

ISSUES OF GROUNDWATER USE AND PROTECTION IN THE OPERATION OF HYDROCARBON FIELDS

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***Abstract:** The article discusses protection of associated underground waters from technogenic pollution in oil and gas fields of Uzbekistan and their rational use as hydromineral raw materials. Underground waters in many hydrocarbon deposits are an obligatory element of oil and gas reservoirs. Rational use of natural resources and environmental protection are currently the most important ecological and nature conservation issues. The protection of underground industrial waters is understood as a set of measures to preserve their qualitative and quantitative state, allowing their use in the national economy. At the same time, associated waters of oil and gas fields must be considered not only as hydromineral raw materials, but also as a factor of environmental pollution. Consequently, the rational use of associated industrial waters, in addition to a large economic effect, can also ensure the preservation of the natural environment.*

***Key words:** microcomponents, microelements, underground water, hydromineral raw materials, deposits, region, basin, hydrocarbon, deposit, fields, environment.*

UGLEVODOROD KONLARINI ISHLATISHDA YEROSTI SUVLARIDAN FOYDALANISH VA ULARNI MUHOFAZA QILISH MASALALARI

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***Annotatsiya.** Maqolada O‘zbekiston neftgaz konlaridagi yo‘ldosh yerosti suvlarini texnogen ifloslanishdan muhofaza qilish va ulardan gidromineral xom ashyo sifatida oqilona foydalanish masalasi ko‘rib chiqilgan. Ko‘pgina uglevodorod xom ashyosi konlarida yerosti suvlari neft va gaz uyumlarining doimiy yo‘ldoshi hisoblanadi. Shuning uchun, hozirgi vaqtda*

tabiiy resurslardan oqilona foydalanish va atrof muhitni qo'riqlash ekologiya va tabiat muhofazasining muhim muammolari sirasiga kiradi. Sanoat suvlarini qo'riqlash deganda ulardan xalq xo'jaligida foydalanish imkonini beruvchi ularning son va sifatini saqlashga qaratilgan kompleks choralar tushuniladi. Shuning uchun, neftgaz konlari yo'ldosh suvlarini na faqat gidromineral xom ashyosi deb, qolaversa atrof muhitga zarar yetkazuvchi omil deb ham qarash kerak. Demak, neftgaz konlaridagi yo'ldosh sanoat suvlaridan oqilona foydalanish katta iqtisodiy samaradan tashqari, yana tabiiy atrof muhiti muhofazasini ta'minlashi mumkin.

Kalit so'zlar: *mikrokomponentlar, mikroelementlar, yerosti suvlari, gidromineral xom ashyo, yotqiziqlar, region, havza, uglevodorod, uyum, kon, atrof muhit.*

Introduction and relevance of the problem. The current level of development of science and technology has created conditions for the economically advantageous use of resources that were previously considered only for the distant future. Therefore, not only the types of deposits developed by industry are important, but also any possible sources of raw materials that are unsuitable today, which can be profitable tomorrow if new technologies for their exploration, as well as processing and utilization, are developed. Depending on the mineralization, ion-salt and gas composition, thermobaric and hydrodynamic conditions of location, groundwater in industrial terms is considered as drinking, technical and balneological, used for heat supply and as a source of electricity generation. Mineralized groundwater with a high content of macro- and microcomponents, as well as their compounds, often act as "liquid ores" and are used as hydromineral raw materials for the chemical, light and food industries, and are also used in agriculture, medicine and other industries. Underground mineral waters and brines are valuable mineral raw materials, which are of interest for the extraction of a number of useful components with adequate content – iodine, bromine, boron, lithium, rubidium, strontium, molybdenum, tungsten, germanium, rhenium, scandium and other elements and their compounds, as well as various salts – table salt, sodium sulfate, calcium chloride, magnesium, potassium, etc. [1, 2].

Formation waters of many hydrocarbon (HC) deposits are an obligatory element of oil and gas deposits. Along with the enclosing structure, the aquifer, confined to productive deposits, constitutes the natural boundary of all industrially significant HC deposits. Therefore, any oil and gas basin is only a part of a hydrogeological basin and is subject to the general laws of its development [5, 6].

The results of the study of underground industrial waters of Uzbekistan, the features of their distribution and conditions of formation are covered by B.A. Beder, L.S. Balashov, V.A. Kudryakov, A.N. Sultankhodjaev, G.V. Kulikov, A.S. Khasanov, L.A. Kalabugin, T.N. Avazov, D.S. Ibragimov, S.A. Bakiev, A.M. Shapiro, T.I. Muminjanov, M.A. Narmukhamedov, T.Kh. Shoimuratov and others.

