

UDC 502

*A. P. GINKUL, S. P. KRIVILEVA***DECREASING OF THREATS TO THE CONDITION OF ENVIRONMENT OF TURKMENISTAN AT THE HYDROCARBON AND MINERAL RAW MATERIALS MINING**

Проаналізовані основні екологічні проблеми Туркменістану, викликані використанням екологічно небезпечних методів розвідки і видобуванні вуглеводневої і мінеральної сировини. Розглянуті основні методи видобування і транспортування нафти, газу і мінеральної сировини, що використовуються у Туркменістані, і екологічні наслідки їх застосування. Виявлені головні причини погіршення природного середовища Туркменістану при видобуванні вуглеводнів на шельфі Каспійського моря. Сформульовані пріоритетні напрями подальшого підвищення екологічної безпеки у нафтогазовому секторі і при видобуванні мінеральної сировини: широкомасштабне впровадження у виробництво новітніх енергоефективних технологій і останніх здобутків світової науки за усім циклом виробництва – від геологорозвідних робіт і розробки родовищ до транспортування і використання природних ресурсів.

Ключові слова: вуглеводнева сировина, родовища, методи розвідки, буріння, екологізація видобування сировини, деградація почв, порушення ландшафту, опустелювання, біорізноманіття.

Проанализированы основные экологические проблем Туркменистана, вызванные использованием экологически опасных методов разведки и добычи углеводородного и минерального сырья. Перечислены основные используемые в Туркменистане методы добычи и транспортировки нефти и газа и экологические последствия их применения. Выявлены основные причины ухудшения природной среды Туркменистана при добыче углеводородов на шельфе Каспийского моря. Сформулированы приоритетные направления дальнейшего повышения экологической безопасности в нефтегазовом секторе и при добыче минерального сырья : широкомасштабное внедрение в производство новых передовых энергоэффективных технологий и последних достижений мировой науки по всему циклу производства – от геологоразведочных работ, освоения и разработки месторождений до транспортировки, хранения и использования природных ресурсов.

Ключевые слова: углеводородное сырьё, месторождения, методы разведки, бурение, экологизация добычи сырья, деградация почвы, нарушение ландшафта, опустынивание, биоразнообразия.

The main ecological problems of Turkmenistan caused by the use of environmentally hazardous methods of exploration and production of hydrocarbon and mineral raw materials are analyzed. The main methods used in Turkmenistan for the extraction and transportation of oil and gas and the environmental consequences of their use are listed. The main causes of the deterioration of the natural environment of Turkmenistan during the extraction of hydrocarbons on the shelf of the Caspian Sea have been identified. Technological innovation in the exploration and production sector has equipped the industry with the equipment and practices necessary to continually increase the production of natural gas to meet rising demand. Hence formulated the prior areas for further rising of environmental safety in the oil and gas sector and extraction of mineral raw materials: wide introduction into the production of new innovative energy-efficient technologies and the latest achievements of the world science in the entire production cycle - from geologic explorations, development and development of production to transportation, storage and use of natural resources.

Keywords: export of hydrocarbon raw materials, equipment, Turkmen gas, exploration methods, drilling, dangerous extraction of raw materials, open manner extraction, greening of raw materials extraction, soil degradation, landscape disturbance, desertification, binding.

Introduction. Currently the mining and processing of hydrocarbon and mineral raw materials is the basis of the Turkmenistan economy. The state of affairs in the oil and gas industry largely determines the state of the entire economy of the country; the main source of income and the main source of foreign exchange earnings is the export of hydrocarbon raw materials and products of its processing. The structure of the oil and gas industry is dominated by the gas industry: Turkmenistan accounts for 11.7 % of proven global gas reserves and 1.2 % of its global production. As of October 1, 2011, the total geological reserves of natural gas and oil in the country were estimated at 71.21 billion tons (resource reserves of land deposits), and another 18.2 billion tons – the reserves of the sea shelf.

Since for decades, from the bowels of the Turkmen SSR, all mineral and raw materials have been systematically pumped out, and the republic (at the time of its entry into the USSR) was turned into a raw material appendage of more developed regions. The cost of compliance with

environmental requirements and the absence in the USSR of innovative technologies for drilling and production of raw materials led in those years to ignore the requirements of environmental protection and environmental safety due to the lack of scientific regulation of anthropogenic loads and an adequate subsoil use strategy, environmental degradation has become with creation in a number of regions (velayats) of a strained ecological situation that threatens the consequences for the health of the population of Turkmenistan. Serious threats to the entire Caspian region can be caused by potentially possible accidents and oil spills during the development of its reserves from the sea shelf [1]. It should be borne in mind that the main sources of pollution are the exploration of deposits, namely drilling and well equipment, as well as the related leakage, emergency emissions and associated water discharges, and oil refining effluents. To a much lesser extent, the impact of the actual operation of the wells: the extraction, transportation of oil, as well as its processing.

