

Geoecological monitoring of the “Mustaqillikning 25 yilligi” gas field

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Abstract. The article analyzes an unified system of results of state geoecological monitoring at a gas field in southern Uzbekistan, highlights problematic geoecological aspects in the exploration and development of gas fields of this system, and explores the legal basis for the activities of subjects of the state environmental monitoring system. The necessity of changing and supplementing the legislation is indicated for more effective management of nature and ensuring geoecological safety with the help of the Geoenvironmental monitoring system. The necessity of creating a regional system of geoecological monitoring is substantiated and equipped with modern software for online monitoring of the state of the environment in Surkhandarya region.

1 Introduction

In accordance with the approved environmental monitoring program agreed with the State Committee for Ecology of the Republic of Uzbekistan in 2021, studies were carried out to assess the environmental impact of the following oil and gas operations:

- Drilling and testing of wells at “Mustakillikning 25 yilligi” field in South Uzbekistan, in particular, Surkhandarya region;
- Objects of environmental monitoring are:
 - atmosphere;
 - surface reservoirs and streams;
 - soil, subsoil and landscape of the area;
 - radiation environment;
 - production waste and consumption;
 - flora and fauna.

The purpose of environmental monitoring is to assess the state of the environment, flora and fauna in the course of oil and gas operations for subsequent analysis of the impact of ongoing Oil and Gas operations, as well as to ensure the state of the environment in the area of activity.

The tasks are:

- the assessment of the actual state of natural environment;

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

The complex of environmental studies includes a field survey of the terrain, vegetation and animals, sampling of soils and subsoils, surface and ground waters, atmosphere, along with appropriate laboratory analyses, processing of results and issuance of conclusions.

The map shows the regime stations of eco-audit 2017-2018 (EA 2017) points of Eco monitoring 2021.

At each local and background observation point, in accordance with the calendar schedule, samples of atmosphere, surface waters, soils were taken, and radiation measurements were also carried out [1-11].

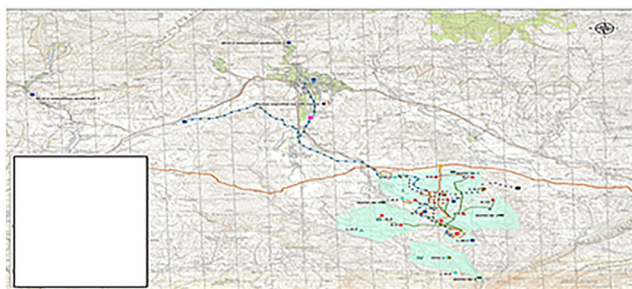


Fig. 1. Schematic map of the investment block "Uzbekiston Mustakilligi" of Surkhandarya region.

2 Results of environmental monitoring of the state of atmosphere

The studies were carried out at 4 EONPs (No. 1, 2, 3, 4) and 4 local observation points (L-A-1, L-A-2, L-A-3 and L-A-4) and 10 well pads (K- 1, K-2.....K-10).

The level of atmosphere 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 atmosphere of populated areas on the territory of the Republic of Uzbekistan".

The results of studies of the composition of atmosphere indicated the following.

- The content of such pollutants as carbon monoxide, sulfur dioxide and nitrogen dioxide in the atmosphere of the entire surveyed territory was not detected, except for isolated cases when the content was at a level of up to 0.4 MPCm.r.;
- The content of carbon monoxide in the atmosphere of the entire surveyed territory, both at stages I and II of observations, did not exceed the established MPC level; at the second stage of observations, its concentrations decreased compared to the previous stage and for the entire period was within 0.01 - 0.4 MPC m.r.;

In general, the above values of carbon monoxide, sulfur dioxide, nitrogen dioxide are lower than the established normative values and these data correspond to the values recorded in the given territory during the environmental audit of 2017 and the values of environmental monitoring of previous years. The content of inorganic dust ranged from 0.05 to 0.9 MPC m.r., its concentration increased depending on the strengthening of wind gusts in the territory at the time of research [12-15] (Figure 2).

