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ASSESSMENT OF ECOLOGICAL RISK CAUSED BY LEAKS TO THE EARTH SURFACE WHEN INCREASING THE VOLUME OF GAS INJECTED INTO THE GARADAGH GAS RESERVOIR

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ANNOTATİON

The article notes that maintaining seismicity and the geological-tectonic structure of underground gas storage facilities, which are of exceptional importance in the national economy, is one of the important problems and is always the focus of attention of the state of Azerbaijan.

Before environmental risks arise when changing the volumes of gas injected and withdrawn from the reservoir, it is proposed to compile maps reflecting the state of stress and deformation for different levels, taking into account the increase and decrease in the effect of density in the reservoir.

Key words: seismomagnetic effect, geodynamic regime, geomagnetic field strength, gravity force, gravimetric field strength, local anomaly, engineering-seismic exploration.

QARADAĞ QAZ ANBARINADA QAZIN HƏCİMİNİN ARTIRILMASI ZAMANI YER SƏTİNƏ SIZMALARIN ETDİĞİ EKOLOJİ RİSKİN QİYMƏTLƏNDİRİLMƏSİ

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XÜLASƏ

Məqalədə xalq təsərrüfatında müstəsna əhəmiyyəti olan yeraltı qaz anbarların (YQA) seysmikliyi və geoloji-tektonik quruluşunu mütəmadi nəzarətdə saxlamaq vacib problemlərdən biri olmaqla daim Azərbaycan dövlətinin diqqət mərkəzində olduğu qeyd edilir.

Anbara vurulan və götürülən qazın həcmi dəyişdikcə yaranacaq ekoloji risklərdən öncə, anbarda sıxlıq effektinin artıb- azalmasını nəzərə alaraq müxtəlif səviyyələr üçün gəginlik – deformasiya vəziyyətini əks etdirən xəritələrin qurulması təklif olunur.

Açar sözlər: seysmomaqnit effekt, geodinamik rejim, geomaqnit sahəsinin gücü, cazibə qüvvəsi, qravimetrik sahənin gücü, yerli anomaliya, mühəndis-seysmik kəşfiyyat.

ОЦЕНКА ЭКОