GEOECOLOGICAL MONITORING OF UNDERGROUND WATERS IN THE ZONE OF INFLUENCE OF THE OBJECTS OF THE MINING AREA OF KURSK MAGNETIC ANOMALY (KMA) (ON THE EXAMPLE OF JSC «STOILENSKY GOK»)

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Abstract
The relevance of geo-ecological monitoring of underground waters of mining areas of CMA is shown, the results of monitoring in the zone of influence of OJSC «Stoilenksy GOK» are analyzed

Keywords: geoecological monitoring, man-caused impact, the regime of underground waters, the chemical composition of the underground water-bearing horizon, the coefficient of filtration.

Currently, iron ore basin of the Kursk magnetic anomaly is the basic raw-material base of metallurgical industry of the Russian Federation. The share of open development, carried out in Lebedinsky, Stoilenksy and Mikhailovsky GOKs, accounts for more than 60% of produced iron ore in Russia. In the process of extraction of the mining enterprises of the region KMA in General and Stoilenksy GOK in particular, increasing their impact on the regime and quality of underground waters, which are the only source of economic and drinking water supply to the population of the region.

According to the branch of OJSC «Geo centre-Moscow» TC «Beldorodeomonitoring», the estimated prognostic resources of fresh underground waters on the territory of Belgorod region - 2200 thousand m3/day, reported daily on the territory of the region is extracted about 756 thousand m3, of which about 40% are drainage water 4 iron ore mining enterprises: Lebedinsky and Stoilenksy processing plants, mines of combine «KMAruda» (mine by. Gubkin) and Yakovlevsky mine. On the territory of Kursk region in the mining area (Mikhailovsky GOK) is extracted more than 20 million m3 of underground waters per the year. The most exploited horizon is of bath aquifer, from which pumped 66% the volume of underground water.

Due to dewatering of moist declining ironstone field, work performance on ore mines under construction, exploitation of large underground water supply point of main productive aquifer, functioning of hydraulic architecture (water storage research, hydraulic-mine dump, containment point), on the territory of region KMA for a range of aquifers underwater regime is prominent disturb.

The results of the preliminary analysis of the status of water resources in KMA region allow making a conclusion that is progressive deterioration of the quality of the aquatic environment, and the amount of the consumed water resources will continuously grow, therefore, there is a threat of ecological and national security of the country. Therefore, the continuation and development of the geoecological monitoring due to the increase in the studied area, is in demand of the task, the solution of which can be used in the future for the forecast calculations, that will allow to form the development strategy of sustainable water use and water resources management the region of KMA.

In accordance with the «Project of the development of the sector in the period until 2030» in 2005 the capacity of the regime of the network in areas adjacent to the tailing pond of Stoilenksy mining and processing work. Was drilled 19 observation wells
at Turon-Konyaksky and Alb-Senomansky aquifers. In 2006, secure network was enlarged by 25 monitoring wells at the Quaternary water-bearing horizon.

The extension of the regime of network made it possible to assess the impact of tailings on the status of the level and hydrochemical regimes of the groundwater Turon-Konyaksky of the aquifer in the South part of the studied area. In 2010, the secure network of Stoilensky mining and processing work supplemented by another 15 wells, from them 3 wells constructed in the ore crystallized, 10 wells on Alb-Senomansky and 2 wells - the Quaternary water-bearing horizons. Thus, the total number of operating wells is 71.

Starting from 2011 along with underground waters, in the system of monitoring is monitoring of the condition of surface water technical water and the river Oskol.

According to the LLC NTC NOVOTEK, for the twelve-year period of observations (1999-2011 gg.) under the influence of a system of drainage, significantly decreased the level of groundwater in ore-crystallized aquifer (8.96 m), in Alb-Senomansky aquifer decrease amounted to 5.85 m. In comparison with the natural ground water level release it in Alb-Senomansky aquifer within the career amounted to 40 meters or more, Turon-senomansky aquifer completely drained in the centre of depression.

Despite the rise of water level in the tailings of Stoilensky mining and processing work, within the areas adjacent to it, there has been a General lowering of levels of underground waters in Turon-konyaksky and Alb-senomansky aquifers. Apparently, this is due to climatic factors. In General, during the period of monitoring (2004-2011) there has been a surge of water levels from 0.24 to 1.88 m, as compared with the natural up to 25 m and more.

Changing groundwater levels Quaternary aquifer depends largely on weather and water losses in the technological cycle. The maximum values of levels timed to the March-April, in this period of time up to the depth of the water from the day surface on the sites of location of the depot of Stoilensky mining and processing work, KKD, concentrating factory was 0.7, 1.94, 4.48 m, respectively. Maximum lowering of groundwater levels in the limits from 0.3 to 3.77 m is dedicated to the month of October. In the border areas of industrial site of ground water levels lie at a depth of 12-15 m and below.

According to the results of hydrochemical sampling in the Quaternary aquifer allocated four types of water: hydrocarbonate calcium, hydrocarbonate magnesium-calcium, sulphate-hydrocarbonate calcium and sulfate-hydrocarbonate magnesium-calcium.

The first type of water is typical for a large part of the observed territory, other types of water were confined to small areas, not territorially connected with each other.

The majority of the ground waters are characterized by high rigidity to 18.88 mg-EQ l. For a number of wells noted excess of maximum concentration limit on silicon to 19.99 mg l (maximum concentration limit 10 mg l).

