

Results of environmental monitoring at “Uzbekiston Mustakilligi” investment block in 2022



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1. Introduction

According to approved environmental monitoring program agreed with the State Committee for Ecology of RUz in 2022, studies were carried out to assess the environmental impact of the following oil and gas operations:

- drilling and testing wells at "Mustakillikning 25 Yilligi" field;
- construction of Baysun Gas Processing Plant (BGPP).

The facilities of environmental monitoring are :

- ✓ atmospheric air;
- ✓ surface water reservoirs and watercourses;
- ✓ soils, subsoils and terrain;
- ✓ radiation situation;
- ✓ production and consumption waste;
- ✓ flora and fauna.

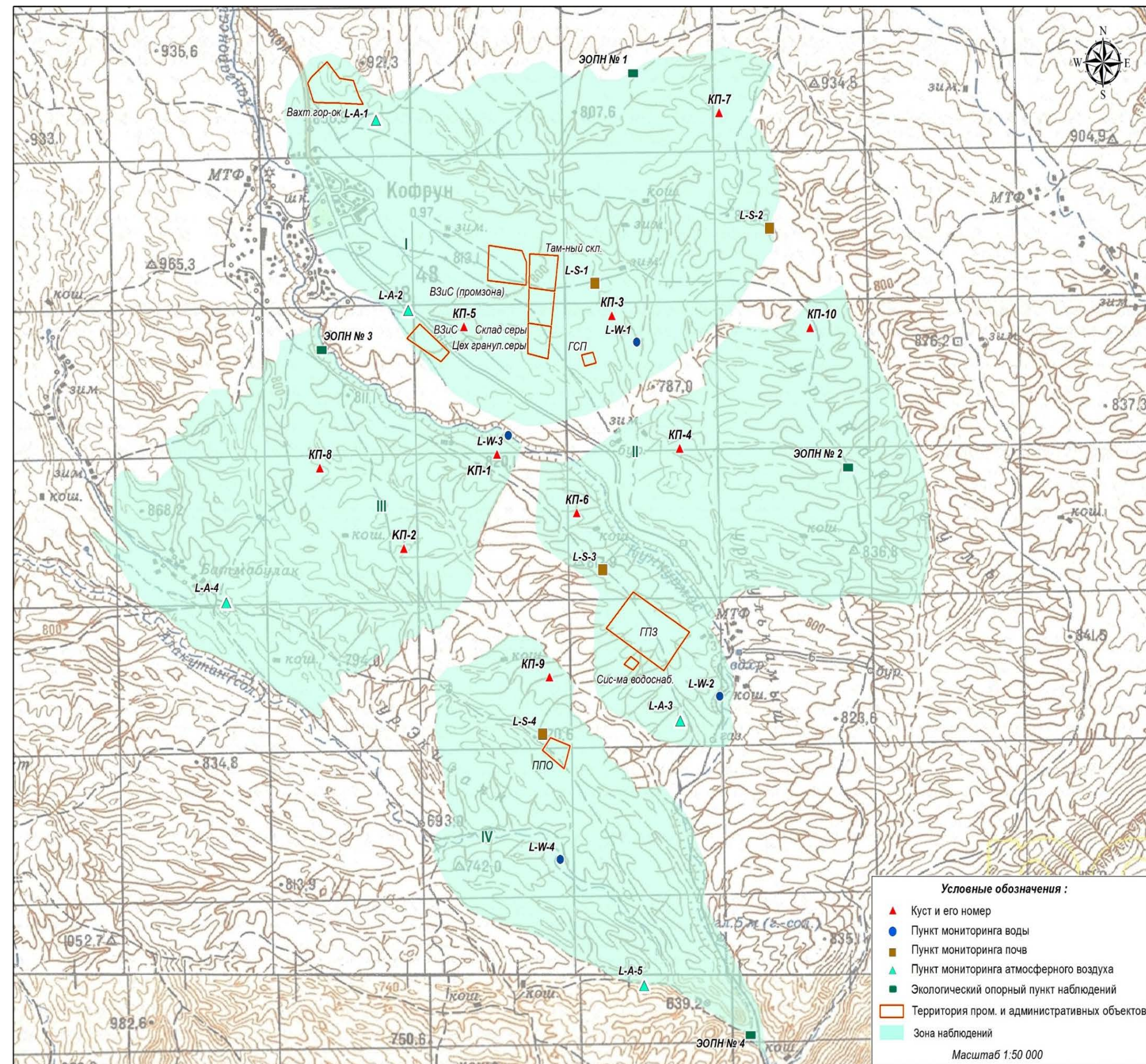
2. Purposes and tasks of study

The purpose of environmental monitoring is to assess the impacts carried out by SURHAN GAS CHEMICAL OPERATING COMPANY FC LLC (hereinafter referred to as Operator) by its production activities on the environment in order to take timely measures to prevent violations.

The tasks are:

- ✓ assessment of the actual state of natural environment;
- ✓ comparison of obtained information with data of Environmental Audit (2017-2018) conducted before the start of oil and gas operations;
- ✓ monitoring the state of natural environment and ongoing changes in the contract area;
- ✓ predictive assessment of the impact of man-made processes on the state of environment on the Contract area.

3. General principles of environmental monitoring



In 2022, within the scope of Environmental Monitoring, Operator continued studies to assess the impact of oil and gas operations (OGOs) on environmental objects at "Uzbekistan Mustakilligi" Investment Block. The studies were carried out by Center for Specialized Analytical Control of the State Committee on Ecology of RUz within the scope of concluded contract in accordance with "Program of industrial environmental monitoring of the state of environment during oil and gas operations at "Uzbekiston Mustakilligi" investment block carried out by Operator in 2022" approved at the meeting of HSE subcommittee and agreed with the State Committee on Ecology of RUz.

