MODERN GEOCHEMICAL SITUATION IN STAROOSKO-GUBKINSKY MINING REGION, AN KMA

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Abstract

Evaluation of contemporary geochemical situation in the in Staroosko-Gubkinsky industrial area, as one of the most converted regions of extraction of iron ores in Kursk magnetic anomaly was made. The level of accumulation of pollutants, calculated the measure of total chemical contamination of soils was assessed

Key words: geochemical situation, mining activities, pollutants, pollution of soil, Kursk magnetic anomaly.

In the Belgorod region are the world's largest deposits of iron ore - Lebedinsky, Stoilensky, Yakovlevsky, in the Kursk Magnetic Anomaly. Development is conducted by open (Lebedinsky, Stoylensky) and closed (Yakovlevskoe) method with the 60-70-ies of XX century.. It is considered that the areas of mining in the region KMA refer to are not environmentally safe zones. The main factors of negative effects of mining activities on the environment and population: 1) the transformation of the surface (quarrying), 2) dusting piles of rocks - atmochemical transfer, and 3) the filtration of water from tailing ponds beginning from entering the underground aquifers - hydrochemical transport; 3) factor of presence - the environmental impact of communications (pipelines, roads surrounding industrial area). [1]

The main share of emissions into the air company from smokestacks of factories and ventilation channels, dusting magnetic separation tailings, tailings slight dusting of external storage oxidized quartzites, explosions in the pit and transfer of particles already deposited with the wind. Most of them are deposited in the vicinity of the enterprise and its industrial site within the sanitary protection zone, a minority of atmospheric transport of pollutants transported over greater distances and falls in the range of 4-8 km from the release point. In addition to emissions of ore mining and processing plants the toxicants in air emissions from the exhaust pipes of vehicles, settling near highways and cities influence on the contamination. So there is the need to assess the geochemical conditions of the soil cover, as the main "drive" and an indicator of pollution man-made pollutants. [2]

The major industrial load on yourself experiencing Stary Oskol located in the immediate vicinity of the Stoilensky, Gubkin bordering Lebedinsky mining complex; Yakovlevo, near which is Yakovlevsky mine. According to the Belgorod Regional Center for Hydrometeorology and Environmental Monitoring, the air in the whole city of Stary Oskol (located as close to the Stoilensky) contaminated ingredients, background concentrations are presented in Table 1. These values are due to the action of existing facilities and Stoylensky ore mining and processing plant (ore mining in the quarry, rock and ore storage, transportation, processing, and maintenance of the main production), other mining companies, construction and energy complex. Analysis of the above background concentrations of ground-level indicates that the environmental situation in the region as a whole is satisfactory.

Table 1: Background concentrations of pollutants

Substance	Concentration	
	Mg /cubic	shares of MPC
Suspended solids (2902)	0,177495	0,354
Sulphurous anhydride (330)	0,007609	0,015
Nitrogen dioxide (301)	0,094729	0,474
Carbon monoxide (337)	2,070597	0,414

Ultimately - allowable concentrations adopted in accordance with GN 2.1.6.1338 - 03 "Maximum - permissible concentration (MPC) of pollutants in the ambient air of residential areas," GN 2.1.6.2309 - 07 Tentative safe levels of impact (TSLI)of polluting substances in the atmospheric air of populated areas

As a result of our research Starooskolso-Gubkinsky industrial unit were studied levels of accumulation of heavy metals in soils and identify approximate boundaries of the distribution of the dangerous zones and moderately dangerous pollution of soils (by total chemical pollution index Zc).

Analysis of soil and groundwater samples Starooskolsko-Gubkinsky area 22 held by the content of metals and other items (oil, benzopyrene, phenol, xylene, etc.), as well as several radioactive components: Be, V, Cd, Co, As, Ni, Hg , Pb, Se, Sb, Cr, Tl, Mn, Cu, Mo, Zn, Fe, Ag, Al, Sr, Ba, Zr, S, SO3, 137Cs, 40K, 226Ra, 232Th, Aef (in accordance with the SP 11-102-97 and MU 2.1.7.730-99).

Sited points soil-ground samples was carried out taking into account the sources of pollution, the main directions of air flow from operating facilities, orographic terrain and with the expected structure of the field of pollution (according to p.4.10, § 4.16, § 4-19 SP 11-102-97 § 2. 17.4.3.01-83 Standard, 2.2. 17.4.4.02-84 GOST, SNIP 11-02-96.). Points along the vectors of the wind rose (for the warm and cold seasons), located at a distance of 100, 200, 300, 500, 1,000, 2,000 m, except for periods extending to the industrial sites (quarry dumps).

Geochemical study of soils was carried out in accordance with regulatory requirements. Testing conducted from the surface layer by the "envelope" (mixed sample on an area of 25 m^2) to a depth of 0-5 and 5-20 cm, the selection was done at the regulatory distance from the road.

The study was conducted mapping of the measurement results, we calculated the coefficients of concentration of each element is calculated total pollution index (Zc), which determines the risk of soil contamination (Fragment of measurement results is given in Table. 2). As background values used average values of observation points distant from industrial facilities in Starooskolsko-Gubkinsky area.