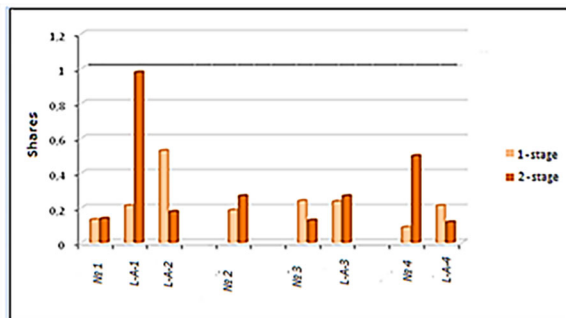
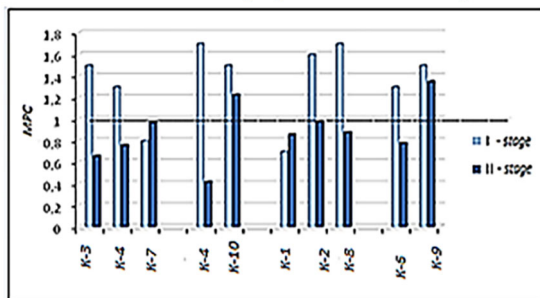


Fig. 2. The content of inorganic dust in the atmosphere of the surveyed area for stages I and II of 2021.

An increased content of hydrogen sulfide in atmosphere of the surveyed area was recorded only at two local observation points and one EOPN, on the territory of well pads, an increased content of hydrogen sulfide was recorded only on the territory of K-10 and K-9, in the rest of the surveyed territory its concentrations were decreased comparing to the first stage observations and were fixed lower than the established normative value.

- The data obtained during the monitoring the air for the content of hydrogen sulfide in it in current year is slightly higher than the indicators of the environmental audit of 2017 and environmental monitoring conducted in 2021, when its maximum concentration was fixed at the level of 0.6 MPC m.r., however, they are lower recorded concentrations of hydrogen sulfide during environmental monitoring in 2019, when its maximum concentration was at the level of 2.0 MPC m.r. It should be noted that deviations are temporary and the level of hydrogen sulfide in the atmospheric air decreases (dissipates) upon completion of work and concentration of wells. Of the hydrocarbons, as in previous years (2017-2021), only methane was detected in the atmospheric air, however, its concentrations do not exceed the tentatively safe exposure levels (SLI).
- According to the results of field and laboratory studies in summer and autumn periods, there was no significant impact on the atmospheric air during oil and gas operations at “Uzbekiston Mustakilligi” investment block.

In general, the results of the research showed that the level of 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 the EA in 2017. It can be concluded that air does not experience an increased anthropogenic and techno genic load [16-21].



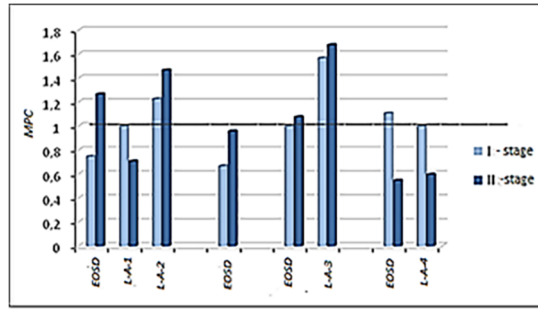


Fig. 3. a) and b) The content of hydrogen sulfide in the atmosphere of the surveyed area for stages I and II of 2021.

3 The results of environmental monitoring, the state of surface waters

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

In the surface waters of Hongaransai within the Contract area, mineralization is up to 6.3-9.38 g/dm³ (stage I) and up to 6.2-8.99 g/dm³ (stage II), a high content of suspended solids, nitrogen, COD, chlorides, petroleum products, phenol, sulfates, manganese and iron. The increase in the amount of salts in the water is associated with the flow of saline groundwater through the channel and the absence of precipitation. On Figure 4 the dynamics of the content of pollutants are shown in the surface waters of Hongaransai within the Contract area.

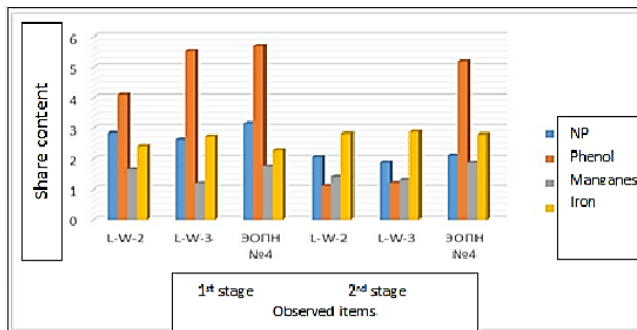


Fig. 4. Dynamics of the content of pollutants in the surface waters of Hongaransai within the Contract area.