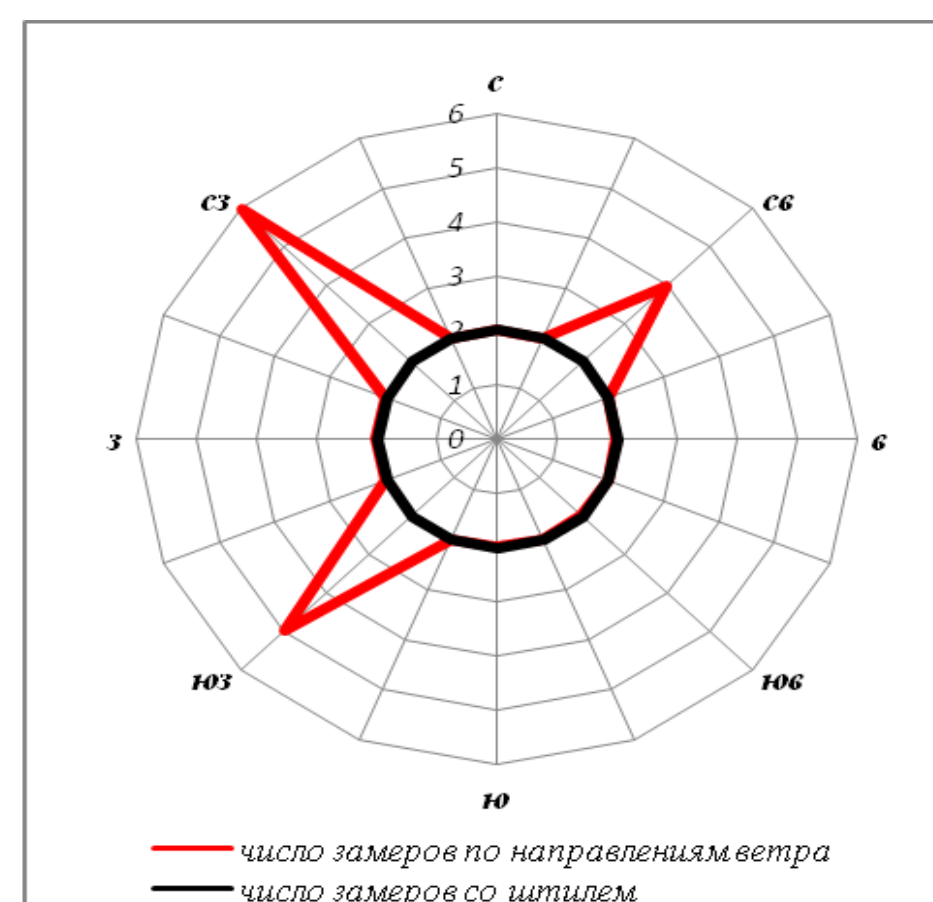
The complex of environmental studies included measurement of meteorological parameters of the territory, field examination of the terrain, flora and fauna, sampling of soils and subsoils, surface and ground waters, atmospheric air, with appropriate laboratory analyzes, processing of results and issuance of conclusions.

The map shows the regime stations of Ecoaudit 2017-2018 (EA 2017) of Ecomonitoring 2022 point. At each local and background observation station, according to the Schedule, measurements of the territory's meteorological parameters were carried out, samples of atmospheric air, surface waters, soils were taken, and radiation measurements were taken.

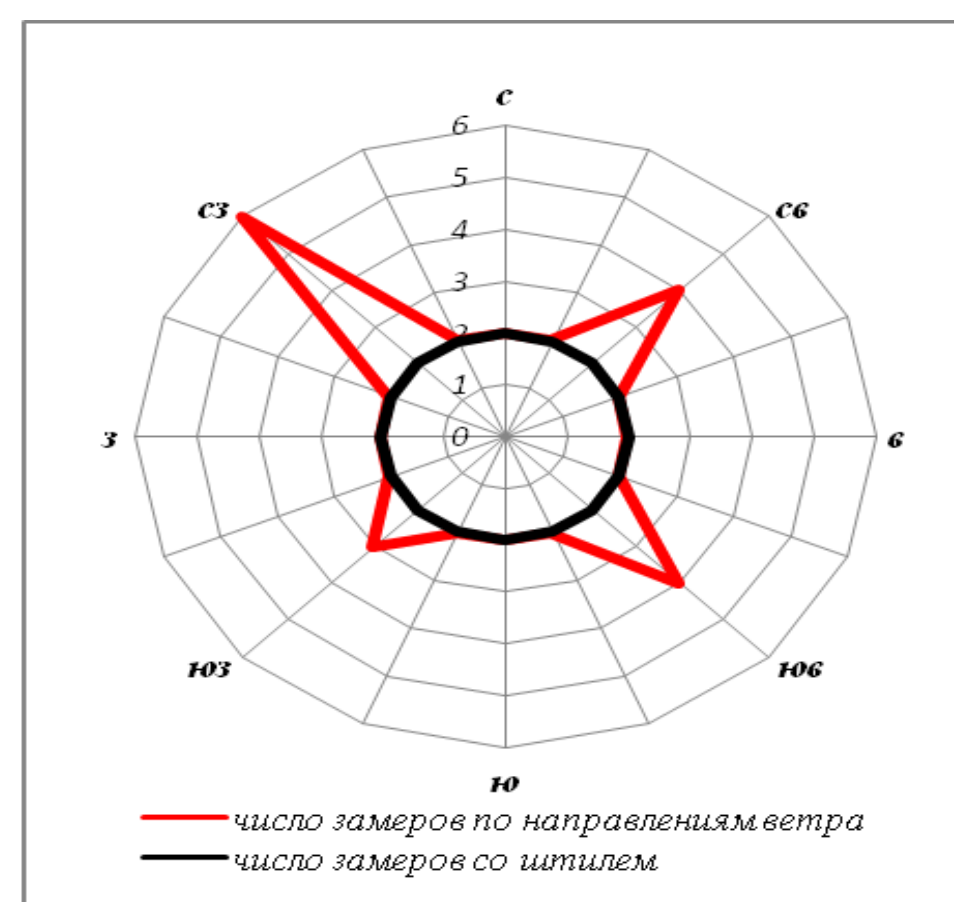
4. RESULTS OF ENVIRONMENTAL MONITORING

4.1 Meteorological parameters

- Based on the results of field studies conducted in spring, summer and autumn periods of 2022 and observations of the main meteorological parameters throughout the surveyed area, it can be noted that during the period of study, as in the past year, the northwestern, northeastern and southwestern wind directions prevailed, winds are gusty, with a speed of 0.6 m/s (quiet) to 6.2 m/s. The distribution of air temperature values fluctuated in spring from 23.8°C to 36.3°C, in summer from 28.4°C to 41.3°C, in autumn from 18.3°C to 31.1°C, depending on the time of measurements, in the morning and evening hours the temperature was lower than daytime readings. The determined values of meteorological parameters correspond to the average climatic readings of the spring, summer and autumn observation periods of the surveyed area.



Wind directions based on data of field studies at the I stage of observations.



Wind directions based on data of field studies at the II stage of observations.



Wind directions based on data of field studies at the III stage of observations.