The collapse of the Soviet Union led to a collapse in demand for Turkmen gas, which was caused by the absence of its own main pipelines for its supply, and the liquidation by Russia of quotas set for Turkmen gas in Russian gas exports to the European market, and a decrease in the solvency of traditional markets, in particular Ukrainian markets. This led to the need for a drastic reduction in the volume of its production and, as a consequence, to the need to plug the wells. Diversification of gas export routes from the northern direction (to Russia) to the southern (to Iran) and the eastern (to China) led to a gradual increase and recovery of hydrocarbon production, but the predominant extensive development of the resource extraction industries and the irrational approach to processing raw materials (which led to excessive accumulation of waste) left a mark on the ecological situation in Turkmenistan [2]. By 2013, oil production has already reached 10 million tons per year, which is 0.006 % of global production. In total, Turkmenistan has identified 19 oil, gas-oil and 65 gas fields. In the northwestern regions of Turkmenistan, six small gas and several large oil fields have been identified.

The huge reserves of hydrocarbons and its wide production increase Turkmenistan's GDP and strengthen the country's economy as a whole, but the use of ecologically imperfect and therefore environmentally unsafe methods of exploration, production, transportation and processing of both hydrocarbons and other minerals seriously damages the state of the natural environment and public health. And the planned increase in production volumes, the introduction of new natural resources and conserved wells, the expansion of foreign economic relations require the development and introduction of an adequate modern mechanism for rational nature management, taking into account local specifics.

The purpose of this work is to study the current ecological situation in Turkmenistan and analyze threats to the state of the natural environment during the extraction of hydrocarbon and mineral raw materials.

Features of development of oil and gas fields in Turkmenistan. Exploration and operation of oil and gas fields and processing of hydrocarbon raw materials of Turkmenistan has its geological, geodynamic, technical and social regional features [3]. They make a significant contribution to the degradation of the environment. In terms of specific mortality, extraction, transportation and processing of hydrocarbons are among the "leading" areas: only ~ 5 % of people living near oil and gas enterprises do not complain about their health.

In the exploration of oil fields, the method of support drilling is used. The core, obtained from deep wells, is studied by layers. For this type of research, wells with a

depth of up to 7000 m are being drilled in promising areas. From one to several wells, from several dozen to several thousand wells – not only oil wells, but also control wells and drilling wells are drilled. The extracted oil is supplied to the pipeline and along it to the oil refinery.

In rotary drilling, the cut pieces of rock are raised to the surface with the help of working fluid circulating in the borehole. The applied chemical (so-called drilling) solutions promote not only the removal of particles to the surface, but also the formation of a mud cake on the walls of the well. These chemical solutions cause contamination of groundwater, soil and drinking water in the immediate vicinity of the drilling site.

Sometimes the drilling sites after the end of work resemble the places of nuclear catastrophe, turning into a zone of ecological disaster. When the well is opened, the oil under pressure starts to gush, but since this effect persists for a short time, then in the future, pumps are used to lift oil or inject compressed gas into the well. To increase the pressure in the formation, water is pumped into it. Horizontal wells are used for sub-gas zones and fields on the Caspian Sea shelf. At the same time, there is a risk of increasing seismic activity in the region. The increase in seismicity is associated with the extraction of oil: this leads to a change in the stress state of rocks in the massifs. For example, a strong earthquake with a magnitude of 6 points associated with oil production occurred in Western Turkmenistan in 1983: the Kumdag earthquake arose 20 years after the start of the Kumdag oil field development.

A very significant factor of pollution are associated (reservoir) waters, after separation they are discharged into natural ponds-evaporators – takyrs or barchanic depressions. Because of the oil film, the mass death of birds is sometimes observed on the surface of such "lakes", and because of their increased mineralization (exceeding in most cases 3,6 lb/in³) these waters slowly seep into the ground in the direction of groundwater movement instead of evaporation. Before the beginning of oil production, natural depressions in the terrain (takyr) should be used by the local population as a gathering place for drinking water. Now they are irretrievably spoiled (for example, on the Cheleken Peninsula) and water to the settlements have to be fed through many kilometers of waterways.

