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Analisys of technogenic impact on geosystems of the European Russian North

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Abstract

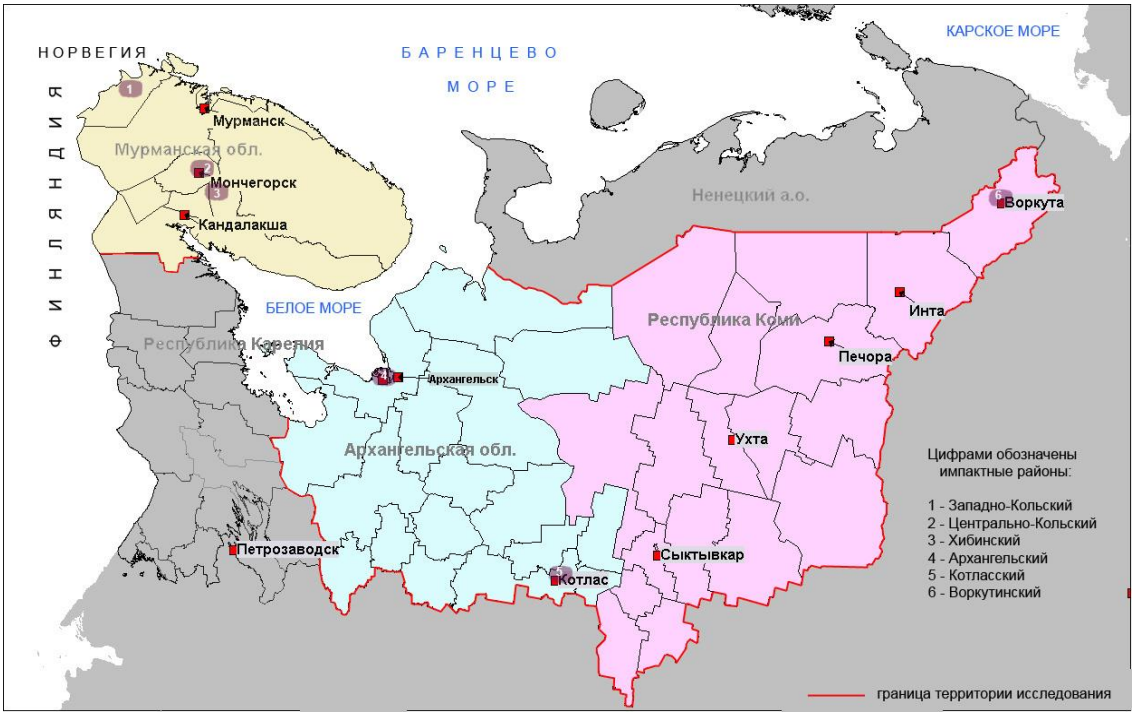
Methodical approaches for carrying out complex geoecological researches taking into account natural and economic peculiarities of the North are developed. The detailed characteristics of the features of the nature management modern structure and technogenic impact on the research territory are given. Preconditions for regional nature management in its historical-geographical aspect, the structure and the dynamics of nature management at present, the negative geoecological consequences connected with them are analysed.

Keywords: *nature management, geoecological situation, European North of Russia, technogenic impact assessment.*

The development of thebnatural resources in the North of Russia due to a combination of the certain natural and socio-economic backgrounds, as well as limiting factors, and has a long history of reflecting the socio-cultural features of the development of N. space. A feature of this development, the active period of which came in the 30's. XX c., Was predominantly industrial development with a high share of mining and manufacturing industries, resulting in high development pressure on the environment, pollution and degradation of its individual components.

The most urgent of these problems manifested themselves in a number of the industrial centers of the Northern European Russia, where there are the most powerful man-made impact, allowing them to carry to the impact areas. Under the impacted area means land within the territorial-industrial complex, which as a result of human impact has been an adverse change in the environment that led to the emergence and development of critical environmental situations. Characteristics of the impact areas in more detail presented in the works of A.V. Evseeva and T.M. Krasowskaya (1996, 1997, 2004, 2008), the monograph "Russian Arctic: on the threshold of the Holocaust" (1996) and the monograph «Environmental hot spots and impact zones of the Russian Arctic »(2000).

The major areas of impact are studied area (Fig. 1) in the Murmansk region - West Kola (Nickel, Polar), the Central Kola (Monchegorsk, Olenegorsk) Hibinsky (Kirovsk, Apatity) in Arkhangelsk - Arkhangelsk (Archangel, Severodvinsk and Novodvinsk) and Kotlasskiy (Kotlas and Korjazhma) in the Komi Republic - Vorkuta (MO Vorkuta).



Pic. 1. Territory of the reseach

Selection of these areas due to the fact that based on the prioritization of hot spots in the Russian North, carried out by experts under the Ministry of Economic Development RFv "Strategic Action Program" (NAP Arctic, 2005; SAP-Arctic, 2009), they are related to the main areas of impact, which are characterized by the crisis, and in some cases critical ecological situation. The extreme expression of this was the deterioration of the living conditions of the local population and high rates of the lasses of environmental related diseases (marked excess over the all-Russian background up to 10 times in terms of congenital malformations in children, almost 2 times the level of incidence of dermatitis, as well as indicators of respiratory diseases and malignant neoplasms). Mentioned negative factors affected the life expectancy of the population studied industrial centers, which are lower than the overall 2-5 years: 54-58 years for men and 69-71 years for women (Dushkova, Evseev, 2011).

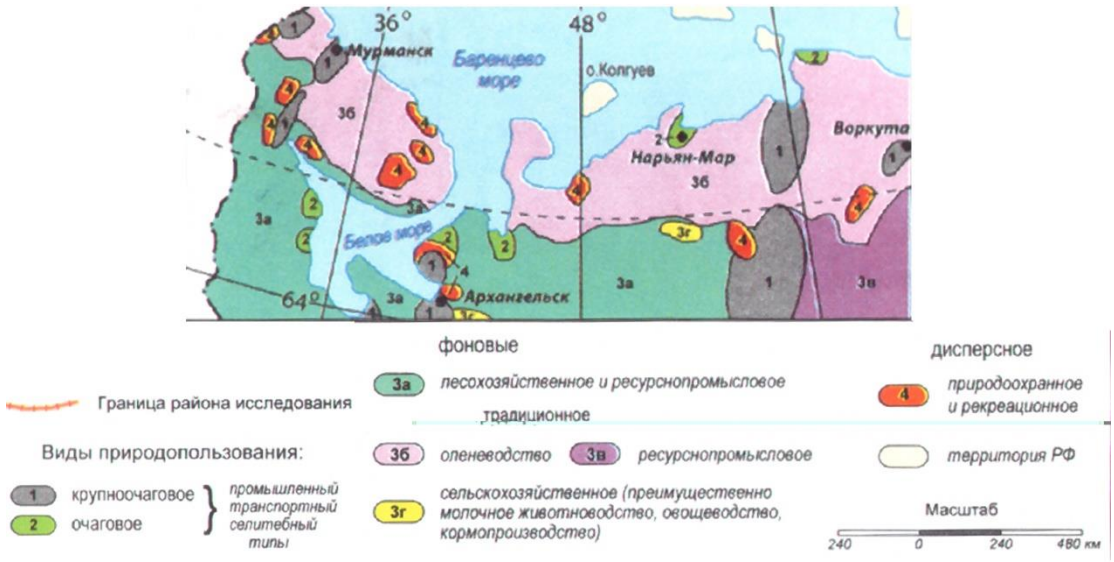
In the course of the research were raised and solved the following problems: an analysis of the regional environmental and historical conditions of its formation, the research of the regional characteristics of geo-ecological situation of territories with strong anthropogenic disturbances Geosystems (impacted areas), the development of methodological approaches to integrated regional geo-environmental analysis.

Based on the methodological and theoretical framework has been developed technique of geo-environmental work, which includes both the field (Expeditionary), and desk studies of ecological conditions, the analysis of literary and library materials, preparation of maps. During the many years of field work in the regions of the Northern European Russia were held landscape-geographical descriptions, samples were taken of the environmental components on landscape profiles (for catena - from landscapes to transeluvial superaqual), collected materials on the environmental situation in the region. In the laboratory, is made of the chemical-analytical processing of the samples for the determination of priority pollutants. The study used the classical methods

in geography (mapping, comparative-descriptive, zoning), as well as mathematical and statistical, scoring methods and expertise. The research results are presented in a series of maps showing the spatial distribution of the anthropogenic impact on the individual components of the natural environment.In the course of the research developed methodological approaches for comprehensive geo-environmental studies, taking into account the natural and economic specifics of the North. On the basis of the available materials processing (field, mapping, remote sensing, statistical, literary and stock) contains a detailed description of features of modern structure of nature and human impact in the study. Analyzed the prerequisites of becoming a regional nature in the historical and geographical aspects, the structure and dynamics of nature use at the present stage, the conflicts of nature and the associated negative geo-ecological consequences. The formation of the regional structure of nature was largely predetermined by a specific natural conditions and historical features of the economic development.

The fatures of the modern structure of the nature using

The north of Russia is characterized by the following nature: background, macrofocal, patchy and dispersed (Fig. 2). The greatest territorial extension to the European North has a background of nature, which includes the following types: traditional land of indigenous peoples of the North (reindeer herding, hunting and fishing), forestry (produces about 60% of the deforestation of the Russian Federation), Agricultural and Resource and fishing. The lowest ranges generally wills river valleys set aside for agricultural nature. For these types of nature use is not exclusive direct dependence on the resource base, but also on sredoob-forming functions of geosystems. This leads them to adapt predominantly zonal-raising. A characteristic feature is the balance of energy-material flows dominated by man-made streams which, however, does not destroy the system of "nature - population - economy" (Krasovskaja, 2008).



Pic. 2. Natural resources in the North-West of Russia (by: Krasovskaja, 2008)

The particulate form of the natural resources, including environmental and recreational types, in areal extent is still in last place, although its role in the maintenance of the entire system of the North is very high. Dispersed nature is also a zonal adapted and characterized by a high depend-

ence on habitat-forming ecological functions. Recreational type of wildlife includes sanitary-and-spa, sports, tourist areas of natural and cultural heritage, gardens and orchards, etc. The environmental nature extended to the territory of less than 5% of the total area of the European North of Russia. It includes comprehensive nature reserves and wildlife sanctuaries of federal and regional, national parks, natural monuments, etc. For these types of natural resources is also typical of real-balanced energy metabolism in the system of nature.