4. RESULTS OF ENVIRONMENTAL MONITORING.

4.2 Monitoring of atmospheric air condition

The studies were carried out at four environmental base observation stations EOPN (No. 1, 2, 3, 4) and five local observation stations (L-A-1, L-A-2, L-A-3, L-A-4 and L-A-5) and 9 well pads (K -1, K-2, K-3, K-5, K-4, K-6, K-8, K-9, K-10 and one well No. 1 (Kognysai)). The level of atmospheric air pollution was assessed in relation to the sanitary and hygienic standards developed and approved by the Ministry of Health of the Republic of Uzbekistan - SanPiN No. 0293-11 "List of maximum permissible concentrations (MPC) of pollutants in the atmospheric air of populated areas on the territory of the Republic of Uzbekistan.

The results of studies of atmospheric air composition have shown the following.

- The content of pollutants such as carbon monoxide, sulfur dioxide, oxide and nitrogen dioxide in the atmospheric air of the entire surveyed area, as in previous years, does not exceed the established standard values for these substances and is at the level of 0.7 MPC one time concentration and below.
- The content of inorganic dust ranged from 0.03 to 0.9 MPC one time concentration, its concentration increased depending on the strengthening of wind gusts in the territory at the time of research. In general, these data correspond to the values recorded in the given territory during the environmental audit and the values of environmental monitoring in previous years.

➤ the content of hydrogen sulfide in the atmospheric air of the entire surveyed area did not exceed the established standards at all stages of observation in the current year.(Fig. 1.) At the III stage of monitoring, its concentrations are fixed at the level of 0.1-0.6 MPC one time concentration, which is 0.0015 mg/m³ - 0.0053 mg/m³, these values are lower than the concentrations fixed at II stage, when its maximum content was fixed at the level of 0.9 MPC one time concentration (0.0072 mg/m³). In general, the content of hydrogen sulfide in the atmospheric air of the surveyed area in the current year is slightly lower than the values of the previous year, when its maximum concentration was recorded at the level of 1.7 MPC one time concentration.

➤ The increased content of hydrogen sulfide in the atmospheric air of the surveyed area in the current year was recorded only on the territory of three well pads of the Eastern zone (K-4, K-6 and K-10) and one well pad of the Western zone (K-8), its concentration in the atmospheric air of the rest of the surveyed area is below the established standard value. The maximum concentration of hydrogen sulfide in the current year is fixed at the level of 1.4 MPC one time concentration, which is slightly lower than the values of the previous year, when it was 1.7 MPC one time concentration. It should be noted that the concentration of hydrogen sulfide in the atmospheric air on the territory of suspended wells (provided there is no accumulation of wastewater that may have an increased content of hydrogen sulfide) is below the established standard value, which may indicate that the level of hydrogen sulfide in the atmospheric air decreases (disperses) during completion of works and suspension of wells. Compared to the data of the environmental audit and environmental monitoring in 2020, when the maximum concentration of hydrogen sulfide was recorded at the level of 0.6 MPC one time concentration, the data of this year are slightly higher, but they are lower than the recorded concentrations of hydrogen sulfide during environmental monitoring in 2019 and 2021, when its maximum concentration was at the level of 2.0 MPC one time concentration and 1.7 MPC one time concentration respectively.

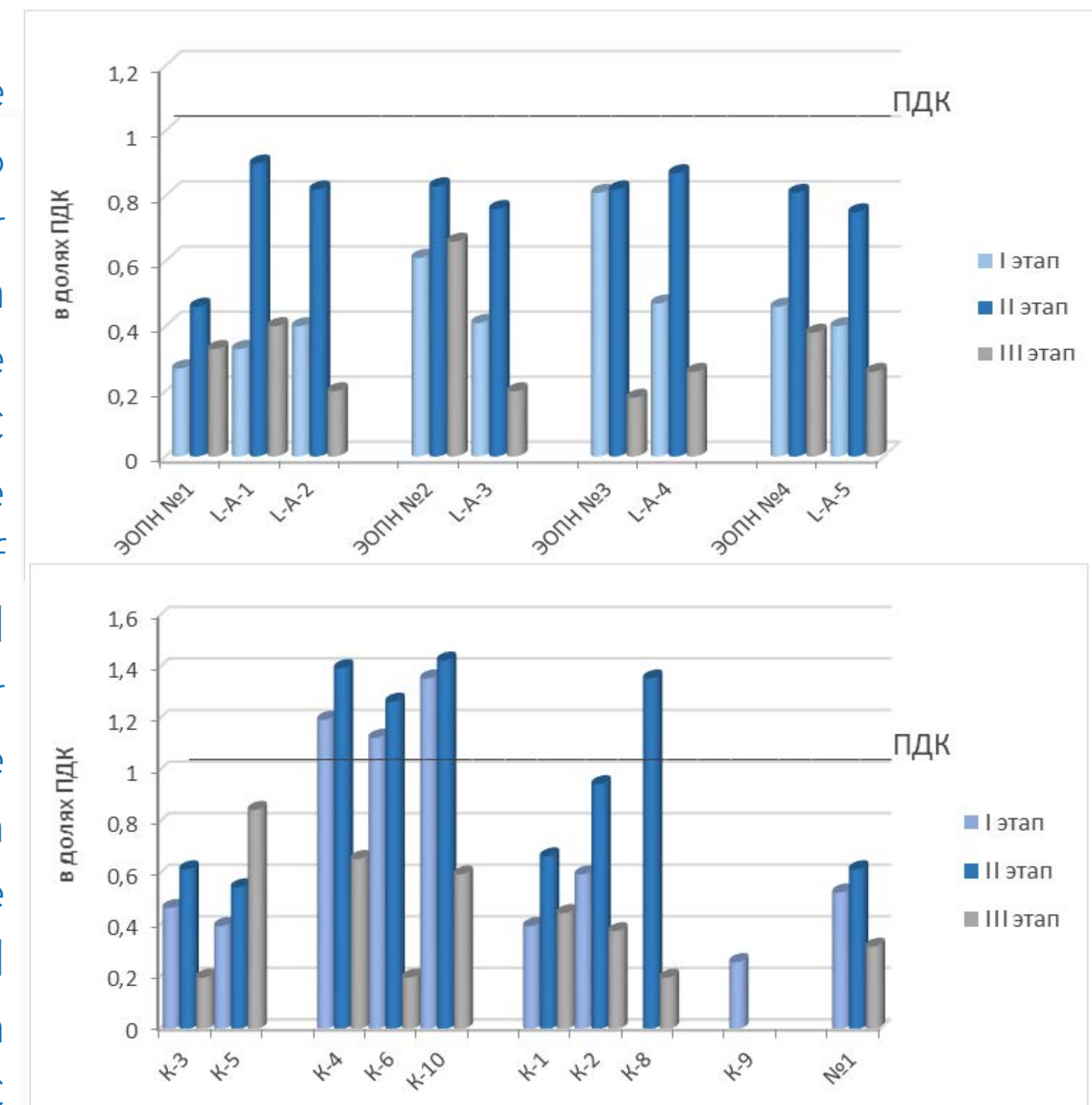


Fig. 1. The content of hydrogen sulfide in the atmospheric air of the surveyed area for I, II and III stages of 2022.

