

Ecological Aspects of Arctic Development

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Abstract

The subject of the study is the ecological and economic mechanism for eliminating accumulated environmental damage in the Arctic. The purpose of the study is to develop recommendations for further improvement of the environmental and economic mechanism for eliminating accumulated environmental harm, including program methods. Issues of the state of the environment and environmental safety in the Arctic zone of Russia are considered. The main attention is paid to the formation of a program to eliminate accumulated environmental damage on the contaminated islands of the Franz Josef Land archipelago and other territories. The methodological basis of the work is made up of applied research by domestic and foreign scientists in the field of environmental economics and environmental protection, and materials from geo-expedition surveys of contaminated areas. The results of the study consist in the development of a program for the elimination of accumulated environmental damage on the contaminated islands of the Franz Josef Land archipelago, the preparation of proposals for further planning and organization of cleanup work. The main results of the study have found application in the practice of the Russian Ministry of Natural Resources, production organizations, as well as in the educational process.

Keywords

Arctic, Resource Potential, Accumulated Environmental Damage, Geo-Ecological Survey, Territory Cleanup, State Register of Objects of Accumulated Environmental Damage, Programs, Infrastructure, Strategic Environmental Assessment

1. Introduction

In recent years, the Arctic has increasingly attracted attention, due to a number

of factors, including:

- significant reserves of hydrocarbons and other natural resources;
- unique types of biological resources (polar bear, walruses, white gull);
- geopolitics—expansion of various types of activities of countries in the Arctic;
- growth of maritime transport through the Northern Sea Route;
- national security;
- development of cruise eco-tourism, historical and cultural monuments of Arctic exploration.

On the development of the Arctic region in the Russian Federation, important documents have been adopted, including “Fundamentals of the state policy of the Russian Federation in the Arctic for the period until 2035”, “Strategy for the development of the Arctic zone of the Russian Federation and ensuring national security for the period until 2035”, State program of the Russian Federation “Socio-economic development of the Arctic zone of the Russian Federation”, describing prospects for the development of the Arctic region (Decree of the President of the Russian Federation No. 164, 2020; Decree of the President of the Russian Federation No. 645, 2020, Decree of the Government of the Russian Federation No. 484, 2021).

Industry development strategies in the field of fuel and energy, transport complexes, national and environmental security have been approved, fundamentally changing the prospects for the functioning of economic sectors in the Arctic. The Decree of the President of the Russian Federation provides for the further development of the Northern Sea Route and an increase in cargo traffic along it to 80 million tons per year, which will accordingly entail an increase in the level of functioning of related sectors of the economy (Decree of the President of the Russian Federation No. 204, 2018).

In this regard, it is very important to take into account during the development of the Arctic not only socio-economic, but also environmental issues that may arise during the implementation of infrastructure projects in this region.

Research carried out in recent years by the Productive Forces Research Council into assessing the state of the Arctic environment shows that investors might encounter a number of unforeseen environmental problems that will negatively impact the implementation of large projects in the future.

2. Research in the Field of Assessing the State of the Natural Environment in the Arctic

2.1. Purpose of the Study

The purpose of the study is to develop recommendations for further improvement of the environmental and economic mechanism for eliminating accumulated environmental damage in the Arctic, preventing the possibility of future environmental damage in this region.

2.2. The Main Environmental Problems in the Implementation of Technological Development of the Arctic

The following main environmental problems should be highlighted when im-

plementing the technological development of the Arctic:

- current pollution of the region from the activities of industrial enterprises and various organizations;
- the presence of significant amounts of accumulated environmental damage that arose in past years of Arctic development;
- the need to prevent future environmental damage from new projects (SOPS, 2013; VAVT, 2017).

Main part:

The current environmental situation in the Arctic zone of the Russian Federation is characterized by:

- unsatisfactory assessment of atmospheric air in a number of industrial regions;
- littering of large areas as a result of past transport, military and economic activities;
- the presence of pollution of seas and water bodies on land;
- threat to the qualitative and quantitative state of biodiversity;
- land degradation, including natural forage lands, in areas where industrial facilities are located;
- transboundary environmental pollution;
- radiation pollution of the environment;
- significant amounts of accumulated environmental damage.