Methods of natural gas extraction. The extraction of natural gas is carried out only by the method of fountain operation of wells. After the location of the deposits is determined in the same way as the oil production technology, the well begins drilling with the introduction of a special drill and a working fluid – a solution. Due to natural energy, gas rises up to the surface of the earth, here it is collected in a pipeline and sent for processing. In the process of drilling operations, gas can also be released, as

well as during pumping through leaks in the gas pipeline. To date, reducing uncontrolled emissions is reduced to only two methods:

- a) controlled natural gas combustion;
- b) controlled release of gas into the atmosphere.

Both of them are environmentally unsafe and represent a vivid example of irrational use of natural resources. Significant impact on the deterioration of the quality of the surrounding natural and urban environment is caused by noise and vibration that occur at all stages of work. The use of various structural and engineering techniques leads to intensive soil degradation, which is particularly active in the west of the Turkmenistan during the development of oil deposits. In other regions, in connection with the discovery and development of gas deposits, the plants are equipped with multi-purpose gas fields and communication routes, which are the cause of technical depletion. The process of violation of an eclectic relay in the area of geological and prospecting works takes place during the stages of drilling operations, pipelines, as well as at the stage of the construction of areas for engineering objects.

Throughout the area of gas deposits, many-sided heavy engineering is moving. As a result, the points from the category of damaged ones with a slab of deflation go to the lagged ones with significant deflation [4]. On clayey ravines, the exploitation of an air transport by air leads to a disruption of the surface, and to the intensive dusting of the adjacent territory, which is particularly perceptible at the actual points and leads to serious consequences for human health.

The problem of desertification of territories is one of the most acute and intractable environmental problems. Currently, in Turkmenistan, about 30 gas plants are being built, there are 400 more gas-searching geological structures in search of gas. Entering into the operation of each craft reveals a remote controller on the floor of about 1482,63 acres.

In the contour of each structure, 15 % of the surface of the damaged penechas (about 74 acres) is barely rotted and almost irretrievably goes to the category of technogenic sands. The industrial development of the peninsula in Turkmenistan was particularly strengthened in the aftermath of the epidemic.

Significant local soil contamination and disturbance of the solvent cover occur in the non-fluidic atmosphere in the course of technological losses and accidents, when emissions of condensate and neutrity are deposited on the incoming territory. Oil as a result of natural processes seeps out of deposits on land and in the sea: thus, in the Caspian region, natural oil yields to the surface were always fixed. But with the development of oil and gas complexes, their technogenic impact has become very prob-

lematic: it is ubiquitous in areas where previously there has never been a natural manifestation [5].

Environmental problems in the extraction and transportation of oil and gas in the sea. Extraction of oil on the shelf, which is expected to increase in the near future, makes a significant contribution to the pollution of the water area [6], especially due to high accidents at oil producing offshore installations. In case of accidents from wells, oil, gas and sludge are released. In Turkmenistan, the bulk of oil production is located near Khazar: 56 offshore platforms with 116 wells are located here.

When drilling wells on the seabed, the spent drilling fluids are discharged into the sea and the drilled residues are ejected from the wells, which are ejected from the well and flowed under pressure; The range of transport depends on the velocity of the bottom currents and the size of the disintegrated particles. Drilling fluids, lubricating and cooling drills and pipes, removing slurries and maintaining the required pressure and integrity of the borehole, flow through the pipes down to the drill bit, and then return to the surface, carry with them fragments of rocks. They are complex dispersed systems, which include weighting agents; materials that reduce water loss; clogging agents; substances that prevent corrosion of equipment; stabilizers of aqueous suspensions; diluents of drilling fluids; substances that reduce friction; antibacterial additives and temperature stabilizers [7]. The spent drilling muds are poured into the sea and their solid phase is in the water column in the form of suspensions.

At the end of drilling, the main source of pollution is associated reservoir waters, the volume of which varies with time and geological formation; they are characterized by high temperature and significant mineralization.

A very useful situation also arises on pipelines that are located in the coastal part of the Caspian Sea in connection with the catastrophic rise of its level. In the case of storms, seawater renders the ground around the pipelines; this often leads to the explosion of pipes and the use of oil products in the sea. Oil spills are among the most complex phenomena, because at sea the oil can be in various migration forms (slick-surface film, emulsions, aggregates, forms sorbed by bottom sediments and dissolved, forms accumulated by bottom organisms), the quantitative ratio of which is determined by hydrometeorological conditions, composition and properties of oil, concentration of surfactants in water, etc.