- Of the hydrocarbons, as in previous years (2017-2021), only methane was found in the atmospheric air, however, its concentrations do not exceed the Safe Reference Levels of Impact (SRLI)
- According to the results of field and laboratory studies in the spring, summer and autumn periods, there was no significant impact on the atmospheric air during oil and gas operations at "Uzbekiston Mustakilligi" investment block.

Conclusion: In general, the results of the studies showed that the level of atmospheric air pollution with inorganic dust, carbon monoxide, nitrogen dioxide and hydrocarbons in the contract area does not exceed the MPC and the background indicators of EA 2017.

The atmospheric air does not experience any increased man-made and technogenic load from the Operator's activities.

4. RESULTS OF ENVIRONMENTAL MONITORING.

4.3 Surface water condition

Surface watercourses at the site of oil and gas operations are represented by one watercourse - Khongaronsai, the channel of which passes through Boysun city and Kofrun village and then, cutting through mountain uplifts, enters the valley of the Surkhandarya River.

The surface water of the Khongaronsai River within the Contract Area retains high content of sulfates, chlorides, BOD, COD and heavy metals.

During the observed period, the content of oil products in the surface water of the Khongaronsai fluctuated at the level of 0.055-1.31 mg/dm³. The maximum concentration of oil products was detected at III stage in the water of L-W-2. Compared to stages I and II of observation, at stage III at the observed L-W-2 station, oil products are up to 13.1 times higher (Fig. 2).



Fig.2. Dynamics of changes in content of oil products in the surface water of the Khongaronsai River for I, II and III stages of 2022.



Surface water of the Khongaronsai river (L-W-1).



Surface water of the Khongaronsai river (L-W-2).

During the observed period, in the surface water of the Khongaronsai, the content of manganese was found up to 1.1 - 6.88 times, iron - up to 2.9-12.2 times higher than the MPC, their maximum content was noted at stage III in the sections - L-W-2, L-W -3 and environmental base observation station EOPN-4 (Fig. 3.)

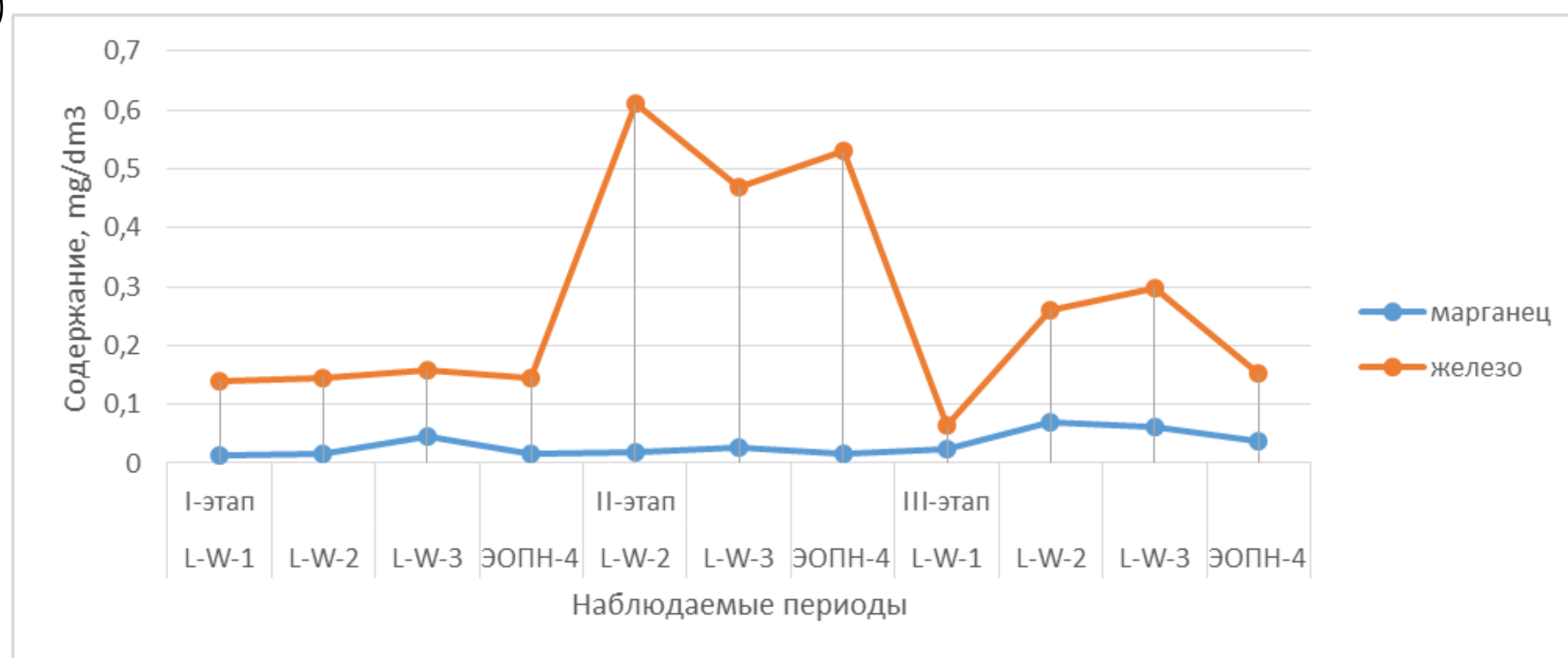


Fig. 3. Dynamics of changes in the content of manganese and iron in the surface water of the Khongaronsai River for I, II and III stages of 2022.



Surface water of the Khongaronsai river (L-W-3).