Regarding the current environmental pollution in the Arctic, the following can be noted. The production and transportation of hydrocarbon raw materials in the Arctic regions of Russia create a powerful anthropogenic impact not only on land ecosystems, but as a result of emergency spills through the river flow system, they exert significant pressure on the river and marine ecosystems of the Arctic.

Certain inland regions of the Arctic zone of Russia are characterized by a strong transformation of the natural geochemical background, atmospheric pollution, degradation of vegetation, soil and ground, the introduction of pollutants into the food chain, and increased morbidity among the population.

There are four main sources of environmental tension. These are the Murmansk region (10% of the total emission of pollutants), the Norilsk agglomeration (more than 30% of the total emission of pollutants), areas of development of oil and gas fields in Western Siberia (more than 30%) and the Arkhangelsk region (high degree of pollution with specific substances). Cities in the Arctic zone are constantly included in the list of cities with significant levels of air pollution

Among the industries of the Arctic zone, which are associated with the formation of impact territories, the first place is occupied by mining and metallurgy with the largest centers in Norilsk, Monchegorsk, Pechenga, Zapolyarny, Olenegorsk, Kandalaksha, Talnakh, Kovdor, Deputatsky, etc. (Shevchuk & Shumikhin, 2019).

Despite the economic recession of the 1990s, the areas of polluted areas continue to grow slowly due to a disproportionate decrease in production and the inertia of natural processes. The centers of the mining and metallurgical industry

are characterized by increased levels of accumulation of toxic substances in ecosystems, and an increased incidence of bronchopulmonary, oncological and skin diseases in the population. Extraction and primary processing of mineral raw materials in the Arctic zone leads to mechanical disturbances of soil and ground, mainly in areas of the permafrost zone, as well as pollution of ground and surface waters and atmospheric air with strontium compounds, copper, heavy metals (especially mercury), petroleum products, etc.

The loads on the landscapes of the tundra, forest-tundra and northern taiga of Western Siberia and the Bolshezemelskaya tundra are especially high. The number of accidents in individual fields is not the same, but is directly related to the size of the fields and, accordingly, the total number of technical facilities on its territory, the duration of their operation, and the density of technical loads in the field area. Each of them is a potential source of environmental impact.

The annual quantity and scale of leaks of petroleum hydrocarbons into the environment is extremely large. As a result, in oil-producing regions, during the operation of fields and the operation of pipeline systems, a significant amount of man-made petroleum hydrocarbons has already accumulated in soils and their content is continuously increasing. The range of possible concentrations of bituminous substances in the soils of northern Russia exceeds the MPC by tens and thousands of times (Shevchuk & Shumikhin, 2019).

3. Legal and Regulatory Support for Environmental Protection

The solution to the problem of the current impact on the environment can be achieved based on compliance with the requirements of the new edition of the Federal Law “On Environmental Protection”, as well as taking into account the goals and objectives of the national project “Ecology”. The project includes a number of federal projects and is actually a “road map” of environmental activities of departments, regions and businesses. The total financing of the project is more than 4 trillion rubles, of which 3.2 trillion rubles come from extrabudgetary sources (Passport, 2018).

Russia’s special national interests in the field of sustainable development of the Arctic cover the areas of economics, ecology, social policy and science. The aggravation of the environmental situation in the Arctic is caused by a number of reasons, including impacts caused by the consequences of economic activities in the past.

In the twentieth century, a powerful industrial potential with a pronounced raw material orientation was created in the Russian Arctic. As a result of the curtailment of economic and other activities in the Arctic in the 1990s, the problem of accumulated environmental damage arose. The current state of the environment, as well as projects for new development of the Arctic zone, raise questions from the perspective of environmental safety.

Regarding the cleanup of the Arctic regions from accumulated environmental harm and waste, a whole package of regulations has been adopted aimed at: eli-

minating landfills and reclamation of the territories where they are located, identifying and assessing objects of accumulated environmental harm, as well as organizing work to eliminate accumulated environmental harm, arising as a result of past economic and other activities, the obligations to eliminate which were not fulfilled or were not fulfilled in full, the procedure for providing subsidies from the federal budget to support regional projects in the field of waste management and elimination of accumulated environmental damage.