Hydrochemical sampling of Turon-konyaksky of the aquifer has shown that underground water, as in previous years, are divided into three types: hydrocarbonate calcium, sulphate-hydrocarbonate-sodium-calcium and hydrocarbonate magnesium-calcium. Hydrocarbonate calcium water circulated to the South and South-East of tailings of Stoilensky mining and processing work. Hydrocarbonate magnesium-calcium waters have a significant spread on the area and are confined to the area of the North and South of the tailings dam.

Sulphate-hydrocarbonate-sodium-calcium type of water was observed within the tailings and on adjacent to it territory.
Underground water of the described horizon fresh and had a year characterized by the dry residue within 269-543 mg/l, content of sulphates - 5,27-145,78 mg/l, chloride ions - 5,47-44,22 mg/l. For the eight-year period of observations in the waters of Turon-konyaksky of the aquifer has increased content of sulphates from 7-27 to 46 mg/l. For the rest of the components of significant qualitative changes were observed.

In Alb-senomansky the water-bearing horizon of underground waters are characterized by 6 types. The most common types are hydrocarbonate magnesium-calcium waters, they are observed to the North and the South-West of the tailings dam. Hydrocarbonate calcium waters mainly typical for the site adjacent to the valley of the river Oskol, and sulphate-hydrocarbonate calcium waters are confined to the area of the North-East from the quarry of Stoienskyy mining and processing work.

In General, groundwater Alb-senomansky water-bearing horizon of unleavened have dry residue 319-848 mg/l, content of sulphates - 13,83-299,4 mg/l, chloride ions - 5,95-by 65.0 mg/l.

Over a five-year observation period (2007-2011) underground water Alb-senomansky of the aquifer in the area of location of the water intake «Boiler of Stoienskyy mining and processing work» have not undergone any significant changes.

Water ore-crystallized aquifer refer to sodium calcium bicarbonate type. They contain dry residue 239-495 mg/l, the ions of sulphate 16,71-59,74 mg/l, chloride ions 52,19-89-85 mg/l. In the waters of the described horizon there was an increased concentration of iron mainly due to the ferrous ion. The excess of MPC for the rest of the ingredients have not been observed.

In a career of Stoienskyymining and processing work the quality of drainage water was observed on the horizon of ~93 m overall and in the sump. In the course of 2011, drainage water of the Northern and Western side, on a plot of the output of the closed drainage, were characterized by sulphate-hydrocarbonate calcium type. Drainage water on the West side of the plot output of wells # 4 in the given year were characterized by hydrocarbonate-sulphate calcium type. Drainage water of the South of the open pit in 2011, in March and in September had hydrocarbonate-sulphate calcium composition, in May and November - sulphate calcium.

Within the South-Eastern side of the career of drainage water in may 2011, were characterized by sulfate-calcium-sodium composition, in September and November - sulphate calcium. Starting from 2010, in the drainage waters of South-Eastern side of registered an increased content of sulphates, solid residue and at the same time decrease the pH and hydrocarbons, which, apparently, is connected with the opening of rocks containing pyrite, in the process of expanding of the quarry. In 2011, there was excess of MPC for Nickle, cadmium, and manganese.

The water in the sump pit in March and September 2011, had sulphate-magnesium-sodium composition, in may sulphate-sodium-magnesium-calcium and in November - sulphate, magnesium-calcium.

From 2011, the composition of geo-ecological monitoring was introduced control over the qualitative composition of surface waters in the zone of influence of the objects of OJSC «Stoylenksy GOK», including technical water tailings of Stoienskyy mining and processing work and sludge reserves UDN and the water of the river Oskol division confluence into it of the river Chufichki.

As a whole in the compartments of the tailings of Stoienskyy mining and processing work the technical water changed from the seasons of the year. In March 2011, the water in the bays
and in the buffer capacity had sulphate-hydrocarbonate magnesium-sodium-calcium type, in June - hydrocarbonate-sulphate, magnesium-calcium-sodium, in September and November - hydrocarbonate-sulphate calcium-sodium.

The constancy of the composition was characterized by water in the tailrace of the dam protection of stockpiles and the pond-battery, it had a composition is sulphate-hydrocarbonate-sodium-calcium.

The water in the upper reaches of Foreign Log changed its composition within a year from the sulphate-bicarbonate magnesium-calcium to the sulphate-hydrocarbonate calcium. In general, technical water tailings and adjacent to it ponds have dry residue 448-602 mg/l, content of sulphates 121,19-188,33 mg/l, chloride ions 26,89-44,41 mg/l. There was a slight periodic excess of MPC of iron general and oil products, from for micro-component - at manganese in the upper Threshold of the Log. For the rest of the components of the observed excess of MPC is not observed.

Water flowing in the sludge collector UDN, had in the course of the year, the permanent composition, it is characterized by sulphate-hydrocarbonate calcium type and contains the dry residue 458-503 mg/l, the ions of sulphate 103,22-140,05 mg/l, chloride ions 34,21-35,09 mg/l. It is noted excess of MPC of iron General and oil products, and the rest of the defined components within the norm.

Composition of the water in the river Oskol constant and is characterized by a hydrocarbonate calcium type, quantitative difference observable components above and below the confluence of the river Chufichki insignificant. The water is generally dry residue 350-472 mg/l, the ions of sulphate 37,91-81,35 mg/l, chloride ions 22,58-35,45 mg/l. The excess of MPC-defined components are not noted.

With the prospects of further development of production, improvement of technological processes at the enterprises of Stoilensky mining and processing works the role of anthropogenic impact on the whole on the environment and on the regime of surface waters, in particular. Due to the utilization of drainage water there is a possibility of artificial replenishment of stocks of underground waters, so it is recommended that further monitoring with the purpose of more complete evaluation and possible forecasting of influence of the complex of mining enterprises on the ecological situation of the territory.