It should be noted that the discharge of wastewater into the surface waters of Hongaransai from the Operator’s production activities is not provided for and is not allowed, therefore, the watercourses of Hongaransai do not experience anthropogenic impacts from the facilities under construction at “Mustakillikning 25 Yiligi” field.

3.1 Monitoring of the state of sub soils

The content of dry residue of water extract soils ranges from 0.044% to 0.864%, subsoils from 0.042% to 0.890%, which indicates low and medium salinity of soils and subsoils.

The content in the soil of local points (near the wellhead, the pit of drilling waste and the location of fuel and lubricants) of sulfates is higher than the MPC up to 16.8 times, chlorides, calcium, magnesium is higher than the background up to 24.7 and 15.2 respectively.

The content of sulfate in the soil of local points above the MPC by 17.6, calcium and magnesium chlorides are above the background up to 78.2, 33.2 and 14.0 respectively.

Oil pollution of local points of well pads in the humus horizon ranged from 0.025 mg/kg to 3.540 mg/kg, in soils from 0.010 mg/kg to 26.440 mg/kg.

At the GPP construction site, no abnormal excesses of the analyzed components in soil and subsoil were detected.

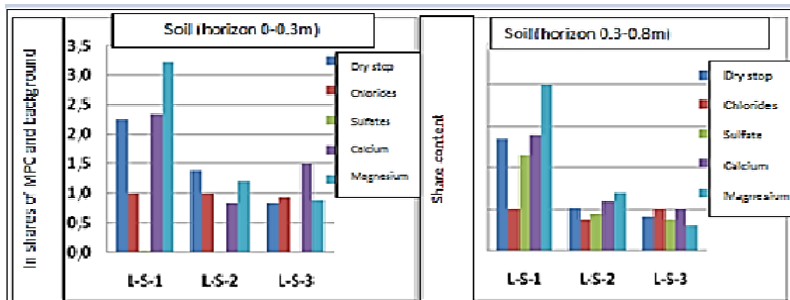


Fig. 5. The content of ingredients in soil and subsoil at local observation stations (in shares of MPC for sulfates and in shares of the background for dry residue, chlorides, calcium, magnesium) at the 1st stage of observations in 2021.

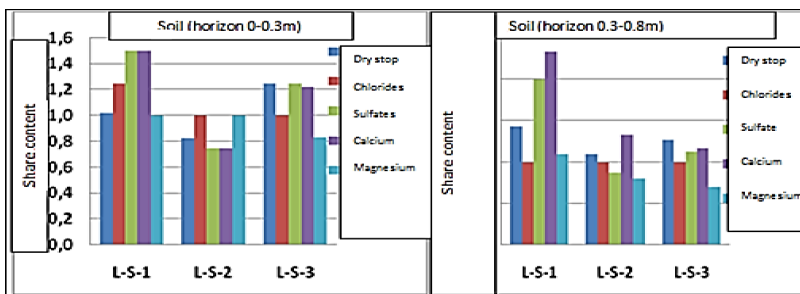


Fig. 6. The content of ingredients in soil and subsoil at local observation stations (in shares of MPC for sulfates and in shares of the background for dry residue, chlorides, calcium, magnesium) at the 2nd stage of observations in 2021.

Environmental monitoring was carried out at four EONPs (No. 1, 2, 3, 4) and three local observation points (L-S-1, L-S-2 and L-S-3).

Between the results of the content of these ingredients, there are differences in some local stations in the direction of increase. The increased content of sulfates, calcium chlorides, magnesium in soil and subsoil of observation stations is caused by the use of bulk soil with a significant salt content in the preparation of sites.

Relying on the data of 2019-2020, the salt composition of soil has also changed upwards. These changes in the contents are also associated with seasonal fluctuations of the components, their redistribution between the humus layer and soils.

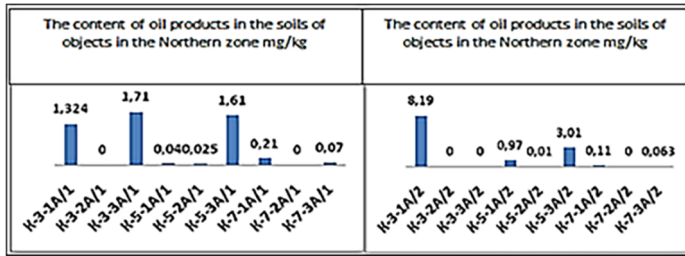


Fig.7. The content of oil products in soil and ground at local observation points of the Northern zone (mg/kg) at the 1st stage of observations in 2021.