The joint occurrence of groundwater and hydrocarbon deposits in the subsoil causes their mutual interaction, which, in particular, is reflected in the change in the chemical composition of groundwater under the influence of hydrocarbon deposits and rocks. At the same time, in the formation systems "rocks-HC-groundwater" of sedimentary basins, water halos of deposits are formed (zones of influence of the microelement composition of rocks or the interaction of

hydrocarbon deposits and groundwater), without studying which it is not possible to clarify the features of the distribution of the hydrochemical field in the zone of oil and gas exploration probing [3, 4]. Associated production and processing of groundwater from production wells of production fields can be carried out in individual sections of fields, the choice of which is made taking into account geological, structural and hydrogeological conditions on the basis of technical and economic calculations. Taking into account the modernization and diversification of oil and gas production in the republic, wastewater from oil and gas fields can become one of the promising sources of obtaining micro components, rare elements and medicinal mineral waters. It is necessary to take into account that water and aqueous solutions in the subsoil, including oil and gas fields, are part of the environment around us. Rational use of natural resources and environmental protection are currently the most important environmental and nature conservation issues. The use and protection of industrial wastewater in oil and gas fields is also an integral part of environmental protection and rational nature management. The protection of industrial waters is understood as a set of measures to preserve their qualitative and quantitative state, allowing them to be used in the national economy.

According to the existing requirements and principles of integrated development of liquid and gaseous hydrocarbon deposits, formation waters with a high content of valuable elements are also considered as a potential source of their production. Accordingly, the main areas of legal regulation in the sphere of rational use of subsoil for purposes not related to the extraction of minerals and environmental protection are the Laws of the Republic of Uzbekistan: “On Subsoil”, “On Water and Water Use”, “On Nature Protection”, “On Waste”, etc. In accordance with the specified requirements, when conducting geological exploration and production work, it is necessary to comply with the norms and rules of technology for conducting work related to the use of subsoil, extraction of minerals and processing of mineral raw materials (Table 1).

Table 1

Impact of exploration and production work carried out at oil and gas fields on the environment

Production and technological stages	Natural objects		
	Lithosphere (earth's surface, subsoil)	Hydrosphere (aquatic environment, underground waters)	Atmosphere (atmospheric air)
Prospecting and exploration of mineral resources	- violation and pollution of soil and vegetation; - alienation of land for the construction of drilling rigs and placement of temporary settlements; - activation of exogenous geological processes.	- pollution of Surface and groundwater by flushing liquid; - salinization of surface water bodies during self-discharge of brines, opened by exploratory wells.	- emergency emissions of oil and gas during drilling and development of wells; - gas and dust pollution during construction of roads and industrial sites.
Extraction	- withdrawal of land from agricultural use for oil production facilities.	- violation of the isolation of aquifers due to overflows.	- pollution by hydrocarbons, hydrogen sulfide, sulfur and nitrogen oxides during well operation.

Primary processing and transportation	- allocation of land for waste storage; - violation of the environmental situation during the construction and operation of main oil pipelines.	- leakage of petroleum products and chemical reagents from tanks and dosing units; - pollution of surface and ground waters with fuels and lubricants, household and technical waste.	- spraying and spilling of oil and oil products; - losses due to evaporation of light fractions of oil during storage in tanks and during loading and unloading operations.
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Environmental protection measures in the oil and gas industry provide a significant social and economic effect. The costs of preventing environmental pollution in the extraction of hydrocarbon raw materials are reasonable and economically justified, since they are several times less than the costs required to eliminate the damage caused by man-made pollution. For the geological environment, the danger of hydrocarbon pollution is due to its progressive rate and the wide distribution of sources of impact (Fig. 1).