In accordance with Law No. 7-FZ “On Environmental Protection”, identification of objects of accumulated harm is carried out by state authorities of the constituent entities of the Russian Federation or local governments through an inventory and survey of the territories where waste disposal facilities are located. Assessment of an object’s accumulated environmental damage includes establishing:

- volume or mass of pollutants, waste and their hazard classes;
- the area of territories and water areas where the object of accumulated environmental damage is located, the categories and types of permitted land use;
- the level and volume of negative impact on the environment, including the ability of pollutants to migrate to other components of the natural environment, the possibility of pollution of water bodies, including those that are sources of drinking and domestic water supply, the possibility of environmental risks;
- the presence at sites of accumulated environmental damage of hazardous substances specified in international treaties to which the Russian Federation is a party;
- the number of people living in the territory where the environment is negatively impacted due to the location of the site of accumulated environmental damage;
- the number of people living in the territory where the environment is under threat of negative impact due to the location of the site of accumulated environmental damage (Federal Law, 2002).

All this information must be reflected in the inspection report of the object of accumulated harm.

4. Development of Work to Eliminate Accumulated Environmental Damage

It should be noted that by 2010, at the level of the Russian government, there was an understanding that a special place in solving the problem of accumulated environmental harm should be given to the Arctic territories of the Russian Federation. This was emphasized in the draft Federal Target Program “Elimination of Accumulated Environmental Damage for 2014-2025” and in public speeches at the highest level of government. A relatively complex environmental situation has developed in the Arctic. The main reason for this is that in the 20th century, economic and military facilities, infrastructure, a significant number of barrels and tanks for various types of fuel, lubricants, and household waste were

abandoned along the coastline of the Arctic zone and on many islands. As a result of climate impacts, infrastructure facilities and fuel and lubricants storage tanks are destroyed, which leads to pollution of the natural environment (Federal Target, 2013).

According to the Russian Ministry of Natural Resources, by 2010, the country had accumulated 31.6 billion tons of waste, 2 - 2.3 of which were toxic. It is obvious that such objects occupy significant areas of land, causing chemicals to enter groundwater, which leads to contamination of surface and underground water bodies, including water supply sources, and disruption of the geochemical balance of the territories (Federal Target, 2013).

As a result of economic activities in the past and present, impact areas have been formed in the Arctic, characterized by a strong transformation of the natural geochemical background, atmospheric pollution, degradation of vegetation, soils, the introduction of pollutants into the food chain, and increased morbidity among the local population.

4.1. Work to Clean Up the Contaminated Islands of the Franz Josef Land Archipelago

Large-scale work to clean up the Arctic territories began in 2010, after Russian Prime Minister V.V. Putin visited the islands of the Franz Josef Land archipelago. They noted that it is necessary to carry out a real general cleaning of our Arctic territories. Clean up those landfills that have been accumulating for decades around polar cities and towns, fields, military bases, ports and airfields, in the tundra, on islands and in the Arctic Ocean (RIA Novosti, 2010).

Based on the results of V.V. Putin's trip by order of the Government of the Russian Federation, the federal state budgetary institution "Russian Arctic National Park" was created, the subject and goals of which are the preservation and restoration of unique and typical natural complexes and objects located on the territory of the National Park, environmental education of the population, development and implementation of scientific methods of nature protection, environmental monitoring, creation of conditions for regulated tourism and recreation.

Among the works on cleaning up territories in the Arctic, the project "Program for the Elimination of Sources of Negative Impact on the Contaminated Territories of the Islands of the Franz Josef Land Archipelago for 2012-2020" should be highlighted. Below, in more detail, taking into account the history of the issue, we will dwell on the work to eliminate accumulated environmental damage that was carried out in these territories (Shevchuk, 2023).