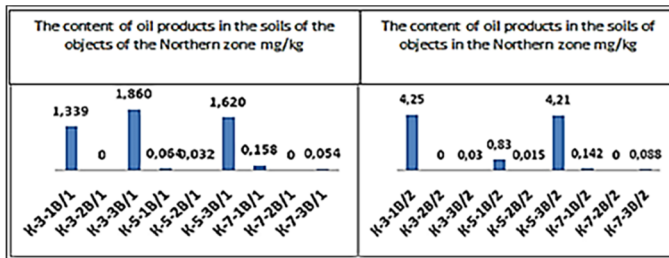


Fig. 8. The content of oil products in soil and ground at local observation points of the Northern zone (mg/kg) at the 2nd stage of observations in 2021.

A slight increase in the content of oil products in soil and subsoil of well pads in 2021 is associated with ongoing operational work, storage of drill cuttings, placement and use of fuels and lubricants (fuel and lubricants) and is defined as techno genic.

It should be noted that the above-mentioned anthropogenic factors will be eliminated as a part of the reclamation of the drilling site after completion of drilling operations, in accordance with the design requirements/decisions for the construction of wells, the Regulations for the neutralization/disposal of drilling waste at the completion stage (dismantling, conservation of the well, reclamation of the site).

Based on the results of the laboratory studies, it can be concluded that there was no significant impact on the condition of soil and subsoil during oil and gas operations at the Investment Block "Uzbekiston Mustakilligi" at the 1st and 2nd stages of observations.

3.2 Environmental-radiation monitoring

In the period of industrial environmental monitoring during the construction of wells, studying the radiational situation on the territory of the site, measurements of the EDR (equivalent dose rate) of external gamma radiation were carried out at 10 stations, and soil samples were taken from two horizons (from a depth of 0-30 cm and 30-80 cm) to determine the "Total specific alpha activity (TSAA)", as well as at 7 stations (at stage I) and at 6 stations (at stage II) of monitoring, water samples were taken to determine the content of natural radionuclides ²²⁶Ra, ²²²Rn and ²³⁸U. The DER values of external gamma radiation and TSAA at the site do not exceed the background values and permissible sanitary standards.

On the territory of the Contract area, at 7 observation points (Stage I) and at 6 observation points (Stage II), wastewater samples were taken and gamma spectrometric studies of the selected water samples were carried out to determine natural radionuclides: gross content of uranium-238, radium-226 and radon-222 (²²⁶Ra, ²²²Rn and ²³⁸U). The values of DER for external gamma radiation from soil and the content of natural radionuclides in water samples comply with the requirements of SanPiN No. 0193-06 (NRB-2006).

Based on the results of conducted radiation monitoring, none of the monitoring stations exceeded the established standards for radiation and environmental indicators, all parameters in water and soil were much lower than the standards. Radionuclide contamination of water resources and soil on the territory of the investment block "Uzbekiston Mustakilligi" was not recorded.

3.3 Monitoring of temporary collection sites for production and consumption waste.

Waste is mainly associated with the production of such works as drilling, well casing which is accompanied by the formation of drilling waste. All generated drilling waste enters a waterproofed sludge pit, neutralized with reagents by curing and followed by burial in a sludge pit. The formation of production waste is temporary in nature - only during the construction of the well [6-8].

The results of a visual inspection of the places of storage, production and consumption waste at the Investment Block "Uzbekiston Mustakilligi" showed the implementation of the planned environmental measures in terms of waste.

The state of storage sites during oil and gas operations at wells at the time of the departmental.

4 Results of biological monitoring

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

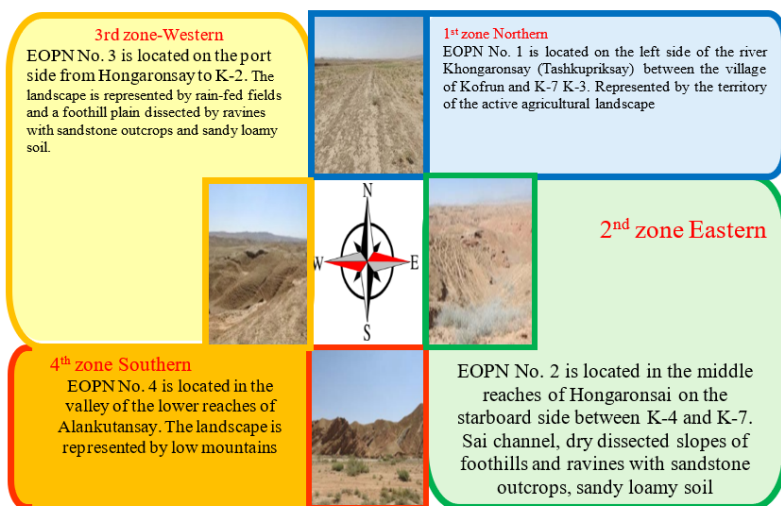


Fig. 9. Results of biological monitoring at representative sites of each of the 4 ecological zones.