Quite the opposite on the impact on the environment is macrofocal and patchy nature, intensive development of which began only in the 20's and 30's. The twentieth century. and is associated with the expansion of the industrial North. His characteristic types of natural resources - industry, energy, transport, residential and special (military) - differ in the intensity of use of natural resources, the volume of seizures of matter and energy, transformation of matter-energy flows and the nature of the impact on the environment. Active economic activity associated with the development of mining, mineral processing, pulp and paper industry, metallurgy, mechanical engineering, energy and transport networks, has led to the development of vast spaces, a significant increase in the appearance of the old and new towns and industrial centers. For the industrial structure is characterized by a large share of the mining and manufacturing industries with significant volumes of the extraction of thenatural resources. For example, the extraction of copper and nickel industry on the Kola Peninsula in the period from 1996 to 2004. amounted to 68.5 million tonnes, while production of apatite-nepheline ore enterprises of JSC "Apatite" during the same period - 311.8 million tons This has led to high anthropogenic impact on the environment, pollution and degradation of its individual components (Dushkova, Evseev, 2011).

Thus, the existing structure of the natural resources in the European North of Russia, in which the dominant role is resursopotreblyayuschim species (macrofocal, patchy, background), is in conflict with the role of the North in the formation of regional and global ecological balance. The study of the impact of man-made features showed that the Northern European Russia are characterized by a complex geo-environmental situation caused by human activities, and, above all, the extraction and processing of raw materials, often with outdated technology. Consider the nature of the contamination of components of natural environments, and changes as a result of anthropogenic geosystems activities for each subject area of impact.

The pollution of the air

The analysis of the air condition shows that for the considered impacted areas are characterized by high volumes of load aerotechnogenic pollutants. On emissions of pollutants into the atmosphere among the considered areas of impact Vorkuta is in the first place (290 thousand tons per year), despite the closure of several mines and carrying out activities to reduce emissions to the atmosphere (Fig. 3).

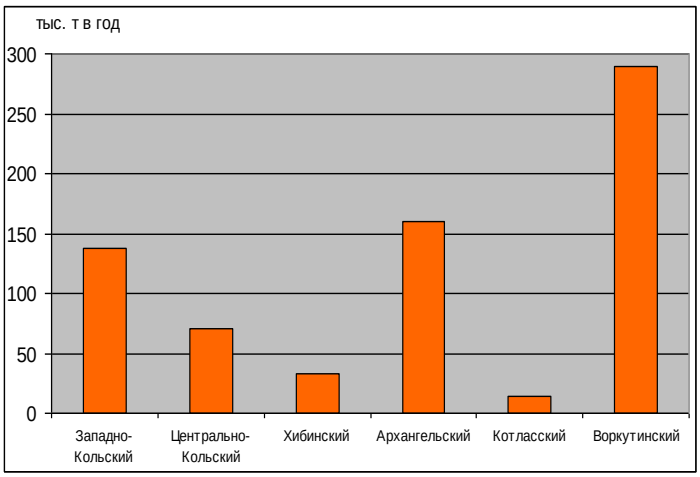
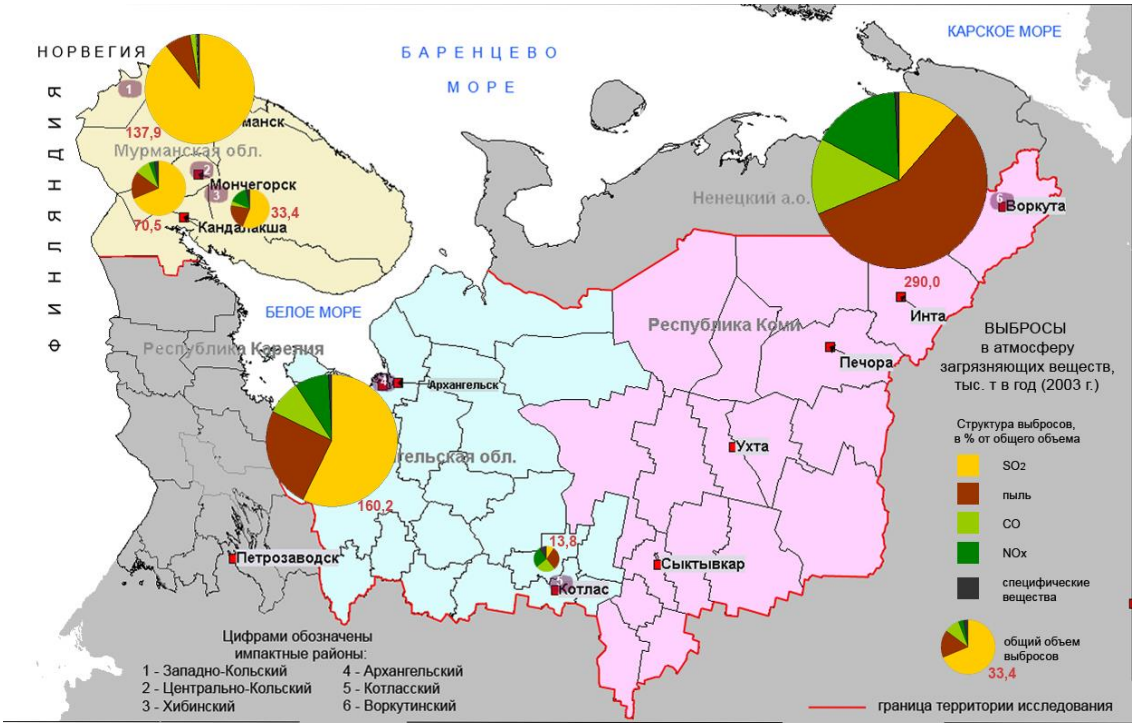


Fig. 3. Total emissions of air pollutants in the impact areas of the ECP (2006)

The specificity of the industrial production also causes a different structure of pollutant emissions, which are considered separately for each area of impact (Figure 4).



Pic. 4. The structure and amount of the emissions of air pollutants in the impact areas of the Northern European Russia

The western kola impact region. Non-ferrous metals and mining led to significant emissions of pollutants into the atmosphere. Their main source of income is the factory "Pechenga" of "Kola MMC" which enterprises are located in the Polar and village. Nickel. The raw material for the plant is its own sulfide ore. The main products of the plant are matte, which is processed at JSC "Severonikel" to commodity metals and sulfuric acid. Ore extraction is conducted in 10 fields, including open pit - at the Zhdanov and underground - by Polar, Kotselvaara and Semiletka. In the industrial emissions is dominated sulfur dioxide, carbon dust, heavy metals (copper, nickel, cobalt). Total emissions from major sources of air pollution, "Pechenga" is 137.9 thousand tons per year, of which S02 emissions were 124,4, N0x - 0,6, CO - 2,2, dust - 10.6 thousand tons (Report ...,

2006). The annual average concentration above 1 MAC observed for formaldehyde - 1.3 MAC, SO2 - 1,4. The maximum values for the year, measured in 20-minute intervals in the MAC values: SO2 - 4,2, NOx - 2,5, CO - 2,5, benzo (a) pyrene - 1.3. Thus, the emissions of sulfur dioxide and particulate matter with a decrease in the period 1999-1998 gg., Due to the economic downturn in the country. But an even greater reduction of pollutants according to the notes of 2001-2002. Due to changes in the area of technological process of pelletizing and sintering processing plant in the melt shop. Of all the analyzed period, emissions decreased by almost a factor of 2.5 for sulfur dioxide and 1.5 times in solids. A different situation is observed for nickel emissions into the atmosphere during the period did not decrease, but increased (from 301 to 328 tonnes per year). Emissions of copper there was a slight decline (from 180 to 173 m).

It should be noted, and long-range atmospheric transport features. The fact that the Kola Peninsula is located in a zone of active influence of Atlantic cyclones that move air masses from Western Europe to the European part of Russia. There is only one station control of pollutants with transboundary drift - in Rayakoski, but it controls the flow of mainly sulfur compounds, although the transfer of heavy metals on the Kola Peninsula beyond doubt. Thus, the total metal loss per day in western 10 times the minimum throughout the region. The average content of SO42- similar nature of the deposition of heavy metals, the annual cross-border flow of this substance on the territory of the Kola Peninsula is just over 3 t/km2. By estimates of some observers, the contribution of long-range transboundary pollution by sulfur compounds of the Kola Peninsula is 60% (Evseev, Krasovskaja, 1996; Kalabin, 2000; Evseev, 2004).

The Central kola impact region. The main sources of the emissions in the area are non-ferrous metals "Severonikel" of "Kola MMC" in Monchegorsk, specializing in the extraction and enrichment of raw materials for the steel industry of "Alcon" in Olenegorske, utilities, engineering plant and transport. They supply into the atmosphere large amounts of sulfur dioxide and nitrogen, heavy metals, phenols, benzo (a) pyrene, hydrogen fluoride, dust and other industrial emissions of major pollutants (total of enterprises "Severonikel" and "Alcon") is 70 , 5 thousand tons per year, of which S02 - 48,3, N0x - 2,2, CO - 6,4, dust - 11.7 thousand tons per year (Report ..., 2006).

The annual average concentration above 1 MAC celebrated on formaldehyde - 2.7 MPC suspended solids - 1.3 MAC. The maximum values for the year, measured in 20-minute intervals in the values of MPC: NOx - 2,0, CO - 1,4, dust - 1.4, benzo (a) pyrene - 1.4. Industrial sites in the vicinity of the enterprise "Severonikel" observed constant maximum permissible concentration of sulfur dioxide (3.7 - 5). In some calm days are exceeded sanitary norms by 30 times, and environmental - almost 300 times (Kalabin, 2000; Dushkova, Evseev, 2011).

During the period under review (1990-2005 gg.) Observed significant reductions in air emissions: 5.6 times for sulfur dioxide, 5.4 for nickel, 3.6 times the solids, 2.9 for nickel. Emission reductions due to the economic downturn in the country (1997-1998 gg.) And the implementation of measures for the improvement of production processes, energy and resources.

The Hibinskiy Impact region. The main emissions are supplied by mining and processing production ANOF-2 (Apatity) and ANOF-3 (Kirovsk) JSC "Apatite", tailings and dumps of "Apatite", Open (career) and closed (mine) production, as well as thermal power plant "KolEnergo" (Apatity GRES). JSC "Apatite" is developing an open pit and underground deposits of six apatitnefelinovyh Hibin and has a structure of four mines and two processing plants. The priority pollutants of the area of impact are: dust, sulfur dioxide, carbon oxide, strontium, aluminum, benzo (a) pyrene, flotreagenty, oxides of nitrogen, phosphate, fluoride, heavy metals, etc. The total amount of emissions is 33.4 thousand . tons per year, of which SO2 - 18,7, NOx - 6,0, CO - 1,3, dust - 7.2 thousand per year (Report ..., 2006). The maximum values for the year, measured in 20-minute intervals in the values of MPC are: NOx - 1,1, dust - 1,2, CO - 1,6.