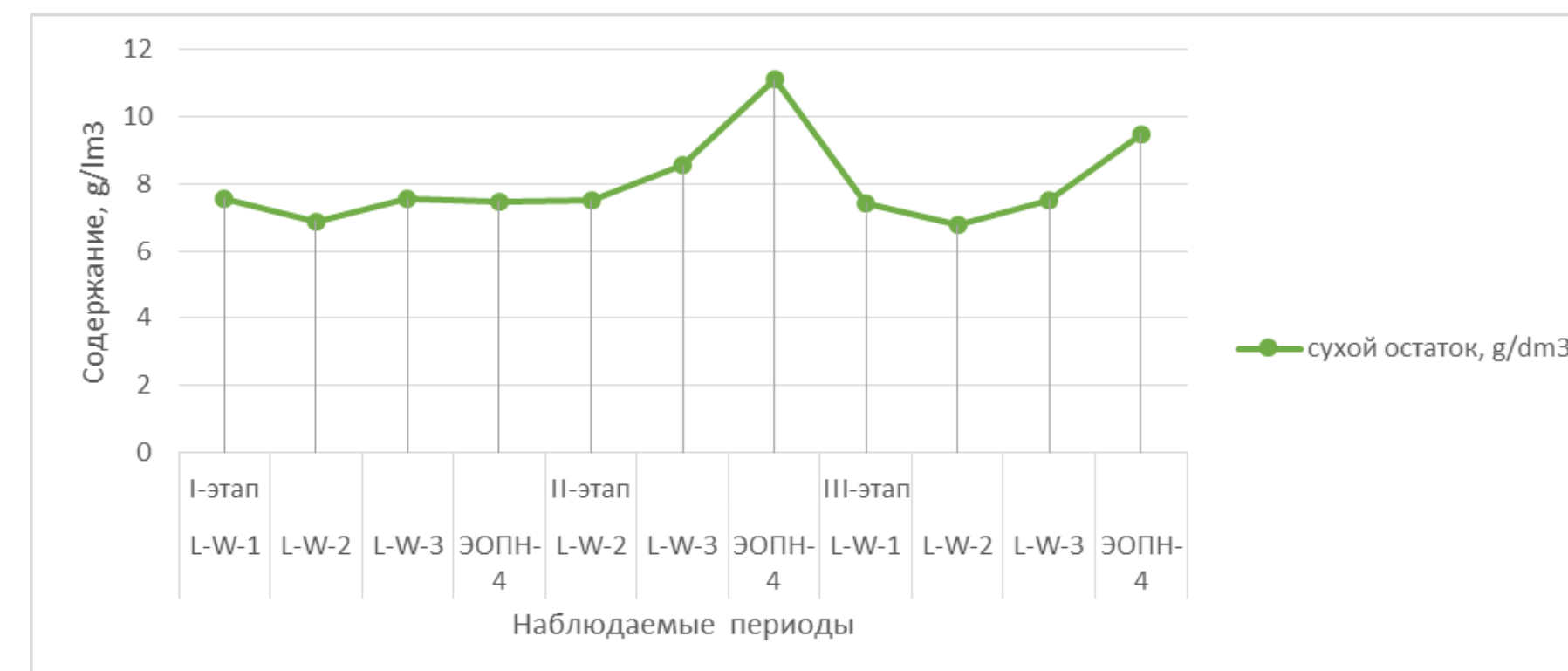


Fig.4. Dynamics of change in dry residue content in the surface water of the Khongaronsai River for I, II and III stages of 2022

In surface water, the dry residue is at the level of 6.78-11.12 g/dm³ and depends on the season and water content of the reservoir. The maximum content of dry residue was noted at stages II and III at the river station of environmental base observation station EOPN-4 (Fig. 4).

It should be noted that the discharge of wastewater into the surface water of Khongaronsai from the Operator's production activities is not provided for and is not allowed, therefore, Khongaronsai's watercourses do not experience man-made impacts from the Operator's facilities under construction at "Mustakillikning 25 Yiligi" field.

4. RESULTS OF ENVIRONMENTAL MONITORING.

4.4 Monitoring of soils and subsoils condition.

At each stage of observations, 140 soil and subsoil samples were taken. Diagnostics of the general condition of the soil cover and subsoils, the content of pollutants in them was carried out according to organized system of observations.

In the soils and subsoils of the background integrated observation stations, with a slight increase in the total salt content, no noticeable deviations in the content of oil products, chlorides, sulfates, calcium, magnesium, and sodium were noted. The results are quite consistent with the data obtained earlier (including in 2021).

At local observation stations for soils and subsoils L-S-1 and L-S-3, an excess of MPC for sulfates up to 1.9 times, an excess of background values for chlorides up to 1.5 times, calcium up to 1.7 times, magnesium up to 2.5 times and comparable oil products content were identified.

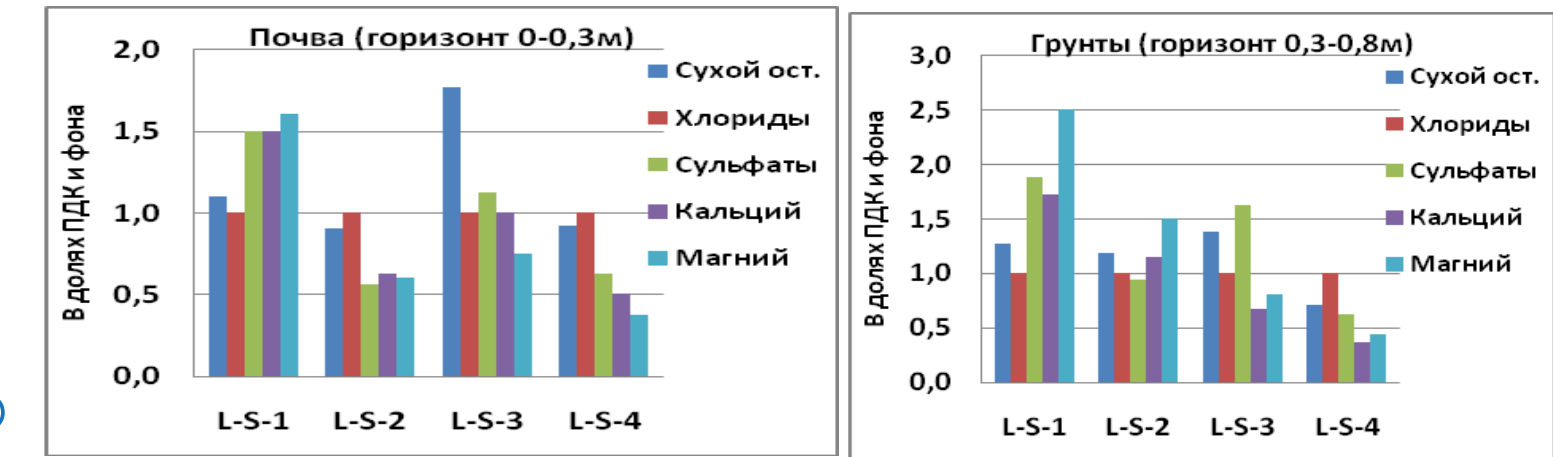
Production monitoring of wells was carried out in soils and subsoils at three local points: near the wellhead, the drilling mud pit and the location of fuel and lubricants.