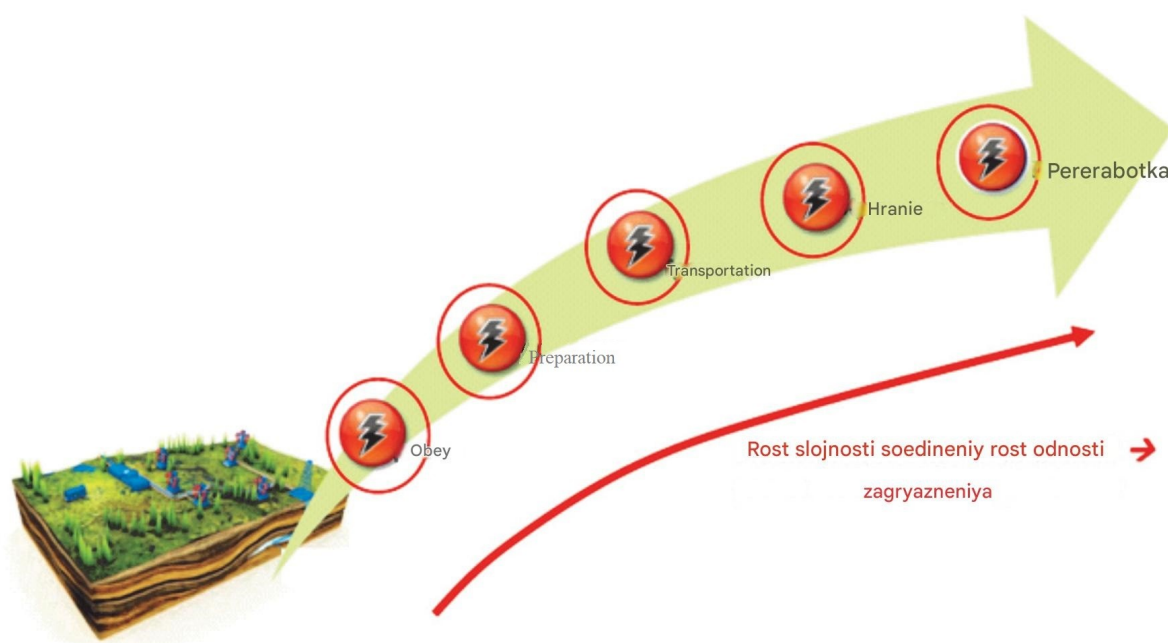


Fig. 1. Scale and specificity of hydrocarbon pollution.

Large material and labor costs allocated for environmental protection in the oil industry indicate the need to improve the forms and methods of planning, the introduction of a system of scientifically based standards. For example, the US Environmental Protection Agency has developed special standards for the discharge of oil and waste water during exploration and exploitation of fields. These standards are revised every 5 years taking into account the "best available technology" and the conditions of oil production at sea and on the continent [7].

In recent years, the costs of preventing the consequences of environmental pollution have increased significantly. Most industrialized countries spend 1-3% of their gross national product on these purposes (Sweden, France, Germany, Great Britain, USA). The leading position belongs to Japan, which, due to specific geographic and economic conditions, annually spends up to 5% of its gross

national product on environmental protection.

Discussion of the results. In Uzbekistan, in particular in the Bukhara-Khiva oil and gas region (BKhNGR), pollution of natural (surface and ground) waters is one of the most common and dangerous phenomena. An indicator of hydrosphere pollution is the solubility of oil and oil products in water. In some cases, oil enters the earth's surface with water after oil separation, which leads to soil pollution in exploited oil and gas fields. In addition, exploitation of fields with reservoir pressure maintenance (RPM) involves pumping in large volumes of surface water (Northern Urtabulak, Kruk, Umid, Kokdumalak, Kultak, Shurtan, Northern Shurtan, Ilim, Chunagar, etc.), which leads to changes in the macro-microcomponent composition of groundwater.

From year to year, the volume of associated waters extracted together with oil at the Bukhara-Khiva oil and gas region fields also increases, only at the fields of the Kruk field the volume of discharged waters reaches 2000 m³/day and more, and at the Severny Urtabulak field - more than 1000 m³/day. At some fields, much more is discharged. Waters associated with oil and gas fields, during hydrocarbon extraction, are discharged into natural depressions of the relief, polluting and removing from economic circulation significant territories of pastures for distant-pasture cattle breeding [8, 12].

According to experts, when injecting surface waters (from Lake Devkhona with a mineralization of 11 g/l) into productive formations (with a mineralization of 99 g/l), the following changes occur: the chemical composition of the extracted waters becomes Cl-SO₄, the mineralization of formation waters decreases to 18 g/l, and, accordingly, the value of microcomponents due to the dilution of formation waters. Acid treatment of productive formations to increase oil recovery and heat treatment have a particularly strong effect on formation waters [4, 10, 11]. Such treatment can lead to corrosion of production columns and, accordingly, leakage of hydrocarbons into overlying aquifers, which negatively affects the quality of groundwater. These issues require careful study during further research in the preparation and development of hydrocarbon deposits.

Currently, about 4 million m³ of associated water are extracted per year during the development of oil and gas fields in the republic [1, 8, 9]. With average mineralization values of 100-150 g/l, the following is removed with these waters annually: 4 million m³ x 100 g/l = 400 thousand tons of chloride salts. Assuming that 50% of associated water is used to maintain reservoir pressure, the remaining 200 thousand tons of salts per year enter surface watercourses (collectors, discharge lakes, etc.) and remain in the form of salts on the earth's surface after evaporation. As a result, there is an increase in mineralization and oil pollution of groundwater, surface watercourses, as well as salinization and pollution of soils.

Conclusions. Thus, the underground waters of the deep horizons of the sedimentary cover of the Bukhara-Khiva oil and gas region are saturated with various microcomponents and rare elements, which, in most cases, accompany known and already identified and exploited oil and gas fields. At the same time, associated waters of oil and gas fields should be considered not only as

hydromineral raw materials, but also as a factor of environmental pollution. Consequently, the rational use of associated industrial waters of oil and gas fields, in addition to a large economic effect, can also ensure the preservation of the natural environment.

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