control and management system of air purification in the conditions of the adopted technologies. In this regard, in order to solve the environmental and technological safety problems of the Russian Arctic scientifically grounded proposals on environmental protection and preservation of ecological balance when industrial exploiting which are essential not only for the Arctic, but for the entire planet in terms of ensuring environmental safety are required. [13, 14].

2. Materials and methods

The aim of the work is to study the problems of environmental safety associated with air pollution when exploiting mineral deposits in the Arctic. For the study the largest resource companies which industrial enterprises mainly operate in the Arctic regions and provide publicly available data on environmental indicators were studied. The analysis was carried out based on the results of the work of the following resource companies:

- PJSC NOVATEK. Extraction of natural gas, gas condensate and oil.
- PJSC Severstal (Division Severstal Resources). Production of iron ore pellets, iron ore concentrate, coal concentrate, coal, strontium ferrite powders, crushed stone.
- PJSC "MMC "Norilsk Nickel" (Polar Division and Kola MMC). Production of technical sulfur, technical selenium, cathode copper, precious metal concentrates, nickel matte, primary nickel, nickel carbonyl shot, nickel carbonyl powder, nickel concentrate, cobalt concentrate, electrolyte cobalt, technical sulfuric acid, sodium sulfate, sodium chloride, nickel matte, copper matte.
- PJSC ALROSA. Diamond production.

The analysis was carried out on the volume of air emissions and greenhouse gas emissions for the period 2015-2019.

3. Results

Air emissions of the considered Arctic companies are presented in table 1.

Table 1. Air emissions, thousand tons [15-18].

	2015	2016	2017	2018	2019
PJSC NOVATEK	66.2	121.2	92	70.3	75.6
PJSC Severstal (Division Severstal Resources)	214.9	220.8	204.7	219.7	213.3
PJSC “MMC “Norilsk Nickel”	2064	1936.4	1846.8	1926.6	1952.7
PJSC ALROSA	9.4	8.9	7.5	9.8	8

PJSC NOVATEK demonstrates a negative trend in air emissions despite the implementation of environmental protection measures with the most important program for the beneficial use of associated petroleum gas. The company names the commissioning works, new production facilities and an increase in production and processing volumes due to the development of production activities as the main reasons for the high level of emissions [15]. PJSC Severstal (Division Severstal Resources), PJSC “MMC “Norilsk Nickel” and PJSC ALROSA show a slight decrease in air emissions due to more efficient implementation of environmental protection measures, modernization of production and changes in production and processing volumes [16-18].

Greenhouse gas emissions of the considered Arctic companies are presented in table 2.

Table 2. Greenhouse gas emissions, million tons of CO₂ [15-18].

	2015	2016	2017	2018	2019
PJSC NOVATEK	4.4	6.6	4.9	7.7	11.1
PJSC Severstal*	1.6	1.5	1.4	1.5	1.5
PJSC “MMC “Norilsk Nickel”	-	10	10.2	9.9	9.8
PJSC ALROSA	0.91	0.88	0.47	0.46	0.46

*Data presented for the entire PJSC Severstal company excluding Cherepovets Steel Mill which accounts for the largest share of direct greenhouse gas emissions (more than 93%).

PJSC NOVATEK demonstrates a negative trend in greenhouse gas emissions despite the use of cogeneration technology which almost doubles coefficient of use of the fuel combustion heat leading to a decrease in fuel gas consumption and as a result to a reduction in greenhouse gas emissions and use of alternative sources of electricity such as solar panels and wind turbines. The company explains the increase in greenhouse gas emissions by the commissioning of oil assets and bringing them to their design capacity, the expansion of the gas use as a fuel at compressor stations, an increase in the number of well clusters and inclusion of emissions from PJSC YAMAL LNG. During the implementation of the YAMAL LNG project an innovation technology for utilization of emissions containing methane which provides for their return to the technological process for re-liquefaction or use as fuel gas for own needs was envisaged [15].

PJSC Severstal, PJSC “MMC “Norilsk Nickel” and PJSC ALROSA show slight reduction in greenhouse gas emissions. PJSC Severstal explains the decline by the utilization of high amount of gas,

the formation of less methane from ventilation and degassing systems of coal mines and the utilization of coal mine methane as fuel for boilers at Vorkutaugol and the commissioning of a new drying of iron ore concentrate at Olcon [16]. PJSC “MMC “Norilsk Nickel” explains such results by the attention to the implementation of a large-scale program of environmental efficiency improving within the framework of projects to modernize and expand production [17]. PJSC ALROSA explains the deviations in greenhouse gas emissions by the implementation of the program of innovation development and technological modernization, the concept of energy saving and energy efficiency improvement, measures to reduce emissions, re-equipment of gas stations, commissioning of new fields, conversion of motor vehicles from liquid fuel to natural gas and increased consumption of oil and diesel [18].