The content of dry residue of water extract from soils and subsoils ranged from 0.118% to 3.372%, which confirmed weak, medium and strong salinization of soils and subsoils. The highest contents were noted at the wellheads K-3, K-8, K-9 and K-10. Strong salinization of soil and subsoil of Kognysai-1 was revealed at all local observation stations.

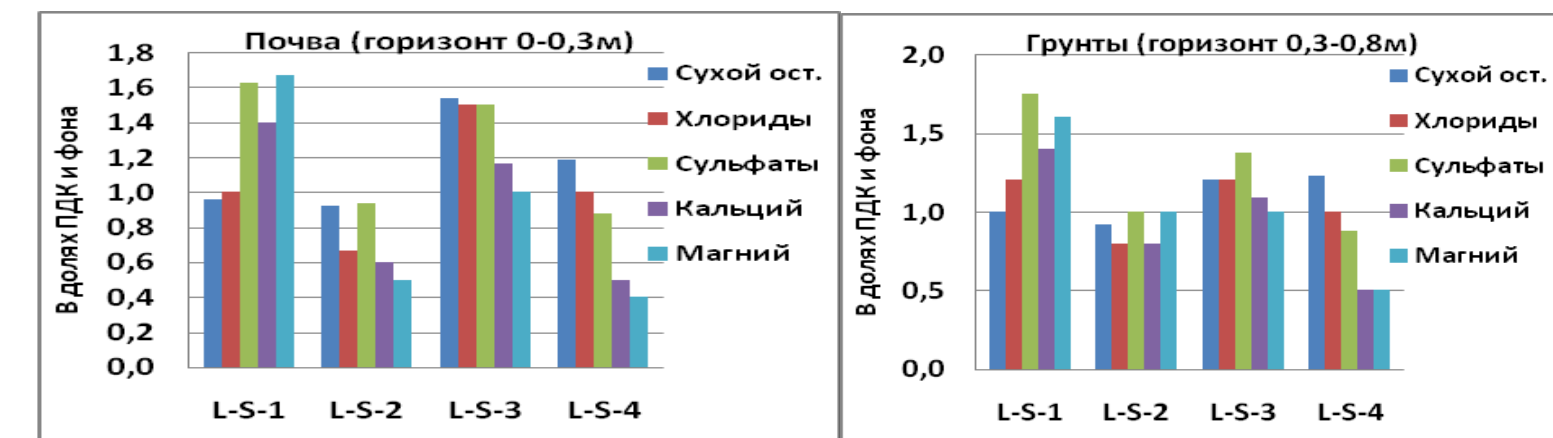
In the soils and subsoils of all the studied local stations, an increased content of chlorides, sulfates, calcium, magnesium is noted (the highest at stage III is near the wellhead K-10).

In the soils the following has been established: exceeding the MPC for sulfates reaches 33.9 times; exceeding the background values for chlorides, calcium, magnesium, respectively, up to 310.0 times, 26.0 times and 8.0 times. In subsoils, the following was established: the excess of MPC for sulfates reaches 31.9 times; background values for chlorides, calcium, magnesium respectively 234.0 times, 51.0 times and 5.6 times. (Fig. 5)

I stage of observations



II stage of observations



III stage of observations

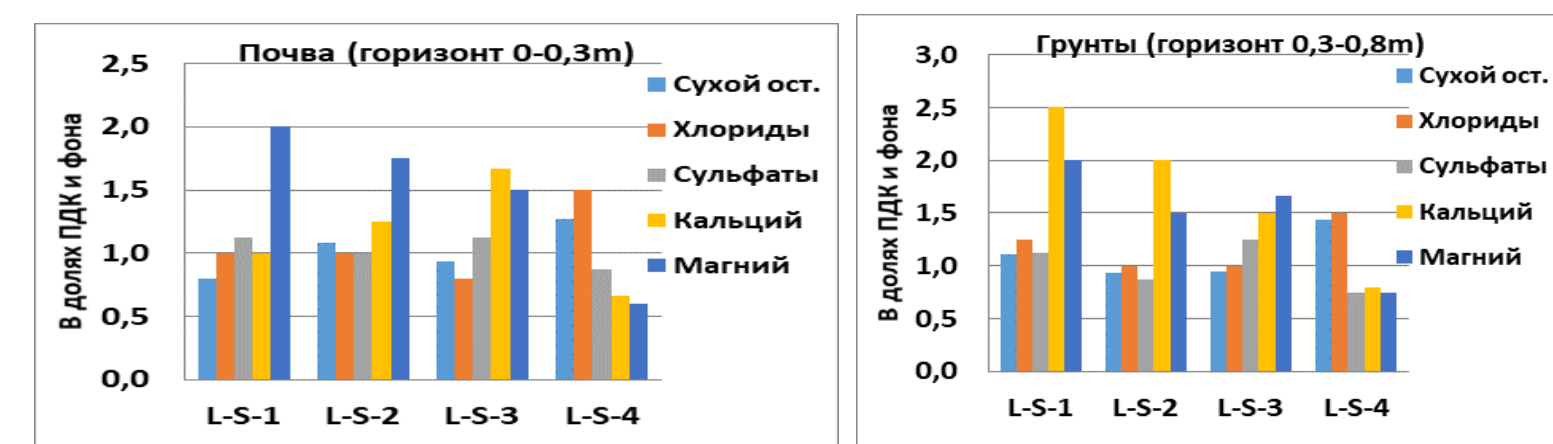


Fig. 5. The content of ingredients in soils and subsoils at local observation stations (in fractions of MPC for sulfates, in fractions of background for dry residue, chlorides, calcium, magnesium) at stages I-II and III of observations in 2022.

Oil pollution of local stations of well pads in the humus horizon was 0 - 161.040 mg/kg, in subsoils 0 - 117.200 mg/kg. (Figure 6.)