Significant source of air pollution by dust are heaps of waste enrichment-state factories - tailing. Thus, according to some estimates (Kalabin, 2000; Evseev, 2003) on the area of impact of the district is scattered by the wind from 200 to 700 million tons of "tails" of an area of about 2,000 hectares. Tailing of "Apatite" are the largest in terms of volume and area sources of secondary pollution of the environment as in the Murmansk region, and among all the considered areas of impact. The danger is contained in the tailings dumps particles of anthropogenic origin, derived from crushing rocks and able to easily penetrate into the mucous membrane (Kalabin, 2000). Furthermore, accompanied by dusting spread much toxic compounds (especially strontium)

Arkhangelsk impact region. Characterized by the specific air pollution harmful impurities from the pulp and paper industry and mechanical engineering, as well as transport and power engineering. For enterprises with the largest emissions of air pollutants are: JSC "Arkhangelsk PPM" Novodvinsk - 49.55 thousand tons (22.4% of emissions in the area), HPP-1 and HPP-2 Severodvinsk - 50 , 6 thousand tons (15.8%); TPP in the city of Arkhangelsk - 27.6 thousand tons (7.8%), JSC "Solombalsky PPM" Arkhangelsk - 8.48 tonnes (4.3%) (State of ..., 2004). The total amount received for the year of air pollutants is 160.2 tonnes (2003 figures), including industrial emissions: SO2 - 91,0; NOx - 13,1; dust - 49.3, CO - 14 , 1 million tons; specific substances (tons / year): Ammonia - 9.6, acetic acid - 9,6, H2S - 142,2, methanol - 85.6, ethanol - 65.0, toluene - 50.1 formaldehyde - 0.4, xylene - 27.3, ethyl acetate - 3.5, white spirit - 18.9, furfural - 1.1, methyl mercaptan - 34.6, turpentine - 0.3. Total emission of thermal power plant is 78.2 tons per year, ie almost half of the total emissions to the atmosphere in the impacted area.

The average annual concentration of benzo (a) pyrene exceeds the MCL of 4.5 times, the maximum is 7.5 MAC, NO2 - 2,5 MPC CO - 2.2 MAC. The average concentration of formaldehyde - 2PDK; maximum single largest concentration - 1.5 MAC. The maximum single concentration of pollutants in the ambient air (solid / multiple MAC): methyl mercaptan - 31.0, CO2 - 8,0; NO2 - 7,9; benzo (a) pyrene - 7.5, particulate matter - 6.0; sulfur dioxide - 0.8, carbon monoxide - 1.8, nitrogen dioxide - 7.9; nitric oxide - 1.2, hydrogen sulphide - 3.1, carbon disulfide - 0.9. Recorded 5 cases of high content of beta-active radionuclides in the air - the excess of the daily average concentration of 5 or more times over the background. Was one case of high pollution (VZ - back-

ground value in excess of 10 times or more) fallout associated with an increased content of radionuclides uranium-thorium origin.

The priority air pollutants Arkhangelsk region of impact include methyl mercaptan and formaldehyde, which are formed during the incomplete combustion of almost all types of fuel and are substances having a high carcinogenic activity. Substances come from incomplete combustion of liquid fuels, as well as in mixtures with other hydrocarbons emissions from industrial plants and vehicles, but mainly formed during the chemical reaction of hydrocarbons in the atmosphere. Adverse changes in the levels of air pollution in urban area also occur due to increasing number of vehicles.

Kotlas Impact region. Among the major sources of air pollutants district allocated the pulp and paper and forest processing industry, chemical industry (paint, phenolic resins). The largest volumes of pollutant emissions into the atmosphere supplies of "Kotlassky" Koryazhma - 12.3 thousand tons, the second-largest air emissions from transport (State ..., 2004). The level of contamination of the area of impact and increased the concentrations of benzo (a) pyrene, and in some periods and methyl mercaptan. The priority pollutants are also oxides of sulfur, lignosulphates, heavy metals, phenols, methanol, dioxins (HCB and PCDD / PCDF - persistent organic compounds).

The total emissions of 13.8 tons per year (in 2003). Pollutant emissions from stationary sources in the reporting period of five years (1999-2003 gg.) Decreased by 48% due to the nature of the activities. There is a tendency to decrease in the proportion of samples that do not meet health standards. This is due to carried out by JSC «Kotlassky" environmental meropritiyami (State of ..., 2004

According to the stationary observation post of "Kotlassky" and monitoring conducted by the North AHEM, in Koryazhma periodically observed air samples with a concentration of methyl mercaptan in the range of 1-2 MPC (State ..., 2004). Annual average concentrations of benzo (a) pyrene - 2.3 MPC formaldehyde - 1.7 MAC. The maximum single concentration of pollutants in the ambient air (solid / multiple MAC): hydrogen sulfide - 1.6, methyl mercaptan - 3.1, benzo (a) pyrene - 3,6, carbon monoxide - 1.8.

Vorkutinskiy Impact region. By gross emissions of pollutants into the atmosphere the most intense environmental and sanitary situation is observed in the city of Vorkuta. In the impact area are home to 80 existing enterprises. The city originated and developed as a center for the coal mining industry. Therefore, leading enterprises are six coal mines (Ayach-Yaga, Vorkuta, Polar, Komsomolskaya, October, North), 4 concentrators, included in Production Association "Vorkutaugol" corporation "Russian Coal", and 1 independent mine "Mine Vorgashorskaja" (Getsen et al, 2005). Administrative and economic union "Vorkutaugol" is closely related to the metallurgical holding "Severstal". In addition to coal mining companies in the area of Vorkuta and its suburbs (the village Vorgashor, pos. Tsementozavodskoy, Moodle, etc.) operate thermal power plant (TPP two), construction materials (cement plant, building materials, wood processing plant),

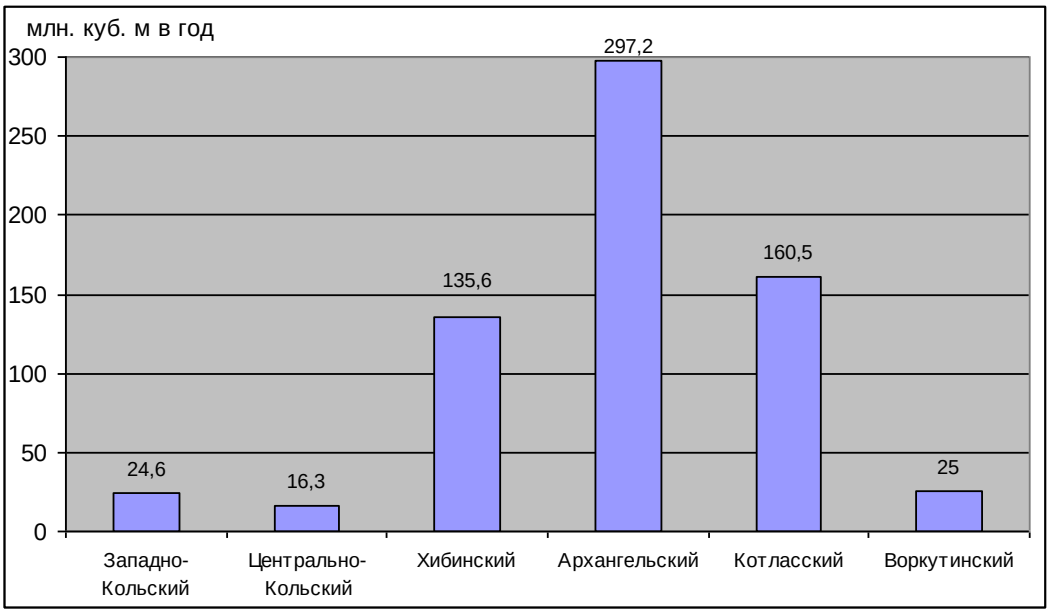
mechanical and repair mechanical plants, and transportation, food, housing and utilities. These facilities are located throughout the city and within a radius of 20 km from the center.

Vorkuta for advanced coal-mining industry, and large objects of electric power industry is characterized by very large amounts of emissions (290 tonnes per year), in which the predominant give hydrocarbons, particulate matter and sulfur dioxide (Vorkuta, 2004). Causes significant emissions is a low degree of purification. Dusty air dumps contribute mines. When developing coalbed methane air flows. Air pollution levels increased. The most important hygienic air pollution in Vorkuta formaldehyde (2.1 MAC), dust (2.1 MAC), benzo (a) pyrene (1.2 MAC). On the other indicators do not exceed the average content of the MPC. Exceeding the maximum marked on formaldehyde (3.9 MAC). The quantity of emissions of carcinogens can be attributed to this region to the territories IMPACT risk of malignancy in the population due to receipt of chemical toxicants.

The pollution of the water objects

Among the many and varied sources of pollution of the biosphere is necessary to allocate water pollution as a result of natural and geological processes of natural and anthropogenic origin. Almost all sources of drinking water of the study area, both surface and underground, exposed human impacts with varying degrees of intensity. Water bodies are ultimately a collector of all kinds of pollution, coming both from the flue emissions smelter metallurgical plants and power plants, and as a part of industrial and municipal wastewater. Industrial waste generated by sewage from areas of mining, mine water is pumped onto land, technological waters after enrichment and smelting of ores, as well as from sewage construction companies and energy companies. The quality of groundwater under consideration with hygiene items as the most reliable, determined by the structure and composition of geological rocks, reliability aquitard, depth of aquifers and penetrating to a depth of man-made pollutants. According GosSanEpidemNadzor and Hydrometeorology, in general, their quality is at the Russian average, only in some cases exceeding them (State of ..., 2004, Report ..., 2006; Getsen ..., 2005).