It should be noted that the indicators of PJSC Severstal (Division Severstal Resources) were influenced by affiliation of an enterprise Yakovlevsky GOK in 2018, the indicators of PJSC “MMC “Norilsk Nickel” were influenced by closure of Nickel Plant in 2016 and the indicators of PJSC ALROSA were influenced by withdrawal from the company of in 2017 the heat and watersupply enterprise (PTWS) being an important source of air emissions [16-18].

4. Conclusions

Studies showed that PJSC NOVATEK demonstrates a significant increase of all considered atmosphere impact indicators. According to the company, the main reason is the commissioning of new industrial facilities.

PJSC “MMC “Norilsk Nickel” and PJSC ALROSA showed a decrease of the indicators. Companies name the closure or decommissioning of industrial facilities as the most important reasons for such changes. A further decrease of the negative impact of PJSC “MMC “Norilsk Nickel” on the atmosphere can be expected due to the closure of the smelter in the Nikel and the metallurgical workshop in Monchegorsk as part of the reconfiguration of the Kola MMC production.

PJSC Severstal (Division Severstal Resources) shows a slight decrease of air emissions and greenhouse gas emissions due to technology improvements and activities despite the addition of additional facilities.

It should be noted that in general Arctic industrial enterprises do not adequately implement innovation resource and energy saving technologies and do not pursue the necessary environmental policy when exploiting mineral resources. It can be stated that the measures of economic incentives for enterprises are insufficient since the fines for violation of environmental legislation are significantly lower than the required costs for the development and implementation of innovation projects. To improve the technosphere safety when functioning industrial enterprises in the Arctic it is required to develop and implement scientifically based innovation technologies by the involvement of scientific organizations to significantly reduce the negative impact on the atmosphere, strengthen control over compliance with environmental requirements and constantly improve environmental policy taking into account the specific features of the Arctic environment and the use of international experience.

5. References

- [1] Basics of state policy in the sphere of environmental development of the Russian Federation for the period up to 2030 (approved by the President of the Russian Federation of April 30, 2012) Available from: <http://base.garant.ru/70169264/> [Accessed 12th March 2021]
- [2] Decree of the President of the Russian Federation from 19.04.2017 No. 176 On the Environmental Safety Strategy of the Russian Federation for the period up to 2025 Available from: <http://kremlin.ru/acts/bank/41879> [Accessed 12th March 2021]
- [3] Energy Strategy of the Russian Federation for the period up to 2035 (approved by the order of the Government of the Russian Federation of June 9, 2020) Available from: <https://minenergo.gov.ru/node/1026> [Accessed 12th March 2021]
- [4] Decree of the President of the Russian Federation from 01.12.2016 No. 642 On the Strategy of Scientific and Technological Development of the Russian Federation Available from:

- <http://kremlin.ru/acts/bank/41449> [Accessed 12th March 2021]
- [5] Pilipenko V I, Vlasova M S, Algina T B *Environment. Technology. Resources* **1** 216-221
- [6] Tsukerman V A, Ivanov S V 2020 *Mining informational and analytical bulletin (scientific and technical journal)* **10** 56–66
- [7] Tsukerman V A, Ivanov S V, Goryachevskaya E S 2020 *IOP Conf. Series: Materials Science and Engineering* **753** 062019
- [8] Stepanova N, Gritsenko D, Gavrielyeva T, Belokur A 2020 *Sustainability* **12(6)** 2367
- [9] Leksin V N, Porfiriev B N 2019 *Studies on Russian economic development* **6** 4-21
- [10] Tsukerman V A, Goryachevskaya E S, Ivanov S V 2019 *IOP Conference Series: Earth and Environmental Science*. **302** 012109.
- [11] Smirennikova E V, Ukhanova A V, Voronina L V 2018 *Administrative Consulting* **9** 59-78
- [12] Nogovitsyn R R, Vasilieva A M 2018 *Problems of modern economics* **4(68)** 203-205
- [13] Tysiachniouka M S, Petrov A N 2018 *Energy Research & Social Science* **39** 29-34
- [14] Tsukerman V A, Goryachevskaya E S, Ivanov S V 2019 *E3S Web of Conferences* **110** 02058
- [15] Sustainability reports of PJSC NOVATEK Available from: <http://www.novatek.ru/ru/development/> [Accessed 12th March 2021]
- [16] Corporate social responsibility and sustainable development reports of PJSC Severstal Available from: <https://www.severstal.com/rus/sustainable-development/documents/reports> [Accessed 12th March 2021]
- [17] Sustainable development reports of PJSC “MMC “Norilsk Nickel” Available from: <https://www.nornickel.ru/sustainability/reporting/> [Accessed 12th March 2021]
- [18] Social and environmental reports of PJSC ALROSA Available from: <http://www.alrosa.ru/documents/социальные-отчеты/> [Accessed 12th March 2021]