

Impact of energetic on environmental pollution in Yakutia

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A special part amongst a number of anthropogenic factors, forming an intensive pressure on natural environment, followed with worsening of environmental conditions is assigned to the energetics. As far as hydrological situation, to a certain extent, performs a “mirror” of total environmental situation, the work attends mainly to emission of pollutants into the atmosphere, as well as to wastes discharge into water bodies in the territory of the Republic of Sakha (Yakutia)

Key words: pollutants, pollutant emission, atmosphere, contamination rate of atmosphere, waste water.

Basic characteristics providing assessment of natural environment conditions are atmospheric emission of pollutants, harmful dash dumping into water bodies, and wastes of production and consumption, produced by human activity.

It should be noted, that the republic territory is located in an unfavorable climatic zone with mean regeneration abilities of the natural environment components: atmosphere, water bodies and soils.

Low atmosphere scattering, frequent recurrence of surface and raised inversions, stagnant phenomena and fogs are characteristic for atmosphere, promoting formation of high-level atmospheric pollution, provided even with a small pollutant emission.

An atmospheric emission increase by 32,5% had been observed during 2000 – 2008 (Fig. 1).

At present, the bulk of anthropogenic emissions into atmospheric air in the Republic of Sakha (Yakutia) come up from power, coal and gas industries. During the year 2008, amount of pollutants ejected by stationary sources was 182 900 tons, 53 600 tons from this was provided by mining operations, 38 300 tons by fuel and energy production. Maximum amount of emission is a result of production and distribution of electric power, gas and water –

108 100 tons, which provides almost 59% of all industrial emission during the period (Fig. 2).

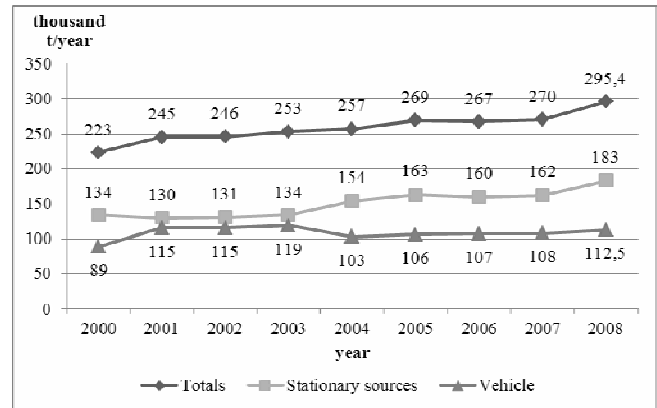


Fig. 1. Dynamics of atmospheric emission

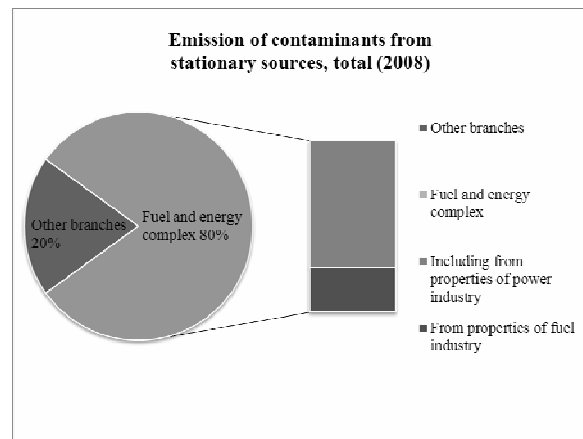


Fig. 2. Structure of emission from stationary sources of branches of fuel and energy complex

Yakutia provided 15% of total atmospheric emission from stationary sources of the Far-Eastern federal district in 2000, and in 2008 the part of the republic raised up to 21,7%. Besides, the degree of pollutant recovery decreased significantly. Thus, in 2003 the characteristic accounted 73,6%, and in 2008 – 66,3%.

In 2007 the maximum emission was provided by production and distribution of power, gas and water, making 108 100 tons or 67% of the total atmospheric emission of the republic, equaling 162 400 tons, and in 2008 the emission from power industry properties decreased to 59%, while the total emission had grown up to 182 900 tons. General increasing

was provided by the growth of pollutants emission quantity from the properties of the fuel sector, notably from production of crude oil and natural gas. Thus, in 2007 emissions comprised 5,2 thousand tons while carbohydrates production, and in 2008 – 26,6 thousand tons.

General sources of air pollutants emission are power industry properties, particularly small boiler-houses, providing emission virtually without a recovery. The part of power industry facilities in the total emission of 2008 was 78,5% (or 127 200 tons), and in 2008 – 80% (146 400 tons).