The nature of water bodies reflect the dumping of contaminated water (Fig. 5). According to this indicator among the studied areas leads IMPACT Arkhangelsk region (278.1 million cu m.), Followed Kotlasskiy (208.0 million cu m.), Due to the activities within their areas of forestry enterprises. The high rate of polluted runoff characteristic of Apatity and Kirovsk (Fig. 6). But it should be noted particularly negative impact mill "Severonikel" industrial waste which is heavily polluted river Nyuday. As a result of our analysis of water samples from this watercourse that concentrations of nickel and copper are ten times exceed the MPC. The unfavorable condition of surface water forces the use of underground water table or goes to the improvement of the method of water treatment

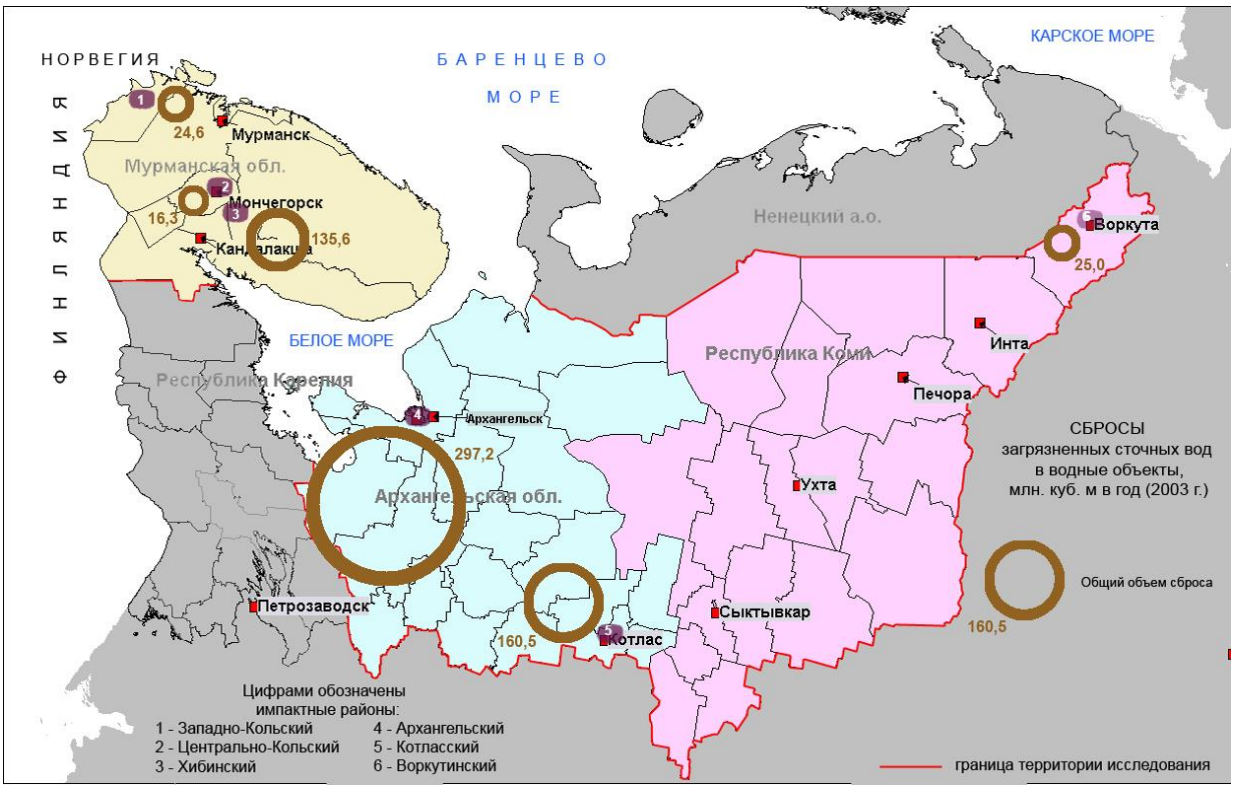


Pic. 5. Total volume of contaminated waste water in the impact areas, mln. m per year (as of 2006)

Consider the nature of the contamination of water bodies for each of the test impacted areas individually.

The Western-Kola Impact region. Contamination occurs as a result of direct discharges of inadequately treated sewage from areas of mining and mine water pumped onto land, as well as storm water and environmental contamination of soil and ground. Combine "Pechenganikel" of "Kola MMC" is one of the largest sources of wastewater discharge not only in this area of impact, but the entire Murmansk region. In the dynamics of the total discharge of wastewater now been declining: in 1999 - 28.6 million m3 in 2003 - 24.6, in 2005 - 18.03 (Report ..., 2006). It is also characteristic pollution discharges of process water after enrichment and melting ores. Thus, after processing to yield matte nickel, copper, cobalt, precious metals, sulfuric acid. The resulting run-

off in the structure contain mineral salts, suspended matter and heavy metals.



Pic. 6. Discharge of polluted effluents into water bodies impacted areas of the European North of Russia

Receiver wastewater plant is the river Kolos-Joki related to the basin Pats-Joki. In the estuarine river alignment has 2 pollution (characterized as "polluted" by more ingredients). The annual average concentration of nickel in the mouth of the river after the wastewater exceeds the MCL by 40 times, copper - 18, Mn - 10 times. The annual average metal content in the water of the river (target 14.7 km above the village. Nickel) experiencing environmental contamination is: copper - 5 MPC, manganese, and nickel - at the MPC. In the flow-untitled average nickel concentration reaches 8 MPC, copper - 9 MAC. The lake Luchlompolo average copper concentration was 13 MPC, nickel - 5 MAC. Maximum sulfate content - 324 mkg/dm3 (3 MAC) was observed (2003) in August, the average concentrations are kept at the MPC. Marked individual cases exceeding the permissible concentration of ammonia nitrogen content, detergents, BOD5, mercury and cobalt. Maximum concentrations of heavy metals in the upper reaches of the river. Ear-Joki has several peaks at the peaks in May and September, indicating that the accumulation in the catchment area. In the lower reaches peak concentrations of marked winter. In the ground they reach the mouth of the following values (mg / g dry matter): nickel - 3500, copper - 2500 (Doklad.., 2006). At the mouth of the river. PATS-Joki maximum content of nutrients is: N (NH 4) - 0.1 mg / l, N (NO-2) - 0.001 mg / l, N (NO-3) - up 0,21-0, 40 mg / liter, P (PO3-4) - 0.05 mg / l. The content of phenols in the mouth of the Pats-Joki reaches 0,021-0,040 mg / l of oil hydrocarbons - 0,31-0,60 mg / l, detergents - up to 0,050 mg / l BOD 5 - to 2 mg / l (Report ... 2006).

According to the Yearbook of the activities of the Kola Peninsula (№ 3 of 2005), for the considered 15-year period as a whole there is a significant reduction of discharges on copper - almost a factor of 2 and a minor for nickel - 1.6 tons, according to the yearbook, peaks in the graph describing

the increase in the discharge of sewage occurred by increasing the contact time of water with the ore at the mine.

The contribution to water pollution in the area under consideration are making communal sewage from the cities and towns. It is necessary to note the presence in the district 5 hydroelectric branch "Kola" JSC "TGC number 1" (formerly "Kolenergo"), combined in a cascade of hydropower Pazskie. Their influence is characterized as a change in the hydrological regime and the arrival of chemicals and sediment as a result of HPP.

The Central – Kola Impact region. Rivers and lakes in the area are polluted mainly industrial waste and sanitary waters, as well as from the inflow to the catchment areas of pollutants from the atmosphere. Significant negative environmental impact of waste dumps and quarries, and first of all they are concerned with the processes of contamination of the drainage system as a result of leaching of overburden. Discharge of wastewater produced from industrial sites Severonikel enterprise JSC "Kola MMC." For example, in 1999 in natural bodies of water was discharged 18.5 million m3 insufficiency treated wastewater, in 2003 - 16.3, in 2006 - 18.3. Combine "Severonikel" discharges waste and mine water in the sump of Technology - the southern part of the lake Nude-Yavr which further flow through the pipes fall into the stream and then Nyuday Monche lip Imandra lake. In this case, the bulk of discharges have on the lake. Nude-Yavr - about 85-90% of all waste (Report ..., 2006). Also significantly contaminated wastewater enterprises Monchegorsk and Olenegorska large areas of the largest in the Murmansk region Imandra Lake, where the waters of the river fall Nyuday industrial wastewater plant "Severonikel."

Based on annual data on the activities of the Kola Peninsula (№ 3 of 2005) revealed that during the past 15-year period as a whole there is a significant reduction of emissions of nickel in waste water - nearly 7 times and copper - almost a factor of 2. According to the yearbook, the reduction of discharges of such pollutants in waste water was due to the implementation of measures to reduce water consumption and water phase and the achievement of MPD.

In the structure of sewage combine of "Severonikel" accounted for the bulk of the biodegradable organic substances - 48.7 m, SO4 - 38,78 m, Cl - 6,8 t, Ni - 6,9 t, Cu - 2,1 t (Report ..., 2006).

In the waters of the river Nyuduay (pollution degree 3) the annual average copper content of up to 40 MACs, nickel - 44 MPC, sulfates - over 7 MPC, manganese - 2 MAC. High concentrations of metals (copper, nickel, manganese) are noted in the waters of the river and Herbal Kumuzhya, lakes Nyudyavr. Lake Monche is in the area of negative impact of smoke emissions combine "Severonikel", the annual average concentration of copper in its waters exceeds the MCL by 11 times, mercury - above the MPC. Lake Imandra in range near the town of Monchegorsk is characterized by elevated concentrations of nickel - annual average of more than 2 MAC, the maximum - more than 8 (Report ..., 2006).

Contribution to the pollution of water bodies in the district also makes ironworks of "Alcon", the total insufficiency of treated wastewater in 1999 amounted to 1.3 million m3 in 2003 - 1.22. The main impact of the lake water Kolozero experience, where the average annual concentration of

copper is 4 MAC, manganese - 3 MAC, as well as lakes Permus (pollution of its tributaries wastewater Olenegorskogo mechanical plant) copper - 3 MAC, Mn - 5 MPC (Report ... 2006).

The significant contamination of water bodies district have domestic waste water of insufficient cleaning of housing and communal services MUP "Monche gorskvodokanal" (7.8 million m3) and the Unitary enterprise "Olenegorskvodokanal" (4.53 million m3), but according to official data (Report ..., 2004), the latter treatment facilities provide almost complete clearing of drains to standard indicators.).

The consequence of water pollution in the district have become unsatisfactory results of water samples for microbiological indicators - 23% reduction and degradation of fishery resources (high incidence of freshwater fish - kidney, liver, bone, resize, reduced life expectancy, slowing the ripening process).

The Hibinskiy Impact region. The serious impact on the water pollution of the area of impact, as well as the entire basin of Lake. Imandra has manufacturing operations at JSC "Apatite". Rivers and lakes in the area are polluted mainly industrial waste and sanitary water. Significant negative environmental impact of waste dumps and quarries, and first of all they are concerned with the processes of contamination of the drainage system as a result of leaching of overburden. The total discharge of industrial waste and mine water company in 1999 amounted to 164.4 million m3 in 2003 - 135.6, in 2006 - 54.5. The structure is dominated by discharges of nitrogen compounds, organic and suspended solids, phosphates, petroleum products, etc. (Report ..., 2006). In the process of extraction and enrichment of apatite-nepheline ore natural water contaminated with fluoride - specific pollutants mine, mine and industrial wastewater main workshops of "Apatite" (Kalabin, 2000).

The bulk of pollution on the lake. Big Wood - mine water underground mines - 45.6 million m3, p. Pearl (discharge of industrial waste water from the tailings ANOF-2) - 27.8 and p. White (household and stormwater Kirovsk and Apatity, filtration and waste water from the tailings processing plant JSC "Apatite" and discharges of small businesses) - 16.3 million m3 (Sandimirov et al, 2003).

The largest volume of pollutants have on the river. White, who under the influence of "Apatite" and Kirovsk and Apatity has 2 pollution. For example, in 2003 the discharge of pollutants in the river. White was (t): BOD. - 23.0, oil - 1.0, suspended solids - 159.0, sulfates - 2945.0, chlorides - 60.0, nitrates - 12.4, nitrite - 2.8, F - 104.7 (Report ... , 2006).