In 2011, the Ministry of Natural Resources and Ecology of the Russian Federation began work to identify and study impact sites on the contaminated islands of the Franz Josef Land archipelago (Alexandra Land Island, Graham Bell Island, Hoffman Island, Hayes Island, Rudolf Island and O. Hooker). In 2011-2012 As part of the project of the Russian Ministry of Natural Resources, the Council for the Study of Productive Forces conducted a geocological survey of the islands of

the Franz Josef Land archipelago. For the first time, a detailed survey and mapping of technogenically disturbed areas, including assessment of soil pollution levels, was carried out using a modern computer program linked to an interactive Geographic Information System. This made it possible to obtain the most complete and reliable information about the sources of negative impacts and the environmental situation on the islands of the Franz Josef Land archipelago, to systematize and summarize data on contaminated areas. During the geoecological survey, soil and natural water samples were taken to determine the total content of petroleum products and heavy metals. Based on the survey results, a list of potentially environmentally hazardous areas was compiled (see **Table 1**), their maps, a list of pollution, and recommendations for their elimination were given (SOPS, 2011, 2012).

The research materials made it possible to develop a “Program for eliminating accumulated environmental damage on the contaminated islands of the Franz Josef Land archipelago in the period 2012-2020” (hereinafter referred to as the Program). The program was approved by the Public Council of the Russian Ministry of Natural Resources (November 2011). The total funding for the Program was estimated at 8.5 billion rubles. The program determined the main directions for the implementation of a set of industrial and organizational measures that ensure the creation of conditions and mechanisms for the implementation of work to eliminate sources of negative impact on the contaminated territories of the islands of the Franz Josef Land archipelago for 2012-2020.

It should be noted that similar cleanup programs have already been implemented in other countries of the Arctic region (USA, Canada, Norway). It was planned to spend \$1.2 billion on the work that the United States carried out in Alaska until 2020 (Shevchuk, 2023). Technological work to clean up the islands of the archipelago within the framework of the Program began in 2012 in several stages: 2012-2013, 2014-2015, and 2017.

During an expeditionary geoecological survey of the contaminated areas of the islands of the Franz Josef Land archipelago in 2011, specialists from SOPS and the Poliinform company tested the preparations Hydrobreak, Soylex, and Biocompost. Biological products based on oil-oxidizing microorganisms and

Table 1. Number of contaminated sites on the islands of the Franz Josef Land archipelago.

Name of the island	Number of contaminated areas, pcs.
Earth Alexandra	13
Graham-Bell	14
Hoffmann	2
Hooker	2
Rudolf	6
Hayesa	23
Total number of contaminated areas, pcs.	60

their associations, intended for cleaning the environment from oil and oil products, are used quite widely. The most promising method for solving this problem in the conditions of the Far North is microbiological treatment technology, which involves placing oil-contaminated soils on specially equipped reclamation sites, where they are subjected to biological oxidation under the influence of an association of psychrophilic hydrocarbon degrading strains that are part of the Soylex biological product (SOPS, 2011).

In 2017 SOPS VAVT of the Ministry of Economic Development of the Russian Federation conducted a repeated geo-ecological survey of contaminated areas of the islands of the Franz Josef Land archipelago in order to assess the effectiveness of cleanup work in 2012-2017. At the same time, the results of technological work to eliminate accumulated environmental damage on the Franz Josef Land archipelago carried out during these years were used. The expedition participants examined 2230 hectares of territory and completed all the necessary amounts of work. Analytical, cartographic and calculation materials were obtained and presented in the report and its annexes (VAVT, 2017).

The cleanup work carried out in 2012-2017 showed high efficiency (a total of 90% of the waste was removed). The results of the cleanup program for the islands of the Franz Josef Land archipelago have been published in peer-reviewed journals and presented at international and national conferences.

4.2. Cleanup Work in Other Arctic Territories

A number of similar works were carried out in other territories: the village of Amderma (Nenets Autonomous Okrug), Wrangel Island (Chukchi Autonomous Okrug), Bely Island (Yamalo-Nenets Autonomous Okrug), in the Kola Bay (Murmansk Region), New Siberian Islands (Republic of Sakha (Yakutia)).

It should be noted that in the period 2011-2015, practical work was carried out to clean up other Arctic territories: Wrangel Island, Amderma, the Spitsbergen archipelago. Of interest is the initiative of the Yamal-Nenets Autonomous Okrug government, which organized a geoecological survey of Bely Island in 2012, and in 2013-2015, and carried out cleanup work on the island. At the same time, the specialists who were responsible for organizing the survey used methodological approaches and materials for organizing work on the field. The Russian Ministry of Defense carried out a number of works to clean up contaminated areas at their bases. Thus, military personnel of the combined environmental unit of the Eastern Military District carried out work to clean up scrap metal in the areas of Somnitelnaya Bay and the former Zvezdny airfield on Wrangel Island (Shevchuk, 2023).