A number of elements in samples of all observation points are not detected: Hg, Tl, Ag.

In the presented samples of soil profiles the concentration of radionuclides and heavy metals are within the existing standards established for soil settlements [Hygienic evaluation of the quality of soil settlements. Method. the decree. MU 2.1.7.730-99].

Indicators of soil pollution by benzopyrene within the study area range at the MPC have a complex structure of the sources of supply in the soil due to the variety of sources of formation associated with industrial activity as GOK, and the network of highways covering the area.

For the area of the mining complexes Starooskolsko-Gubkinsky area is characterized by pollution vanadium, lead, selenium, zinc and chromium. Noted the widespread excess of background values for lead, on average 2-2.5 times (the distance from the industrial area and the

roads lead content in the soil is reduced.) 2-3 fold excess of background values for vanadium is celebrated in the immediate vicinity of the pits and dumps. The distribution of indicators of soil Co, Ni, Sb gravitates to the prevailing wind direction in this area. Thus, the mining activities in the area Starooskolskp-Gubkinsky causes a geochemical situation in the region with environmentally strained ranges in the GOK and in the surrounding area.

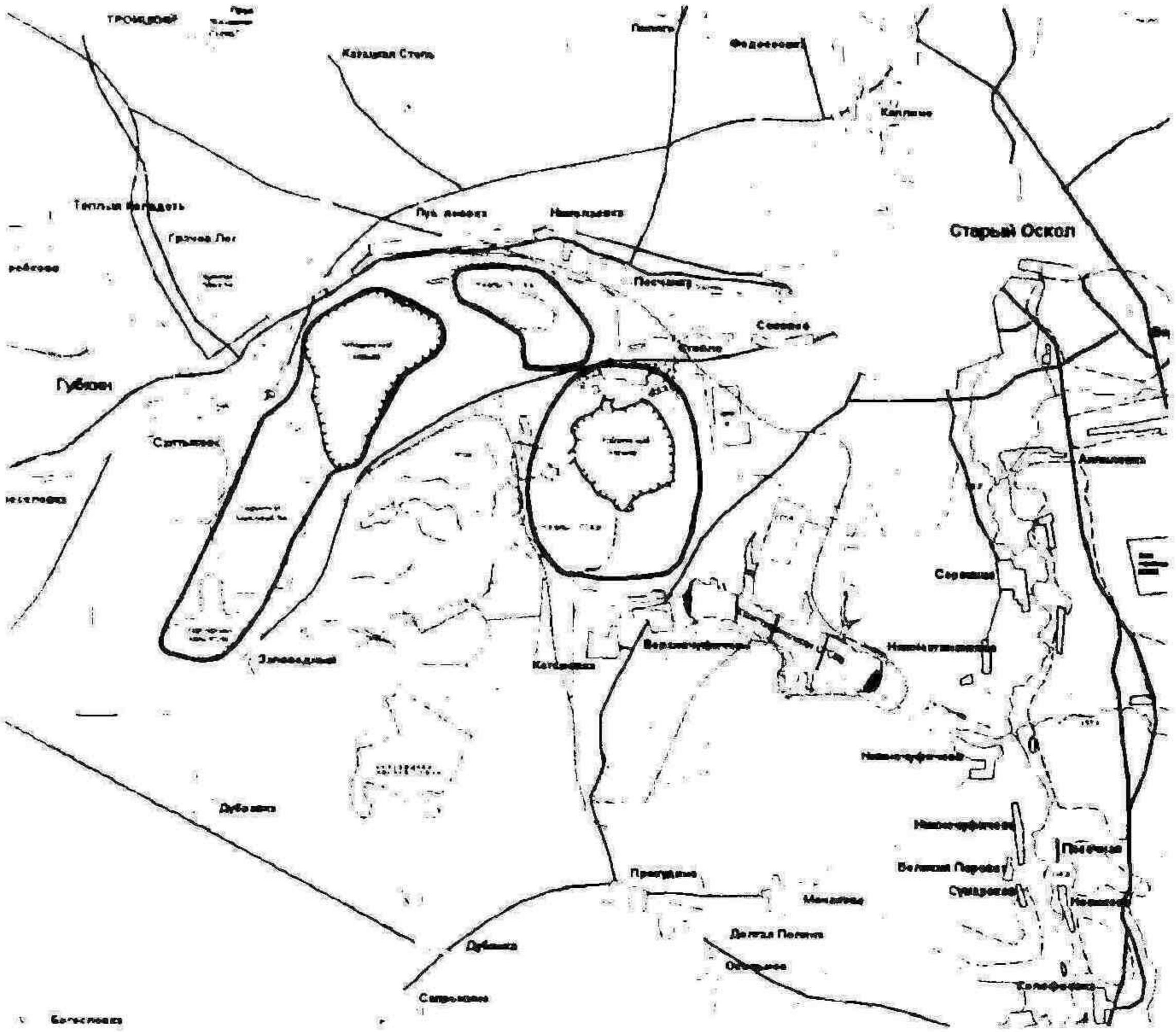
The dangerous zone of pollution in the pits, tailings area is moderately dangerous pollution at industrial sites are located GOK, as a rule, do not go beyond the SPZ enterprises (Figure 1), which, in fact, defines the areas of environmental well-being in this area.