In Lake Big Woodiyavr are the specific elevated concentrations of the pollutants. Annual average concentrations of fluoride and phosphate were higher than the MPC, copper - over 5 MAC. The maximum concentration of fluoride observed in February and May and exceeded MPC by 2 times, phosphates (above the MCL) and total phosphorus - was observed in October, nitrite (above the MCL) and organic matter (BOD5 above 2 MPC) in June (Report ... 2006). The highest concentration of molybdenum than 15 MPC, copper - 22 MPC highs concentrations of metals were observed in February - April.

The content of the specific pollutant (phosphates, fluorides, nitrite nitrogen and suspended organic matter) at p. White is higher than in the lake. B. Woodyavr (Kalabin, 2000; Sandimirov et al, 2003). The average for the year of nitrite nitrogen content was higher than the MPC 5 times, fluoride and phosphate - 2, molybdenum - 8 times, copper - in 4, Mn - 3 times higher than the MPC. The maximum concentration of fluoride was 3 MAC, phosphates - 2, manganese - 9, copper - 8 MAC. Was above the maximum allowable maximum concentration of organfic matter (COD and BOD 5), ammonia nitrogen, total iron, nickel, and detergents (Report ..., 2006). Intensely polluted bodies of water area of domestic waste waters of the insufficient cleaning enterprises of housing and communal services PIMU "Apatityvodokanal" - 18, 22 million m3 (Doklad.., 2004).

Arkhangelsk Impact region. The most important sectors of the economy are the thirsty objects pulp and paper industry, housing and communal services (HCS), engineering, and energy. The presence of pulp and paper mills (PPM) in the area of the impact of this largely determines the quality of surface waters. The largest portion of the total water consumption in the Arkhangelsk region accounts for logging, woodworking and pulp and paper industries - 409, 7 million m3 (State ..., 2004) and electricity - 137.0 of the total 609.2 million m3, of which the enterprise focused mainly on the territory of the Arkhangelsk region of impact.

In the surface water bodies in 2003 was dropped 297.2 million m3 of contaminated wastewater. A great contribution to the pollution of water bodies makes JSC "Arkhangelsk PPM" - 145.54 million m3 wood processing companies (JSC "SLDK", "LDK-1", "LDK-2", etc.) with the enterprises of mechanical engineering, energy and utilities - 81.8 million m3 of "Solombalsky PPM" - 69.4 million m3, MUP "Water canal" - 0.75 million m3 (discharge of storm water without treatment).

The structure is dominated by the discharge of pollutants particulate matter - 3170 m, biodegradable organic matter (BOD) - 1460 tons, mineralization (dry residue) - 1390 m, Robsch. - 72.8 m, N-NH4 - 184 m, N-NO3 - 12,8 m, surfactants - 1.6 m (condition ..., 2004). R. Northern Dvina River near Arkhangelsk characterized as contaminated (WPI - 2.56, the characteristic qualities - 4); flow Maimaksa (White Sea) in Arkhangelsk: WPI - 2.23, a class of water quality / characteristic qualities - 3 (moderately polluted); flow Kuznechiha (White Sea) in Arkhangelsk: WPI - 2.80, the class of water quality / quality characteristic - 4 (polluted). There is also an oil pollution p. Northern Dvina, coming in with JSC "Arkhangelsk PPM" - 0.02 tons / year. Noted leaching oil from the body of mooring OAO "NK Rosneft-Archangelsknefteproduct" Kuznechiha into the river. There is a constant pollution of the coastal waters and river sawmill waste.

It should be noted that in addition to the surface waters and groundwater are contaminated. Thus, the ash dump Arkhangelsk cogeneration plant forms a high ammonium content (up to 45 dm 3) and nickel (1.2 MAC) in groundwater. Groundwater pollution with oil products observed in OAO "NK" Rosneft-Archangelskoilproduct ", described as" minor "- 0.2-0.8 dm 3 (State of ..., 2004).

Thestudies carried out by a group of the scientists of the Arkhangelsk State Technical University (Pavlov et al, 1996) show that changes in the character of the forest vegetation caused Clearfelling

for the needs of the pulp and paper mill, impact on the imbalance of the main parameters of the water balance area and the hydrological regime of watercourses. In addition, causes great damage Moleva alloy rivers, causing pollution and in part, the channel processes of the river systems. Under the influence of the organic recessed changes the chemical composition of water.

The Kotlas impact region. The quality of the surface waters of the area of the impact, as well as the Archangel, affects the presence of the pulp and paper industry of "Kotlassky" located in Koryazhma. In surface water bodies in 2003, they were dropped 160.5 million m3 of contaminated wastewater. In the structure of the faults are present biodegradable organic matter (BOD) - 10,830 tons, oil - 10 tons, suspended solids - 11,010 tonnes Robsch. - 53.5 m, N-NH4 - 148 m, surfactants - 20.8 m (condition ..., 2004).

R.Northern Dvina River near the town of Korjazhma has 4 water quality class and is characterized as contaminated (2.78 WPI). There MPC excess content of iron compounds, copper, zinc, difficult-organic substances COD and lignosulfonates. Average annual concentrations of iron compounds is 7-8 MPC, copper, zinc, organic substances on the COD - 2-3 MAC, organic matter for BOD5, lignosulfonates and oil - 1-2 MAC. The maximum concentration of copper - 8 MAC, COD value - 4 MAC, iron compounds - 10 MPC, lignosulfonates - 8 MAC, zinc - 6 MAC, oil - 4 MAC, the value of BOD 5 - 3 MAC. Also fixed excess concentrations of ammonium nitrogen - 1.5 MAC, are found in the trace amounts of the organo-chlorine pesticides.

Along with the pulp and paper and wood industries the main sources of pollution in rivers and the Northern Dvina Vychegda are enterprises of housing and communal services, Privodinsky LPUMG (linear pumping section of the pipeline) from the point of view of the high probability of man-made environmental disasters. It should also be made to the station Savatier WCD in / h 67967, where as the main source of pollution of soil and groundwater contamination from the surface of the first unpromising aquifer are three fuel storage (Main, a railroad and Consumables). On the territory of all the stores for a long period of operation formed in dvizhnye lenses oil at a depth of 0.5-2.0 m, an average power of 0.4 m Lens petroleum Lying on the water table, make with them vertical and horizontal movement partially unloading at p. Black and creek. The total area of contamination is 3.6 hectares. The concentration of oil in the surface layer of the soil (0-0.5 m) of 15-20 g / kg. At a depth of more than 2 m oil content is reduced (State of ..., 2004).

The Vorkutinskiy Impact region. The main sources of pollution of the surface water area of impact are industrial enterprises - primarily coal (mine water and slurry water processing plants), thermal power, cement manufacturing, mechanical plant, housing and utilities. Only the total discharge of mine waste companies Vorkuta industrial area is about 25 million cubic meters. m / year, including 70% of insufficiently purified (Getsen et al, 2005).

The main contaminant in the slurry is mine waters, wherein the average content of 1000 mg / l (maximum 4000 mg / l) in water in large quantities are present oil (1.5-10.0 mg / L), iron (to 10 mg / l), phenols, copper, nitrogen compounds. Mine water and sludge, industrial and domestic effluents Vorkuta are biological treatment at 5 stations in addition to the number of mines build

additional treatment facilities with a total capacity of 96 thousand cubic meters. m night (Getsen et al, 2005). For the treatment of mine water used complex organic compounds, the enrichment by flotation of coal used polyacrylamides, waste oil cracking and other compounds. However, such a degree of purity insufficient. In addition, virtually no cleaning of drainage water processing plants, infiltration shlamosistem, zolootstoynikov, ponds, dumps and the rest of the industrial zone. Therefore, the surface water enters a large number of pollutants, including biogenic components in concentrations of tens to hundreds of times higher than the maximum permissible concentration (MPC excess incidence over the past 20 years, often reaching 50-92%), which significantly affected the state of the aquatic environment, and the first water district. Vorkuta (Vorkuta, ..., 2004).

During the period from 1980 to 2003 concentration of nutrients and other pollutants into the river Vorkuta reached the maximum values for ammonium nitrogen - 9.3 mg / l, nitrite nitrogen - 17 mg / l nitrate nitrogen - 5 mg / l of phosphate phosphorus - 28 mg / l, easily oxidized organic matter (BOD5) - 7.6 mg / l phenol - 0,047 mg / l, nefteuglerodam - 0.12 mg / l, copper - 0.04 mg / l, respectively 30,1700,16,1400,4,47,3,43 times MPC (Nickanorov et al, 2007). The annual average content of copper was 2.5 MAC, organic matter, total iron, phenols, petroleum products, ammonia and nitrite nitrogen does not exceed the maximum permissible concentration, maximum concentrations were: copper compounds 8 MAC, other indicators - 1-3 MAC. Organo-chlorine pesticides in river water determined in small quantities - 0,001-0,007 mcg / l. However, as a result of a number of environmental measures taken by the city administration, together with the industrial enterprises in recent years (1994-2004) slightly decreased the level of pollution in the river. Vorkuta, which allowed her to transfer from the category of "very messy and dirty" to "very dirty" (Getsen et al, 2005).

This level of contamination significantly affected the quality of water resources, the state of aquatic ecosystems and, above all, to reduce species diversity in aquatic algal flora (oxyphilic ksenosaprobnyh degradation of algae species), reducing their fishery productivity, changes in the chemical composition of the water salinity, alkalized water, etc. At a number of sites on p. Vorkuta, there was a strong eutrophication of water intoxication and even the masses, especially at places direct discharge of mine water treatment plants (Getsen et al, 2005).

Monitoring the quality of drinking water in the Republic of Komi has found that in Vorkuta were exceeded MPC by 3 times or more iron, manganese and bromine. Marked the most adverse water-quality drinking water and found the maximum permissible concentration of ammonia, nitrate, oxidation, strontium, cadmium, lead and petroleum products (Glushkov et al, 2002).

Thus, assessment of the state of pollution of water bodies in these areas of the impact shows that high levels of surface water pollution are local in nature and are defined in the small ponds. But it is necessary to take into account the extreme vulnerability of the weak and the ability to self-cleaning water in arctic conditions. In ponds and streams, have been under constant contamination (b. Nyuduay, Ear-Joki, Northern Dvina, Vychegda, Vorkuta) goes direct discharge of waste iron and steel, pulp and paper facilities and the coal industry. Against the background of falling

metals from atmospheric precipitation and leaching of acid rain, it increases the environmental risk and degrades water quality

The chane of soil and vegetation

Soil pollution source specific elements of the association are due to a multi-component composition of the emissions to the atmosphere (Revitch et al, 2001). The study area is a kind of ecotone zone of high rank, located at the contact of the tundra and northern taiga of natural areas. Geographical features of these areas are caused extremely slow (20-50 years) decomposition of organic material, slow biological cycle of substances, the lack of many mineral elements, the sharp shortage of oxygen. This is reflected in slowing the process of chemical weathering and soil formation (Evseev, Krasovskaja, 1996). Tundra ecosystems are to areas of environmental risk, since technological impact on them contributes to a violation of structural and functional organization and development are difficult to reversible changes, as well as due to the low capacity for self-repair (Vorkuta, ..., 2004; Evseev, 2004; Getsen , 2005). Self-purification processes of soils in this region appear much weaker, and perhaps accumulation of large amounts of toxic compounds.