Depending on the combination of these factors, the depth of immersion and the range of the oil slick are determined. A thin film of oil (at an oil contamination concentration of more than 0.289 lb/in^3) on the surface of water suppresses the vital activity of phytoplankton, reduces the production of oxygen by algae, causes their

death, and also reduces the number of commercial fishes in the Caspian Sea [8]. At sea transportation of oil the main pollution factors are accidents, ballast water discharge and bunkering operations. The export of oil and oil products from Turkmenistan is carried out by tankers through the terminals of Aladzha and Ekerem and through the Turkmenbashi port.

Mining and construction of canals as a threat to the environment. In the process of construction and operation of the Garagum irrigation canal along its route there were different technogenic forms of the reef: dams, rocks, fields of high pulp, ravines, and others. In the north part of Turkmenistan nearby Dashoguz technogenic sands over 300 meters in wide were appeared, and they are forming in the line near channel mobile forms of sand (dunes).

Due to the predominantly shallow occurrence of minerals, their extraction in Turkmenistan is carried out in an open manner, which leads to the need to alienate significant areas, disturb the water balance of soils, deform them, the salinization of the soil layer, the accumulation of large quantities of empty rock waste. All these factors lead to soil degradation and a decrease in bioregeneration in the mining and transportation zone of mineral raw materials.

Reduction of threats to the state of the environment of Turkmenistan during the extraction of hydrocarbon and mineral raw materials. The Turkmen gas complex does not only form the structure of the economy, but it plays a decisive role in all stages of its development.

Until recently, during the extraction, transportation and processing of hydrocarbon and mineral raw materials, a significant outflow of greenhouse gases was produced, which was due to the widespread use of physically and morally obsolete equipment of Soviet times. The cardinal renewal of the entire technical park and the introduction of innovative technologies have made it possible to significantly reduce emissions of greenhouse gases.

Priority directions of further increase of environmental and economic efficiency in the non-oil sector and in the extraction of mineral raw materials are a wide integration in the production of new innovative energy-efficient technologies and recent world-wide achievements in the entire production cycle: from geologic exploration, development and development of production to transportation, storage and use of natural resources.

The main directions for increasing energy efficiency and energy efficiency in the extraction of hydrocarbon raw materials in the oil and gas complex are the introduction of modern methods for controlling the amount of pollutant emissions at all stages of technological processes [9]:

1. Use of automatic systems for the detection of tensils.
2. Decrease of leaks and gaps on the main and oil and gas pipelines.
3. Accomplishment of the system to account for transportation and consumption of oil and gas.
4. Construction of mini-compressor stations on low-production oil deposits.
5. Monitoring the internal consumption of natural gas.
6. The creation of the system of the rational use of oil, gas and mineral raw materials by the establishment of a strategic recovery.

Conclusions.

Turkmenistan's resource-producing industry faces a difficult task to ensure environmentally friendly extraction of mineral raw materials and hydrocarbons, without reducing their production and sales, which may lead to a deterioration of the economic situation in the country.

Specificity of environmental problems in Turkmenistan is due to the peculiarities of desert ecosystems. They are easily vulnerable and even with insignificant technogenic impact they leave the state of equilibrium; therefore, special attention should be given to the protection of the environment extractive industry.

Priority directions of increase of ecology in the raw materials sector are wide integration of innovative approaches of the world science in the whole production cycle.

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Received 17.11.17

Бібліографічні описи / Библиографические описания / Bibliographic descriptions

Зниження загроз стану довкілля Туркменістану при видобуванні вуглеводневої та мінеральної сировини / А. П. Гінкул, С. П. Кривільова // Вісник НТУ «ХПІ». Серія: Хімія, хімічна технологія та екологія. – Х.: НТУ«ХПІ», 2017. – № 48 (1269). – С. 29 – 33. – Бібліогр.: 9 назв. – ISSN 2079-0821.

Снижение угроз состоянию окружающей природной среды Туркменистана при добыче углеводородного и минерального сырья / А. П. Гинкул, С. П. Кривилева // Вісник НТУ «ХПІ». Серія: Хімія, хімічна технологія та екологія. – Х.: НТУ«ХПІ», 2017. – № 48 (1269). – С. 29 – 33. – Бібліогр.: 9 назв. – ISSN 2079-0821 .

Decreasing of threats of the condition of environment of Turkmenistan at the hydrocarbon and mineral raw materials mining / A. P. Ginkul, S. P. Krivileva // Visnyk NTU “KhPI”. – Series: Chemistry, chemical technology and ecology. – Kharkiv: NTU “KhPI”, 2017. – No 48 (1269). – P. 29 – 33. – Bibliogr.: 9 names. – ISSN 2079-0821.

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