In general, atmospheric condition in Yakutia has local alterations. High level of air pollution is observed at the largest communities, where coal and diamond facilities are located, as well as large heat and power stations, and numerous coal broiler houses.

In 2008 an amount of facilities having pollutant emission has grown for 113 units in comparison to the year 2000. Gas and liquid matter, occurring as main air pollutants, dominated in the total emission volume during 2000-2008. Carbon dioxide, comprising 41,1% of all emissions, predominated in the structure of harmful emissions, and nitrogen oxide – 16,8%, sulfurous anhydride (sulfur dioxide) – 7%, and solid matter – 30,5%.

Atmospheric air pollution level at communities of the Republic of Sakha (Yakutia) is estimated ranging high to low. In 2008 an average content of any pollutant type at all the communities under control, excluding the settlement Serebryanny Bor exceeded 1 maximum allowable content (MAC). During an year, any case of extremely high pollution (EHP, exceeding of MAC by 50 times and more) hadn't been recorded.

The high level of pollution in the town Mirny is related, first of all, with high hydrogen sulphide content, maximum of which has exceeded 10 MAC. Air pollution of town by formaldehyde

is significant as well: the air pollution index (API)* is 7 [1].

In general, the API is defined by content of formaldehyde, nitrogen dioxide and suspension, and indicates high pollution level, as hydrogen sulphide contribution isn't considered.

Air pollution level in the town Neryungri is very high and is related to significant formaldehyde, benzpyrene and nitrogen dioxide content. Average annual content of these harmful dashes exceed the value of one MAC, and define EHP equaling 24 [1].

During the last five years the formaldehyde and nitrogen dioxide content growth tendency has been indicated.

Air pollution level in the Yakutsk is estimated as high. Air of the town is polluted by suspense matter, formaldehyde, phenol and benzpyrene. Average content of these harmful dashes exceeded MAC into 2 times and defined the magnitude of API equaling 11 [1].

An area of the maximum air pollution is at the central part of the town, where most maximums of the harmful dash types under control are indicated and the maximum recurrence of high concentrations is noted.

Air pollution level in the settlement Yst'-Nera is estimated as increased. The air is significantly polluted by suspense matter. MAC exceeding recurrence comprised 17%.

The quality of surface water is featured by the characteristics of wastes discharge into water bodies. During 2000-2008 wastes discharge has increased by 1,2 times, including polluted discharge has increased by 1,1 times (Fig. 3).

The part of the republic amongst the regions of the Far-Eastern federal district in 2008 comprised 11,2% from the total wastes discharge into surface water bodies.

* Note: the API – a complex index of atmosphere pollution, considering several dash types. Value of API is calculated by average annual content rates, therefore it characterizes the level of permanent, continuous air pollution. In accordance with existing assessment methods, the level of pollution is considered low if API ranges 0-4, increased if it ranges 5-6, High – if 7-13, and very high if API is ≥ 14 .

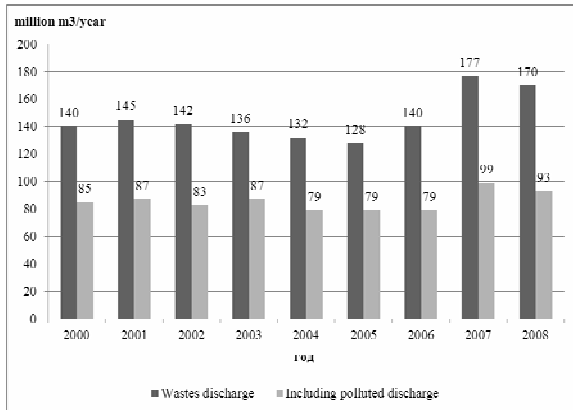


Fig. 3. Dynamics of wastes discharge into water bodies.

Polluted discharge in the structure of wastes discharge of the republic in 2008 (total withdrawn 167 million m³) comprised 93 million m³ or about 55,5% from total wastes discharge.

Impact of power industry on water bodies is related, first of all, with functionality and construction of hydropower stations.

The Vilyui Reservoir is a water body of the common water supply and provides annual runoff regulation at power site for benefits of energetics, water transport in tail-water, fishery and public services. As a result of the reservoir creation forest areas, having 145,5 thousand hectares, occurred to be flooded, as well as 2,3 thousand hectares of harvest areas. The reservoir floor after the flooding wasn't refined of lignose, as a result of which there occurs decomposition and phenol and organic matter receipt.