5. Conclusion

Work on cleaning up a number of contaminated areas in the Arctic, carried out in the last period, has a high socio-ecological effectiveness. It is necessary to expand this type of work to other contaminated areas located in the Arctic, to de-

velop an independent program “Ecological Safety of the Arctic Zone”, and to develop scientific research on environmental Arctic topics.

To increase the efficiency of work to ensure environmental safety in the Arctic, it is necessary to prepare proposals for scientific, methodological and information support of planned work to clean up contaminated areas, conduct field pre-investment surveys, and justify projects for 2024-2025 and for the period until 2035. In this regard, it is necessary to conduct an inventory of environmental projects in the Arctic regions to eliminate past accumulated environmental damage; estimate the volume of environmental damage and the necessary costs for its elimination in the regions of the Russian Arctic.

Given the enormous scale of planned work in the Arctic, there is a clear danger of repeating mistakes in relation to environmental protection when implementing large infrastructure projects.

It is also necessary to prevent future environmental damage arising from new projects.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- (2002). Federal Law “On Environmental Protection”.
- (2013). *Passport of the Federal Target Program “Elimination of Accumulated Environmental Damage” for 2014-2025 (Project)*.
http://www.mnr.gov.ru/upload/files/docs/programma_fzp.doc
- Decree of the Government of the Russian Federation No. 484 (2021). *State Program of the Russian Federation “Socio-Economic Development of the Arctic Zone of the Russian Federation”*.
- Decree of the President of the Russian Federation No. 164 (2020). *On the Fundamentals of the State Policy of the Russian Federation in the Arctic for the Period until 2035*.
- Decree of the President of the Russian Federation No. 204 (2018). *On National Goals and Strategic Objectives of the Development of the Russian Federation for the Period until 2024*.
- Decree of the President of the Russian Federation No. 645 (2020). *On the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period until 2035*.
- Passport (2018). *Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects (2018) Passport of the National Project “Ecology”*.
- RIA Novosti (2010). Russia Plans to Clean up the Arctic Territories from Landfills.
<https://ria.ru/20100923/278447994.html?ysclid=ltjv58dtnl143132396>
- Shevchuk, A. V. (2023). *Problems of Assessing and Eliminating Accumulated Environmental Damage on the Islands of the Franz Josef Land Archipelago in the Period 2011-2017*. LLC “White Wind”, 162 p.
- Shevchuk, A.V., & Shumikhin, O.V. (2019). Ecological and Economic Aspects of Eliminating

Accumulated Environmental Damage in the Arctic. *Bulletin of Moscow State University, Economics Series*, No. 4, 95-106.

SOPS (2011). *Report on the Implementation of Environmental Measures on the Topic: "Development of a Program and Project for the Implementation of Work to Eliminate Sources of Negative Impact on the Contaminated Territories of the Islands of the Franz Josef Land Archipelago"*.

SOPS (2012). *Report on the Implementation of Environmental Protection Measures on the Topic: "Carrying Out Technological Work to Eliminate Environmental Damage Accumulated during the Period of Economic Activity on the Contaminated Territories of the Islands of the Franz Josef Land Archipelago in 2012-2013"*.

SOPS (2013). *Research Report on the Topic: "Assessment of Accumulated Environmental Damage in the Arctic Zone of the Russian Federation and Justification of Measures to Eliminate It and Reduce Environmental Threats Caused by the Expansion of Economic Activity in the Arctic, Including on the Continental Shelf and in the Areas of Russian Presence in the Spitsbergen Archipelago"*.

VAVT (2017). *Report on the Work to Provide Consulting Services on the Topic: "Assessment of the Results of a Geo-Ecological Survey of Contaminated Areas of the Islands of the Franz Josef Land Archipelago in Accordance with the Work Plan and Taking into Account the Work Carried Out in 2012-2017"*.