In general, the environmental situation, the entire territory of the observation can be divided into three sectors. Zone of substantial degradation of ecosystems and highly dangerous pollution in accordance with the "MU 2.1.7.730-99. Hygienic evaluation of soil quality residential areas: guidelines "covering the area of the industrial site, quarries and recent dumps , characterized by excess of maximum permissible concentrations of benzopyrene and index Zc over 16. The highest rates of heavy metals Occupational observed for chromium, vanadium, zinc, lead, and significant contributions to their accumulation in soils makes industrial vehicles.

Zone of moderate degradation of ecosystems and moderately hazardous pollution covers the territory under piles under overgrowth, pastures, forests, tailings, characterized by indicators of pollution by benzopyrene about Macs and index Zc from 8 to 16. The third zone is relatively satisfactory environmental situation surrounds the above zone, located on lands under cultivation, forests and suburban towns, characterized by the absence of MPC exceedances concerning benzopyrene and indicators Zc to 8.

Table 2 Concentration ratios of the elements analyzed in relation to the regional background 2012 (detail)

Regional background		Be	V	Cd	Co	Ni	Pb	Sc	Sb	Cr	Mn	Cu	Mo	Zn	Zc*
	Location of items	1.9	2.5	2.9	7.9	5.8	15.3	2.6	12.2	3	38.1	16.9	2.2	27.9	
Number of observation points	Ki (Paradise - reg) the numbers of sampling points is indicated only in cases of excess units														
1	150 m from the dump		2.4	1.3	1.4	1.2	1.5	2.3	2.4	1.8	1.1	1.1	1.1	-	8.8
2	180 m from the blade (district thickening of the transport network)	1.2	2.1	1.2		1.2	2.5	2.7	1.7	2.2	1.3	1.5	1.9	2.2	10.5
3	400 m from the blade (district thickening of the transport network)	1.4	3.6	1.2	2.5	2.1	2.8	3.0	2.1	3.6	1.3	2.3	2.1	3.0	20.8
4	800 m from the blade (district thickening of the transport network)	1.4	3.5	1.2	2.5	2.1	2.7	2.8	1.9	3.6	1.3	1.9	2.0	2.5	18.4
5	700 m from the dump	-	1.3	-	1.2	-	2.4	2.5	1.9	-	1.2	1.5	-	1.7	6.6
6	1 km from the dump	1.2	2.3	1.2	-	1.3	2.6	2.8	1.7	2.2	1.2	1.4	1.9	2.1	10.9
7	Industrial Zone, the area between the cement plant and quarry (near the highway)	1.2	4.1	1.2	1.4	1.9	2.8	3.3	2.1	3.5	1.2	1.8	2.0	2.5	17.0
8	Industrial Zone, the area between the cement plant and quarry	-	1.1	-	-	-	2.2	2.5	1.3	-	1.1	1.2	-	1.5	4.9
9	land under cultivation, 100 m from the dump, 2.6 km from the quarry	1.2	2.8	-	-	-	2.6	1.8	-	1.2	-	1.1	-	1.9	6.7
10	land under cultivation, 200 m from the dumps	1.2	4.1	1.3	1.4	2.1	2.8	3.0	2.2	3.6	1.3	2.0	2.0	2.5	16.6
11	land under cultivation, 300 m from the dumps	-	1.3	-	1.2	-	1.5	2.0	-	1.3	-	1.5	1.4	1.3	4.6
12	land under cultivation, 500 m from the dumps	-	1.5	-	-	-	2.3	2.5	1.6	-	1.1	1.1	1.1	1.7	5.9
13	land under cultivation, 700 m from the dumps	-	1.3	-	-	-	1.4	1.3	-	-	-	1.5	1.4	1.4	2.8
14	land under cultivation, 1 km from the dumps	1.2	2.2	-	-	-	2.6	1.8	-	-	-	1.1	-	1.6	5.0



Zc 16 to 32 (moderately hazardous pollution)

Zc more than 32 (contamination risk)

Territory with a value of less than 16 Zc characterized admissible (relatively satisfactory) ecological condition of soils

Fig. 1 Distribution of the summary indicator of soil pollution in Starooskolso-Gubkinsky area [1, with updates added].

Thus, at the present time geochemical situation outside of the industrial sites is a moderately strenuous or relatively satisfactory, but further capacity growth rate of oil extraction and processing of raw materials and construction of industrial shops causes the necessity in carrying out of geochemical monitoring of the Starooskolsko-Gubkinsky area.

Thus, in the present situation geochemical outside industrial sites is moderately hard or relatively satisfactory, but further increase in the rate of extraction and processing of raw materials and the construction of production facilities makes it necessary to conduct geochemical monitoring area.

References

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