The content of contaminants in soils is an integrated assessment of human exposure to this particular point. Our studies showed a significant effect of emissions from industrial pollution on the state of the surface layer of soil. The concentrations of some pollutants in soils impacted areas considered significantly above background levels.

The Western-Kola impact region.

Non-ferrous metals, as already mentioned, are the main source of the negative impact on the natural environment of the area of impact. However, compared with the mining companies, are less pronounced mechanical disorders of natural components - soil, vegetation and soils. All substances in the atmosphere eventually fall with precipitation or dry deposition to soil and vegetation.

The total area of contamination associated with industrial activity "Pechenganickel", is 11,200 km2, while the share of the most high, dangerous levels of pollution amounts to 10.3% (1150 km2). This zone is characterized by very high levels of annual anthropogenic load on the main elements of the polluters (850, 94.3 and 87.3 kg/km2 for S, Ni and Cu, respectively), prolonged exposure to which has caused the almost complete (in the immediate vicinity of the plant) or partial, but very strong violation of surface ecosystems, including various types of vegetation, including woody shrub layer and surface vegetation (mosses, lichens). The average content in the horizon moving stock (available to plants) forms of Ni is 140 mg / kg (35 MPC), Cu - 230 mg / kg (76 MPC), and the total content of As 10,5 mg / kg (5 MPC). There is also an increased content of Hg (0,8 mg / kg), which is 4 times higher than the background concentration of the element. In 1988, the area of such a strong impact on the vegetation on the results of the study of satellite images spectrozonal was 760 km2. Zone of moderate impact, fixed on space since 1979 as a distinct change in the vegetation cover of lichens and dwarf shrubs tier in 1988 amounted to 3882 km2, which is rather well to the estimates obtained by mapping (3550 km2). Levels of annual deposi-

tion of main heavy metals Ni and Cu for this area are 50.3 and 39.5 kg/km2. For the area of a weak level of contamination of any visible violations of vegetation is not observed, and the levels of annual deposition of heavy metals far below their natural accumulations (reserves) in the humus horizon AO background areas.

Almost all of the annual emissions of the plant "Pechenga" for heavy metals falls within the zone of contamination, with most of it falls on the danger zone and moderate levels of contamination. The behavior of sulfur in this respect, quite the opposite: only a very small proportion of it (the first interest) falls within the defined zones of contamination, all the rest of it carries over much greater distances from the source of emission. Sulfur - the predominant component aerotechnogenic emissions in the area, is not able to accumulate in large quantities in the upper organic horizons of soils. The researchers found only a few cases of high sulfur content (Evseev, Krasovskaja, 1996; Kalabin, 2000). The main problem that arises due to emissions of sulfur, soil acidification is a result of dry deposition and acid rain. In terms of industrial air pollution revealed significant differences in the acidity of the soil organic horizons between the five-biogeocenosis Memo: horizons of spruce forest soils have a higher acidity than pine.

Heavy metals, which are also typical components aero-technogenic emissions of mining enterprises for processing of copper-nickel ores, actively accumulate in the soil. Thus, they are elements toxicants 1st (As, Cd) and 2nd (Ni, Cu, Co) hazard classes. The concentrations of base metals, contaminants (Cu, Ni, Co) in close proximity to sources of emissions exceed background levels of 3 or more times. Contamination can reach C-horizon only to a very small area in the immediate vicinity of the plant "Pechenga" (Evseev, Krasovskaja, 1996).

We conducted sampling of soil and vegetation to evaluate the levels of accumulation of these elements in the components of geosystems. It should be noted that sampling of mosses provides insight into the actual environmental contamination areas (air pollution) in the past three years, and testing of soil horizon stock captures the effect of many years of pollution and also reflects the chemical composition of the soil-forming loose sediments (geological features).

The results show that the contamination of soil and moss heavy metals and sulfur manifested most widely and covers about 70% of the studied territory of the Murmansk region, forming an arcuate zone of almost continuous pollution from a nickel to Kandalaksha. The most intense man-made anomalies of heavy metals and sulfur are confined to the towns of Nikel and Polar (the centers of production of non-ferrous metals). Area of soil contamination with hazardous and extremely dangerous levels of toxic heavy metals concentration is about 1400 km2 around Nickel and Polar.

Acute exposure is experiencing forest vegetation. Softwood plantations are significantly degraded: progressive defoliation, dieback increases, increased litter of trees, from the old pines and spruces were only charred stumps and trunks (Fig. 7). Half-space-age ecosystem spruce and pine forests have already accumulated a large dose of pollution. On the remaining territory of the pollution can be considered negligible - there is a weak restructuring of the forest ecosystems are degrading

and disappearing highly sensitive species of lower organisms - algae, mosses, lichens (Evseev, Krasovskaja, 1996; Tsvetkov, 2003). However, in recent years, due to lower emissions of toxic substances into the atmosphere by man-made press forests continues unabated.

Pic. 7. The degradation of vegetation in the affected area plant "Pechenga"

The Central-Kola impact region. The most urgent environmental situation and significant impacts on soil and vegetation observed in the area adjacent to the plant "Severonikel." As a result of intense emissions of man-made aerosols, mainly SO2 and some heavy metals, there was shrinkage of forests, particularly in the Lapland Nature Reserve, an area of over 10 hectares (Tsvetkov, 2003). In the area of man-made wasteland there is a complete change in vegetation, and in the remaining degraded peat accumulation of heavy metals exceed background levels more than 200 times (Evseev, Krasovskaja, 1996).

Contamination of this most dangerous gray zone being approximately 2-fold lower compared to a dangerous zone area Nickel Polar, despite the fact that the production capacity of the plant "Severonikel" several times the volume of production of the latter. This fact indicates that the utilization of sulfur emissions at the plant "Severonikel" in recent years carried out quite successfully.

A number of studies (Evseev, Krasovskaja, 1996; Kalabin, 2000; Tsvetkov, 2003) highlighted several areas is not formed under the influence of industrial emissions combine "Severoni nickel." Area of human heath, which is a 2 m south of the industrial area of the plant on the contrary, the Nude, where the highest environmental changes. Characterized by the absence of vertical zoning, the slopes are rocky wasteland with signs of erosion (Fig. 8). The vegetation is absent of northern species, from the old pines and spruces were only charred stumps and trunks. Found on the leaves are brown dots - traces of the action of sulfuric acid. Closed The ground cover is missing. Shrubs typical of the most resistant to pollution crowberry, sometimes cranberries. The species composition of moss strongly depleted. Traces of soil erosion, reddish soil horizon in coming to the surface, there is an intensive accumulation of metals. Levels of long-term man-made loads in this area for the humus horizon AO reach 4100 kg/km2 for Ni and Cu for kg/km2 7050, suggesting that heavy metals, especially copper, intensively accumulated in the organogenic soil layer. The maximum levels of annual deposition of Ni and Cu are 115.9 and 136.5 respectively kg/km2. Average content in the horizon of rolling stock Ni is 186 mg / kg (46 MPC), and Cu - 368 mg / kg

(122 MAC), which once again underlines the powerful impact on the nature of the Monchegorsk plant than the plant in Nikel. In addition to the main components of emissions of Ni - Cu in the horizon AO noted the increased accumulation of As (5 MPC), Mo and Cd. Area of soil contamination with hazardous and extremely dangerous level of concentration of toxic heavy metals around Monchegorsk is 1600 km2 (Evseev, Krasovskaja, 1996).

Area progressive changes in the environment, located 10 km south of promplo-site survey. In the structure of vegetation appear softwood (pine), ground vegetation cover closed, it dominated by dwarf shrubs, mosses, grasses, rare bushy lichens. However, stunted trees, visible necrosis of needles and brown dots on the leaves (Fig. 9), dieback, a high percentage of dead wood, traces of burnt areas. In the depressions found dead sphagnum peat, passive sorbent pollutants contained in the atmosphere. According to our analysis, the concentrations of nickel and copper are higher than background two orders. Soil erosion in their homes much less pronounced.

The zone of the initial changes Geosystems (Pic. 10) is observed visually at a the distance of 40 km from the Monchegorsk, in the Central Lapland Reserve manor, with geochemical characteristics are found at much greater distances - up to 70-80 km to the south of the plant. Adverse effect is manifested in the dieback of trees, most plants accumulate higher amounts of heavy metals exceeding the above background levels may be five (Dushkova, Evseev, 2011).

The background area where there is no man-made environmental changes, are located at a considerable distance from Monchegorsk in the direction of the prevailing winds. Our studies show that with the present reduction in emissions observed revegetation and shifting boundaries of the selected zones. However, the area is characterized by human heath minor changes, because here the natural flows of matter and energy is so changed that the return to the original state Geosystems is very difficult.

Hibinskiy Impact region. The area is characterized by the high mechanical soil disturbance and soil pits, waste rock dumps, etc. In contrast to the mining and metallurgical industry, environmental pollution occurs as a consequence of dust instead of aerosol particles. The particles enter the environment with enrichment facilities apatit nefelins factories of "Apatite" (ANOF) and tailings in the form of dust emissions containing aluminum, strontium, and other toxic elements that are in a lot of land on the surface of the soil and vegetation (Evseev, Krasovskaja, 1997) . Dust particles clog the stomata of the plants, causing them to dry out and the death of a large area nearby (Evseev, Krasovskaja, 1996).

Settling on the surface of the soil, dust particles form the horizon, which prevents the normal development of plants. According to the some studies (Krasovskaja, Evseev, 1997; Kalabin, 2000; Tsvetkov, 2003; Pereversev et al, 2006), the contents of the dust particles in the litter up to 50% t of its weight.

The highest loading caused by the elements such as Al and Sr, the total loss at the area which reaches 2797.5 annually and 220 m, respectively. The long-term accumulation in the humus layer of the soil throughout the area up to 70250 tons of aluminum, and for strontium - 5,378.5 tonnes This perennial accumulation in the upper soil layer of mobile aluminum reached 3,433.3 tonnes, and throughout the area, the figure is 5742.1 tons of other highly toxic elements a significant contribution to the pollution of soil makes the area As (4 MAC), B (above background from 3 to 8 times) and V (above background from 5 to 10 times).