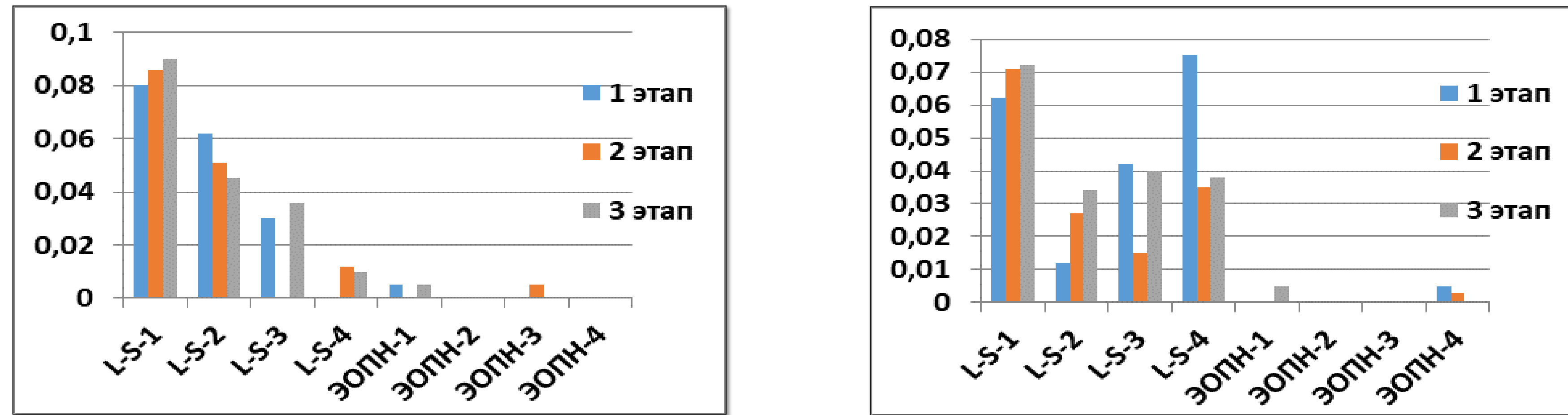


Fig. 6. The content of oil products in soils and subsoils at local and background stations (in mg/kg) at stages I, II and III of observations in 2022.

The results of studies of soils and subsoils showed changes in the salt composition: in the total amount of salts, in the ratio of components and their distribution over the soil horizon. The instability of indicators of ingredients is obviously associated with seasonal redistribution of components between the layers of soil and subsoil under the influence of precipitation and temperature fluctuations in the air.

The established presence of oil products in soils and subsoils is of a man-caused nature and is associated with ongoing operational work, storage of drill cuttings, placement and use of fuels and lubricants.

Conclusion: Based on results of laboratory studies, there was no significant impact on the condition of soils and subsoils during oil and gas operations at "Uzbekiston Mustakilligi" Investment Block according to observations.

4.5. Environmental radiation monitoring

Environmental monitoring was carried out: at four environmental base observation stations (No. 1, 2, 3, 4) and four local observation stations (L-S-1, L-S-2, L-S-3 and L-S-4).

During the first stage of industrial environmental control during the construction of wells, to study the radiation situation on the territory of the site, measurements of external gamma radiation exposure rate were carried out at 13 stations, and soil and subsoil samples were taken from two horizons (from a depth of 0-30 cm and 30-80 cm) to determine the "Total specific alpha activity", as well as at 8 stations and at 5 monitoring stations, water samples were taken to determine the content of natural radionuclides ^{226}Ra , ^{222}Rn and ^{238}U . The values of external gamma radiation exposure rate and total specific alpha activity at the site do not exceed the background values and permissible sanitary standards.

During the third stage of industrial environmental monitoring, in order to study the radiation situation in the territory of the site, measurements of external gamma radiation exposure rate were carried out at 12 stations, soil and subsoil samples were taken from two horizons at 8 stations (from a depth of 0-30 cm and 30-80 cm), and measurements were taken to determine "Total specific alpha activity", and water samples were taken at 4 monitoring stations, and the content of the natural radionuclide ^{226}Ra , ^{222}Rn and ^{238}U was determined. The values of external gamma radiation exposure rate and total specific alpha activity of soils and subsoils and the content of natural radionuclides in water samples comply with the requirements of SanPiN No. 0193-06 (NRB-2006).

Conclusion: Based on the results of performed radiation monitoring, no monitoring station exceeded the established standards for radiation and environmental indicators, all radiation parameters in water and soil and subsoil are much lower than the standards. Radionuclide contamination of water resources and soils on the territory of "Uzbekiston Mustakilligi" investment block was not recorded.

4.6. MONITORING OF TEMPORARY PRODUCTION AND CONSUMPTION WASTE COLLECTION AREAS

Waste is mainly associated with performance of such works as: drilling, well casing, which is accompanied by formation of drilling mud. All generated drilling mud enters a waterproofed sludge pit, neutralized with reagents, by curing, followed by burial in a sludge pit. Formation of production waste is temporary in nature - only during well construction.

The results of visual inspection of production and consumption waste storage areas at "Uzbekiston Mustakilligi" investment block showed the implementation of planned environmental measures in terms of waste.

The state of storage areas during oil and gas operations at wells at the time of departmental environmental monitoring is satisfactory.



5. RESULTS OF BIOLOGICAL MONITORING

Biological monitoring was carried out on representative sites of each of the 4 environmental zones, characterized by homogeneous natural conditions, landscape, sources and degree of pollution.

For environmental monitoring of flora and fauna objects, 6 representative sites were allocated for the Northern zone, 4 for the Eastern zone, 3 for the Western zone, 4 for the Southern zone.

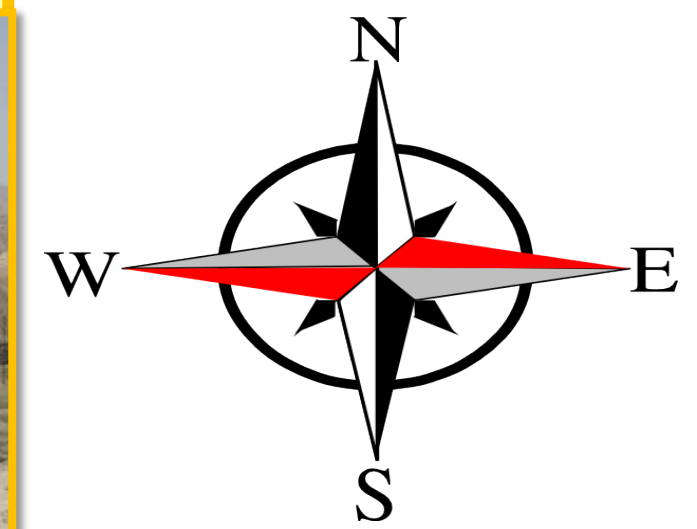
III-zone - Western - a zone of moderate development of low mountains in the upper reaches of Alankutansai.

Monitoring of the state of the flora was carried out at representative biodiversity sites within the borders of environmental base observation station No. 3 and local stations L-A-4, L-W-3. Zone III landscape is dry slopes of foothills and ravine with sandstone outcrops, with area of rainfed land.



I-zone - Northern - zone of active agricultural landscape.