The level of water pollution is defined according to the classification ranging from "conventionally pure" to "extremely dirt". Most of water bodies are "dirt" (IV grade) and "very polluted" (III grade) (Table 1).

Basic sources of surface water pollution of the republic are wastes discharge from gold and diamond extractive industry, power industry facilities, housing and communal services, navigation, inland water transport, treatment facilities of towns and communities. In general, more than 70% of all waste discharge falls on communal services operation and nonferrous metallurgy facilities.

TABLE 1. QUALITY OF SURFACE WATER (2008)

Water body basin	Pollution rank	Basic pollutants
The Lena River	"dirty"	BOD ₅ , ChOD, copper, iron, phenols, manganese, oil products
The Aldan River	"very polluted" "dirt"	Iron, copper, mercury, phenols, zinc, oil products
The Vilyui River	"very polluted" "dirt"	ChOD, phenols, copper, iron, nitrogen nitrite.
The Yana River	"very polluted" "dirt"	ChOD, phenols, copper, manganese, zinc
The Indigirka River	"very polluted" "dirt"	Copper, phenols, iron
The Kolyma River	"very polluted"	BOD ₅ , copper, phenols
The Anabar River	"dirt"	Copper, mercury
The Olenek River	"polluted"	ChOD, BOD ₅ , phenols

If 36,9 million m³ waste water was dumped in 2006, then in 2007 polluted water discharge by "Yakutskenergo" public corporation stock company decreased by 500 thousand m³, and in 2008 – by 2700 thousand m³. Water consumption volume of all power industry facilities in 2006 accounted 50,6 million m³, in 2007 this one decreased by 8,4 million m³, and in 2008 – by 3,0 million m³.

Discharge of insufficiently treated water remained on the level of the last year – 22,3 thousand m³.

Fresh surface water use for industrial need decreased by 661 thousand m³, at the expense of decreasing of water supply period by once-through pattern in the Yakutsk heat station.

During the 2008 water consumption was 3353,6 thousand m³ of water.

Water draining volume into the surface water bodies by "Sakhaenergo" comprised 1928,8 thousand m³; a growth in comparison to 2007 occurred due to Nizhneyana diesel power station, in relation with its reconstruction in the direct cooling system.

Generation and accumulating of consumption and production wastes is one of the big problems of Yakutia. Amongst the regions of the Far-Eastern federal district, the Republic Sakha (Yakutia) comprised 63% of wastes formed in 2007. During 2003-2007 annually generation wastes volume increased by 2 times, and in 2007 it made up 246,6 million ton.

Accumulated consumption and production wastes quantity in the end of 2008 was 0,2 billion ton, besides the rate of utilization and sterilization doesn't exceed 13%.

Bulk wastes generation sources are enterprises of diamond production and coal output industries, their part in total wastes quantity is 60-65%. Basic types of production and consumption wastes in the republic are overburden (4th grade of danger), tailing pile, as well as ash-and-slad (5th grade of danger).

Annually in Yakutia violated areas grow, at the end of 2007 they comprised 34,3 thousand hectares. Maximum quantity of violated areas falls on nonferrous industry enterprises (including diamond production) – 20,9 thousand hectares (60,9% from common violated area), coal industry – 5,5 thousand hectares (16,0%) geological prospecting – 3,5 thousand hectares (10,2%), construction of header - 1,4 thousand hectares (4,1%).

Restoration is applied insignificantly and in 2007 it comprised 1,5 thousand hectares.

In general, contribution of power industry properties is pollutants waste into air, and compiles up to 80% from total stationary sources emission, discharge of polluted inflow, which is 30-35%, generation of production and consumption waste reaching 50-60%.

Thus, the present environmental situation analysis in the Republic Sakha (Yakutia) allowed indication of main environmental problems:

- high level of atmospheric pollution in the towns of the republic (Mirny, Yakutsk, Mokhsogollokh);
- low level of emission recovery in most of boiler-houses;

- high level of surface water bodies pollution, as a result of lack of modern treatment facilities both in large communities and at enterprises;
- lack of supply of biological resources conservation after exploitation and construction of hydraulic structure
- legal disarrangement while demarcation of federal and regional properties, complicating inspection of enterprises-pollutants;
- growth of production activity waste while small part of its utilization.

BIBLIOGRAPHY

- [1] State report of condition and conservation of environment of the Republic Sakha Yakutia in 2008/ Government of the Republic Sakha (Yakutia), Ministry of Nature Protection of the Republic Sakha (Yakutia). – Yakutsk, 2009. P. 2005.

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