The highest level of the accumulation of the pollutants, soil surfaces characteristic of strontium - up to 300 mg / kg. The study of the spread of pollutants in aerotechnogenic of Kirov using the brioindikatsii showed that more than 2 times in their pre-vysheno strontium content of 1.5-2 times - copper, nickel and iron. The results of testing of mosses, reflecting the degree of pollution of the atmosphere with dust as industrial origin (apatitnefelinovye factories, quarries, tailings, highways) and natural (dusting of disturbed soil erosion), identified a wide range of air movement of these elements in the central part of the Murmansk region with the center in the area Kirovsk and Apatity.

To prevent the negative impact of dusty surfaces of the natural landscape and towns held their fastening surface, in particular biological remediation (phytomelioration) by creating dumps on the surface vegetation cover of a composition. In most cases, biological reclamation of industrial waste dumps performed by seeding perennial grasses (Fig. 24) and the development of sufficiently stable meadow community, able to resist wind erosion (Pereversev et al, 2006).

Our studies of tailings two industrial waste dumps in the Murmansk region have established the following. At the caretaker of the tailings "Apatite", which exists in almost 50 years, has formed a Synanthropic flora, which is different from the natural species composition, structure and range of life forms. In addition commensal communities involved 80% of the species of the natural flora. There is a gradual obliteration of sites and restoring them to the original types of plant communities

Arkhangesk impact region. The state of the soil and vegetation in this region, compared with the three above-considered impacted areas is relatively satisfactory. Common areas of contamination were formed around the cities of Arkhangelsk (1500 km2), Novodvinsk (250 km2), Severodvinsk (800 km2). The soils of the Arkhangelsk region have chemical load, modified and converted in connection with industrial and civil construction. According to our research, the total content of heavy metals - copper, zinc and lead - in urban soils of Arkhangelsk (near river port, power plants, industrial hub Kuzechevsky) on most plots do not exceed the MPC. Revealed their accumulation in the upper horizon.

In the studies SevNIILH, Institute of Ecological Problems of the North, Ural Branch of RAS, Astrakhan State Technical University and other research institutions, results on the negative consequences for the forest of chronic air pollution. According to our studies, changes in the level of defoliation and dehromatsii (obeskhvoennosti) crowns of the trees in plantations are already visible to the naked eye. Some studies (Problems ..., 2002; Tsvetkov, 2003; condition ..., 2004) point to a growing impact on the forests of the Arkhangelsk region of the deposition of the pollutants from the air flow coming from the west. The biggest impact in relation to terrestrial ecosystems raids pollution by oxides of nitrogen, resulting in more frequent and expanded the scope of disease outbreaks spruce needles.

Coming as a result of many decades of harmful substances, cases of accidental releases have a depressing impact primarily on forests, located in the border with the cities of Arkhangelsk, Severodvinsk and Novodvinsk areas within a radius of 5 km (Problems ..., 2002). The negative impact is manifested in the form of necrosis of pine needles, reducing the period of her life and the destruction of buffer mechanisms for the protection of forest biocenosis.

Intensive forest management has a negative effect on the soil and vegetation. Occurring after the concentrated erosion of Forestry cause removal of silt in the river floodplains, which annually overlap alluvial deposits. Over large areas of such rivers as the Northern Dvina and Vychegda formed layered soil unproductive, and the most valuable floodplain land, once served as the breadbasket of the Arkhangelsk region, lose fertility (Problems ..., 2002). On the low-lying areas of the watershed areas in the northern and middle taiga after logging concentrated and their consequences - intense fires - there is waterlogging, which is widespread in the Arkhangelsk region.

The negative changes are also associated with cluttering soil waste and construction debris. At pulp and paper mills annually produce millions of tons of wood wastes. Mechanical disorders are the result of development and operation of industrial, transportation, residential areas. The concentrations of heavy metals in the soils of lawns, parks and residential areas are rather low and can be (mg / kg): Hg - 0,07-0,09, Cd - 0,5-1,0, Pb - 30-130. In some areas there are high concentrations of lead - more than 200 mg / kg. Analysis showed that the concentration of the individual metal vegetation and soils (lead, zinc, nickel, copper, etc.) exceeds the baseline value by no more than 3-5 times. All this indicates a relatively low level of chemical contamination of urban ecosystems with heavy metals (Ecology of the northern territories ..., 2002).

Arkhangelsk, Severodvinsk Novodvinsk and remain the centers of formation and accumulation of industrial and household waste, the volume of which are respectively 409.1, 402.2 and 269.3 thousand tons (Problems ..., 2002). The problem of waste management in the region is extremely urgent. The pulp and paper industry is particularly acute problem of safe storage and disposal of mercury-containing wastes of particular risk of contamination of soils of the area of hazardous substances.

Kotlass impact region. As in the Arkhangelsk impact region, the main negative changes are associated with chronic air pollution as a result of PPM and CHP cluttering soil and vegetation waste and construction debris. Common areas of contamination were formed around the city Korjazhma (550 km2). There was a slight contamination of soils with heavy metals territory adjacent to Kotlasskiy industrial site. The total content of zinc in 1 kg of dry soil in Kotlas is 110 mg at an acceptable level of 300 mg. By the volume of waste generated in the Arkhangelsk region in the first place is Kotlas - 779 thousand tons, accounting for 31.2% of the total (Problems ..., 2002). The problem of waste disposal (especially waste of hospitals and clinics in the city) is also significant. According to the Sanitary Inspection, in the district of Kotlassky utilized only 30% of solid waste, the rest goes to landfill. In Kotlas of 2 and they are located close by. The introduction of a new landfill in operation was a real problem (State of ..., 2004). Now dump operated despite the fact that there is no drainage system, no access roads to the wells and fire ponds.

Vorkutinskiy impact region. Analysis of data on the content of heavy metals in the Vorkuta revealed that in the waste dumps are present in significant concentrations of copper, zinc, lead, and mercury. In the conduct of underground mining for every thousand tons of coal produced at the surface rises from 200 to 800 tons of rock, up to 9000 m3 of mine water that contain these elements (Vorkuta, ..., 2004; Getsen, 2005). The content of metals in soils near Vorkuta CHPP and Vorkuta cement plant in excess of the standard values, identified by copper and zinc. Industrial sites near coal mines of Vorkuta also experiencing higher than in the soil and ground and surface waters of cadmium and cobalt. Mining of coal mining method leads to the formation of technogenic provinces by the removal to the surface of rocks and they contain chemical compounds. The natural land cover in the city is practically nonexistent and often a specific layer of soil. Man-made emissions of dust cover a large area of the city and cause elevated concentrations of heavy metals in urban soils. Large areas of the territory occupied by dumps.

At the heart of the restructuring of vegetation Vorkuta area are changes in soil under the influence of emissions of pollutants. In the dust emission area formed technogenic horizon (h = 15-30 cm) the reaction varies soil solution (pH 6,7-8,9), dramatically increases the content of exchangeable calcium (10-20 times) and nitrogen (2-4 times) accumulate heavy metals, such as MPC observed excess copper content in 1,7-1,9 times, zinc - 2,5-5,0 times. There has been increased, compared with the background, the content of Cd 15-20 times, Co - 2,5-3,8 times (Getsen et al, 2005). However, these values are much lower than in the zone of copper-nickel smelter "Severonikel" Monchegorsk on the Kola Peninsula, for example, the concentration of Cu in soils hereinbefore 300 and Ni is 100 times than the background areas (Evseev et . al., 2000).

The main pollutants of soil region are the following metals (mg / kg): Sr - 150, Hg - to 0,22, Cu - 85, Pb - 70, Zn - 400 (Glushkov Maimulov, 2002). The use of slag - waste heat power - as a result of bulk soil in some areas of the city to increase the background radiation due to the concentration of the radionuclides in the combustion of coal. The level of concentration of heavy metals in plants is slightly higher than the background values. This is due to the fact that the vegetation in the city is brought by artificial planting of trees and shrubs, which is updated quite regularly. In the detected local mosses and lichens concentration above heavy metals and strontium does not exceed background values more than 10 times.

We conducted field studies of the reaction of the ground vegetation aerotehno-gene contamination in different areas and around Vorkuta identified several areas with different degrees of pollution. Based on field descriptions of the vegetation we surveyed were classified sites located in the south-west and north-easterly direction from the industrial complex at a distance of about 70 km. In conditionally background zone of vegetation changes are not observed. In the areas of pollution observed loss of communities of some sensitive species of lichen, the lowest diversity is observed at the maximum pollution. On the contrary, the amount of certain groups of moss-like, as well as an abundance of grains increased with the degree of violation.

As a result of the studies have identified two different impact zone. Their formation is due to the influence of the two major sources of pollution - the cement plant (Fig. 27) and the power plant VTETS-2 (Fig. 28). They are located 15 km north of the city of Vorkuta, next to each other. There are no lichens (except P. rufescens and L. saturnium), willow dominated to a greater extent than the other non-contaminated areas. In some areas of this zone have been marked damaged or dead parts of shrubs and dead moss areas with greater frequency than in the background areas. However, and the total thickness of moss here already. Vegetation is also to a large extent covered by dust emissions. Areas with a clear effect of pollution in the Vorkuta region, including all vegetation and soil are approximately 150-200 km2. The same type of change in width of 200-1000 m is observed along the railroads, mines, near the village. Halmer-U there is another highly polluted area with a diameter of 50-100 km 2.

Changes in vegetation in the area of low pollution / violations have similar features, but less visible than in the first zone. In addition, there are grasses and herbaceous plants are more typical of the tundra krupnokustarnikovyh. The length of this zone around Vorkuta is about 600-900 km2.

Mechanical defections of the geo systems

Waste rock and tailings, mine and quarry water, waste water, waste-enriched vegetation and steel plants are sources of mechanical disturbances and man-made elements of migration, in higher concentrations toxic to living organisms. As a result of mechanical stress produced man-made landforms: cleavage and destruction of mountain ranges, the failures of the earth's surface, pits, waste rock dumps, ash dumps, tailings and shlakohranilischa, etc. This not only violated the aesthetic appeal of landscapes, but also has a negative effect, yanie on the environment (Kalabin, 2000). The use of blasting and excavation of huge masses of rock and ore significantly disturb the natural terrain, destroying the tops of the mountains and change the orography lead to ava-

lanches and the emergence of extreme situations in the areas of compact residence of the population.

It is important to note that the ash dumps, tailings and shlakohranilischa are the source of secondary pollution settlements and surface water, as by wind and water erosion, removal of fine dust is toxic components outside the development zone. According to some estimates (Kalabin, 2000; Evseev, 2004; ... Vorkuta, 2004), is only about 5-10% of the waste mining, the main mass of the same is sent to dumps and tailings, covering an area of thousands of hectares. Of the total volume formed in the studied areas of impact particularly toxic waste around 60% is waste of 1-2 classes of danger. Of these, the largest proportion in the waste mining and chemical industries.

It should be taken into account that in these regions there is no strict system of accounting, control and management of wastes. Reliability of the data for the statistical compilations conditional, because it does not take into account large amounts of waste that are placed in the environment spontaneously.

The Western Kola mpact region. As a result of mining (open and underground mining) "Pechenganickel" is formed pits, totaling more than 400 million m3 of mining voids volume of more than 4.7 million m3, large areas are covered with piles of waste rock and tailings. The mines of "MMC Pechenganikel" are dumping waste dumps in the rocky tundra.

The Central-Kola impact region. Located in the district of tailing "Alcon" is the second volume and the area of the source of secondary pollution of the Murmansk region (an area of 940 hectares, the mass of tailings 250 million tons). In the area of Monchegorsk dump volumes are small (an area of about 2 hectares and weight of 5 million tons).

The Hibinskiy impact region. As a result of mining voids formed by the mountain, totaling about 600 million m3. Mechanical effects on the landscape leads to the appearance of man-made landforms - as it is the destruction of the mountains, the earth's surface dips, careers. The use of blasting and excavation of huge masses of rock material breach of the natural terrain, destroying mountain peaks and changes the orography. To produce 1 ton of apatite concentrate produced 3 tonnes of ore. Apatitnefelinovyh ore enrichment occurs at processing sites at the same time for 1 ton of concentrate produces up to 400 tons of waste dumps (Kalabin, 2000).

Tails, which are a by-product of the production of pulp in the form of a special pipeline several kilometers long and with a diameter of 1.5 meters arrive in the pond is a former Bay (White Bay) Lake. Imandra. On the territory of impact area is the largest in the Kola Peninsula tailing apatitnefelinovoy factory number 2 (ANOF-2) "Apatite". If we consider the entire 75-year period of development and operation hibinskih fields, the factories of the tailings "Apatite" has accumulated more than 750 million tonnes of flotation tailings, containing 45 million tonnes of apatite, 450 million tons of nepheline, 40-45 million t of titanium minerals - sphene, titanomagnetite, and aegirine (Dushkova, Evseev, 2011).

Arkhangelsk and Kotlas impact region. In comparison with the above three areas in the mechanical disorders of the impacted areas are negligible. Negative changes associated with cluttering soil waste and construction debris. At pulp and paper mills annually produce millions of tons of wood wastes. However, their overall size and extent of the impact on local ecosystems is ten times lower.

Vorkutinskiy impact region

The method of coal mining os the result in a huge number of dumps, under which employs more than 50.3 hectares and the formation of technogenic provinces by the removal to the surface of rocks and they contain chemical compounds. The natural land cover in the city is practically nonexistent and often a specific layer urbanozem. Man-made emissions of dust cover a large area of the city and cause elevated concentrations of heavy metals in urban soils. Large areas of the territory occupied by dumps. According to the National Report on the State of the Environment of the Republic of Komi (2004), a coal mining enterprises in Vorkuta in 2003 decreased by almost 28% compared with the previous year, and amounted to 7,324 million tons The volume of waste at enrichment amounted to 2.7 million tons of impact to the Vorkuta region is also characterized by the formation of heaps, permafrost degradation due to mining and flow of heat from the burning waste heaps. In the heaps are home to 80 million tons of rock on an area of over 410 hectares. Contamination of gray within 1 km from the waste dumps is 19-30 MPC, within 1.5 km - 5-18 MAC (Getsen, 2005).

It is worth mentioning a number of other adverse processes due to economic activities in the impacted area. It is, first of all, permafrost degradation over large areas caused directly by mining operations, as well as the flow of heat coming from the burning or burning waste heaps. Characterized by the formation of numerous failures of subsidence and the earth's surface, often arising in connection with the seizure of the mines huge volumes of rock (1.1 billion tons), associated gas, groundwater, as well as the development of thermokarst (Vorkuta, ..., 2004).

Thus, all ore career of areas under consideration, as a rule, have an impressive size (length 1.4 km, width 0.8-1.5 km) and the recovery of these workings is economically not profitable. You can use these spaces to accommodate any storage, ancillary facilities etc. In the case close to the development of promising fields should consider the appropriateness of the placement of overburden new production immediately to the waste career. Such a promising option for a group of the East quarry pits of "Apatite" is possible for quarries of "Alcon" (Kalabin, 2000).

External piles of large quarries significantly alter the landscape and in the period of dumping pollute the atmosphere with dust. All of these sites and does not require the use of tailings zone bioremediation and can be used to expand the acreage farms and for construction purposes.

The Analysis of the patterns of the environmental situation in the studied industrial centers. In the course of the studies found that the largest contribution to the pollution of the atmosphere (in terms of gross emissions of pollutants) are making coal companies and power system (IMPACT Vorkuta region). However, the greatest negative impact on natural geosystems have

highly toxic emissions of non-ferrous metals (West and Central Kola-Kola areas). Company mining complex, located in the Khibiny and Vorkuta areas have the greatest mechanical effect on the landscape, which leads to the appearance of man-made landforms. By the volume of wastewater discharge in the lead impact rock areas, where the largest pulp and paper mill - Archangel and Kotlasskiy.

The maximum contribution to soil contamination and damage to vegetation making factories Kola - "Severonikel" and "Pechenga". It is established that the main battery of man-made pollution is the soil cover where airborne industrial pollutants accumulate mainly in the upper horizons of the Ao and A1, which at the same time serve a barrier to the penetration of polluting elements in the lower soil horizons and groundwater. For all considered impacted areas characterized by the highest value of accumulation of pollutants in these horizons. Only for areas adjacent to the industrial area plant "Severonikel" where most disturbed land cover and the most intense process of falling on the landscape of priority pollutant elements (Ni, Cu, Co), characterized by a high level of pollution in the mineral soil horizon that reaches here the level of hazardous and extremely dangerous degree of contamination.

The highest value of acquiring the above problems due to the natural features of the considered areas, caused by confinement to the northern latitudes, and in this connection, slowing down the process of self-healing.

The analysis of the environmental situation in this region showed that it had a strained ecological situation, the average in some areas to catastrophic. The priority airborne industrial pollutants are sulfur dioxide, nitrogen, heavy metals, methyl mercaptan, radionuclides. Among the heavy metals should include a significant accumulation in the individual components of geosystems of copper, nickel, cobalt, which is associated with the emission and discharge of these metals from non-ferrous metallurgy, the arrange-ment in the region. In some areas of elevated concentrations of mercury, lead, arsenic and strontium due to the activities of mining and thermal power (Dushkova, Evseev, 2011).

Since environmental health threat emerged in the West Kola district of impact, due to the negative impact on the environment of copper and nickel production, combined with the adverse conditions of self-purification landscapes with relatively high population density.

The Central Kola impact area is also characterized by the ecological crisis situation, and in the event of an accident at the Kola nuclear power plant - catastrophic. Impacted area of the enterprises of mining and non-ferrous metals are characterized by high intensity of the environmental situation, which is the result of elevated levels of pollution loads on terrestrial and aquatic ecosystems with significant population density.

Vorkuta IMPACT district and the city Vorkuta characterized by a critical environmental situation. The main types of human impact are the mechanical disorders of geosystems and chemical pollution, which is associated with coal mining, developed urban infrastructure, energy and construction industry. Actually chemical pollution is caused mainly by the spread of a large number of toxic compounds in the form of dust from the CHP, a cement plant, processing plants, dumps,

etc. The results of chemical analyze of soil and vegetation have shown that the concentration of man-made pollutants is great. Closure of a number of mines is not significantly affected by the concentration levels of toxic compounds in the ecosystems of the city. A significant contribution to air pollution is due to methane emissions coming from the mines through the ventilation system of mines, since the utilization of this compound is almost done. In general, the ecological situation in the city is relatively stable, and more of its negative aspects are manifested in the mechanical disorders of geosystems, because the vast areas occupied by tailings - waste coal (Vorkuta, ..., 2004).

The critical environmental situation is also noted in the Archangelsk and Kotlassky impacted areas characterized by the high levels of air pollution with toxic compounds, among which are the dust, sulfur dioxide, oxides of nitrogen. The main sources of local aerotechnogenic pollutants are: pulp and paper mill, thermal power facilities, and transportation. Therefore, among the specific pollutants of air basin should be highlighted: methyl mercaptan, benzo (a) pyrene, methanol, hydrogen sulfide, carbon disulfide, etc. The maximum single concentration, for example, methyl mercaptan can reach in some cases 105 MAC, hydrogen sulfide - to 5PDK, benzo (a) pyrene - 2 MAC.

Almost all the sources of drinking water of the study area, both surface and underground, exposed human impacts with varying degrees of intensity. Water bodies are ultimately a collector of all kinds of pollution, coming both from the flue emissions smelter metallurgical plants and power plants, and as a part of industrial effluents (with areas of mining, mine water pumped onto land, process waters after enrichment and melting ores, construction companies and power plants - nuclear power plants, thermal power plants), as well as municipal waste (cities and towns

Conclusion. The studies have shown that the developed to date geo-ecological situation in the region is the result of an industrial model of development, when it was completely ignored by the fact of low ecological capacity of the natural environment of the North and its important role in maintaining the ecological balance of the planet. And it was the North is a zone of formation of the global atmospheric processes and biogeochemical cycling, so the degradation of the natural ecosystems of the North may have adverse consequences on a global scale.

It is shown that for the considered areas revealed the following features.

1. Dangerous level of the atmospheric pollution (emission factor of the load per 1 inhabitant per year up to 3.0 m), which has become one of the main causes of the crisis or critical environmental situation. In the course of the studies found that the largest contribution to the pollution of the atmosphere (in terms of gross pollutant emissions) comes from coal mining and thermal power enterprises, located in the Vorkuta area of impact. However, the greatest negative impact on natural geosystems has highly toxic emissions of non-ferrous metals (West and Central Kola-Kola areas).
2. *Significant contamination of water bodies, which are a kind of collectors of all pollutants entering the flue emissions as smelter metallurgical industries and power plants, and as a part of industrial and municipal wastewater. It was revealed that the volume of polluted wastewater lead*

impact rock areas, where the largest pulp and paper mill - Archangel and Kotlasskiy.

3. The maximum contribution to soil contamination and damage to vegetation make steel mills of the West and Central Kola impacted areas. In this case, the soils in these areas are characterized by high accumulation of pollutants aerotechnogenic not only in the upper organic horizons, but also in the mineral soil horizon B; vegetation is experiencing a strong impact (degradation of forest cover, the progression of defoliation, dieback, etc.).
4. The greatest mechanical effect on geosystems, leading to the appearance of man-made landforms, providing enterprise mining complex, located in the Khibiny and conjugated Vorkuta areas. Particular importance attaches to the above problems in connection with the natural features of the considered areas caused confinement to the northern latitudes, and in this regard, slowing down the process of self-healing.
5. Our studies confirm the need to continue to monitor the state of geosystems areas of research. The results complement the information on the sources of income of pollutants, their spatial distribution patterns and can serve as a basis for strategic development of natural resources in the region and the Environmental rehabilitation of geosystems.

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