5 Results of biological monitoring of flora

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 [9-11].



Fig. 10. Klimakoptera fleshy (blooming phase, October 9, 2021). Deposits "M-25" Surkhandarya region. K No. 2, well 2-OE.



Fig. 11. Multi-branched comb. Deposits "M-25" Surkhandarya region. K 8 -OE.

As a result of the survey, 97 plant species were identified. Red Book plant species were not found on the routes during field surveys.

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.

In general, the vegetation cover of the surveyed area has an average degree of unresolved and retains the ability to self-repair.

6 Results of biological monitoring of the fauna

Among them, 8 species are listed in the Red Book of the Republic of Uzbekistan (2019) and the lists of the Convention on International Trade in Endangered Species of Wild Fauna (CITES): Central Asian tortoise (*Testudo horsfieldi*), Gray monitor lizard (*Varanus griseus*). RDBUz,VU, IUCN:[VU], CITES I, Turkestan Agama (*Paralaukadia lehmanni*), CITES, Steppe Agama (*Trapelus sanguinolentus*), CITES, Vulture (*Neophron percnopterus*), RDB Uz, EN, IUCN:[EN], CITES II, Bearded Vulture (*Gypaetus barbatus*), RDB Uz, NT, IUCN:[NT], CITES II, Griffon Vulture (*Gyps fulvus*) RDB Uz, NT, IUCN:[NT], CITES II, Buzzard (*Buteo rufinus*), CITES.

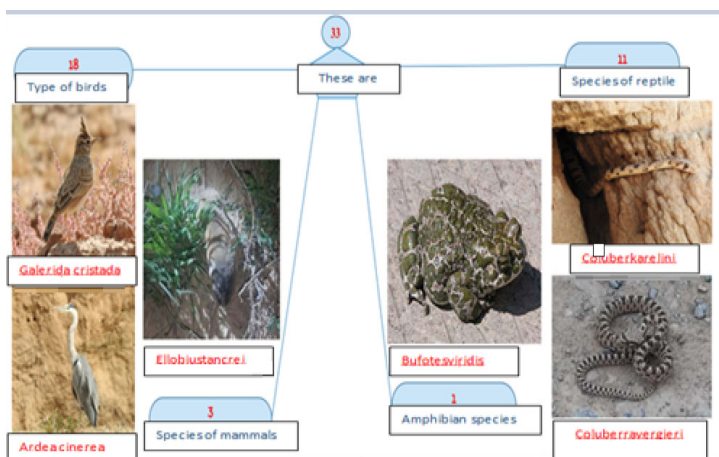


Fig. 12. Results of biological monitoring animal world.

6.1 Biological monitoring

The summer period of 2021 was characterized by abnormally high temperatures and low water levels of sairs and streams, which led to the drying up of all surveyed channels in all ecological monitoring zones. This situation adversely affected the state of representatives of the animal world. As a result, a significantly lower number of species were noted in the first and second stages compared to the 2020 final report data. An equally important factor determining the well-being of population and the abundance of species is the anthropogenic and technogenic impact on the environment. At this period, drilling and construction work is being carried out on the territory of the Investment Block "Uzbekiston Mustakilligi" for the construction of a gas processing plant, a rotational 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. To organize continuous departmental monitoring of the state of the wildlife on the territory of "Uzbekistan Mustakilligi", the Operator's Department of Safety, Health and Environmental Protection have established a system for maintaining observation sheets for wildlife objects.

7 Conclusion

Thanks to the implementation of environmental measures, as well as regular industrial environmental control and monitoring of technological processes and objects of the state of air, surface and ground water, soil and subsoil, in 2021 it can be noted the absence of a direct and tangible impact on the environment. The results of environmental monitoring in 2021 showed that the state of the flora and fauna outside the areas allocated for construction work remains stable, and no significant anthropogenic and man-made impacts on the atmospheric air, aquatic environment, soil, flora and fauna of the contract areas have been identified.

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