The Northern environmental zone covers the left bank of the Khongaronsai (Tashkupriksai), there are 1 background monitoring station for environmental base observation station No. 1 and 5 local monitoring stations L-A-1, L-A-2, L-S-1, L-S-2, L-W-1 in its outline. The landscape of zone I is represented by an agricultural landscape (rainfed fields and deposits) and slopes of hilly foothills (adyrs), dissected channels of temporary streams and dry ravines with sandstone outcrops



II-zone - Eastern - zone of moderate development of adyrs and low mountains of the left bank of the Khongaronsai.

Monitoring of the state of flora was carried out on representative biodiversity sites within the borders of environmental base observation station No. 2 and local stations L-W-2, L-S-3, L-A-3.

The Eastern zone covers the middle reaches of the Khongaronsai (Tashkupriksai), including the channel, the riverbed part of the right and left banks of the sai, dry dissected slopes of foothills and ravines with sandstone outcrops, with a much more dissected relief than biotope-I, and with small areas of rainfed deposits.

IV-zone-Southern - the valley of the lower reaches of the Alankutansai.

Monitoring of the state of the flora was carried out at representative biodiversity sites within the borders of environmental base observation station No. 4 and local stations L-A-5, L-S-4, L-W-4. The landscape of zone IV is dry, relatively gentle and slightly dissected slopes of foothills and a shallow dry ravine with sandstone outcrops, sandy loamy soil.



4.7. Flora

In general, the vegetation cover of the surveyed area has an average degree of disturbance and retains the ability to self-regeneration. In the course of environmental monitoring, it was revealed that the main man-made factors affecting the vegetation cover of the territory of "Uzbekiston Mustakilligi" investment block are intensive grazing and rainfed agriculture.

In the vegetation cover of the surveyed area, the composition of natural dominants and subdominants was mainly preserved. The total projective cover is more often than 25% (it fluctuates between 15–45%), which is explained by both heavy grazing and arid conditions of the territory. Everywhere in the composition of plant communities there is a significant abundance of xerophytic species, ephemera and weeds.

- As a result of the survey, 124 plant species were identified;
- In the course of field surveys, the following species listed in the Red Book were found:
Tulipa tubergeniana and *Gynandiris sisyrinski*;
- It has been established that more than 50% of the species composition of the flora of the territory is associated with specific and limited habitats of river valleys, canyons and dry ravines with sandstone outcrops;

Conclusion: In general, the vegetation cover of the surveyed area has an average degree of disturbance and retains the ability to self-regeneration.



Tulipa tubergeniana
Environmental Base
Observation Station №1
(blooming period, March,
2023)



Gynandiris sisyrinski
Environmental Base
Observation Station №1
(blooming period, March, 2023)



4.8. Fauna

According to the results of environmental monitoring and industrial environmental control over the state of wildlife on the territory of the Investment Block in 4 conditionally divided environmental zones, at environmental base observation stations and representative observation sites, only 45 species were recorded (including 1 species of fish, 8 species of reptiles, 32 species of birds and 4 mammal species), which is 13 more than in 2022.

➤ Of the background species, 7 species were noted during surveys: Bogdanov sand gecko (*Tenuidactylus bogdabovi*), Turkestan agama (*Paralaudakia lehmanni*), Striped racerunner (*Eremias lineiolata*), Tajik racerunner (*Eremias regeli*), Crested lark (*Galerida cristata*), Eastern mole vole (*Ellobiustancrei*) and Libyan jird (*Meriones libycus*);



Bogdanov sand gecko
(*Tenuidactylus bogdabovi*)



Turkestan agama
(*Paralaudakia lehmanni*)



Striped racerunner
(*Eremias lineiolata*)



Crested lark
(*Galerida cristata*)

➤ Besides, Eastern mole volery (*Ellobiustancrei*) and Libyan jird volery (*Merioneslibycus*) were detected;



Eastern mole vole
(*Ellobiustancrei*)



Eastern mole volery
(*Ellobiustancrei*)



Libyan jird
(*Merioneslibycus*)



Libyan jird volery
(*Merioneslibycus*)

Fauna

- The indicator species include See-see partridge (*Ammoperdix griseogularis*), Large rock nuthatch (*Sitta tephronota*), Myna (*Acridotheres tristis*), Raven (*Corvus corax*) and Fox (*Vulpes vulpes*).



See-see partridge
(*Ammoperdix griseogularis*),



Large rock nuthatch
(*Sitta tephronota*)



Common myna
(*Acridotheres tristis*)



Raven (*Corvus corax*)



Fox (*Vulpes vulpes*)

- In the Northern Ecological Zone, Tolai hare (*Lepus capensis tolai*) and Marinka fish (*Schizothorax*) were met, which had not been previously noted during the environmental surveys of 2019-2021.



Tolai hare
(*Lepus capensis tolai*)



Marinka fish
(*Schizothorax*)



The summer period of 2022 was characterized by abnormally high temperatures and low water levels of sais and streams, which led to the drying up of all surveyed channels in all environmental monitoring zones. This situation adversely affected the state of fauna representatives.

An equally important factor determining the well-being of populations and the abundance of species is the man-made and technogenic impact on the environment. Currently, drilling and construction work is being carried out on the territory of "Uzbekiston Mustakilligi" Investment Block for construction of BGPP, shift camp and other related infrastructure facilities. As a result, animals lose their usual habitats and begin to move in search of the most suitable place.

Compared to 2021, in 2022 the scale of the man-made impact associated with OGO has increased. However, the technogenic impact as a whole has a local scale, areas with mechanical damage or destruction of vegetation are noted in a line of up to 20–30 m along the roads, gas pipeline, within a radius of up to 50–100 m near the wells and the shift camp. In such areas destitute of vegetation, for example, on embankments of the road, there are erosion processes.

In order to organize permanent departmental monitoring of the state of wildlife on the territory of "Uzbekiston Mustakilligi" Investment Block, HSE Division of Operator has established a system for maintaining observation sheets for wildlife objects.

5. Conclusions

Owing to implementation of environmental measures, as well as regular industrial environmental control and monitoring of technological processes and facilities, condition of the atmospheric air, surface and ground water, soils and subsoils, in 2022 we can note the absence of direct and noticeable impact on the environment from the activities of SURHAN GAS CHEMICAL OPERATING COMPANY FC LLC.

The results of environmental monitoring in 2022 showed that the state of flora and fauna outside the areas allocated for construction work remains stable, no significant man-made and technogenic impacts on the atmospheric air, water environment, soil, flora and fauna of the contract areas have been identified.



THANK YOU FOR YOUR ATTENTION!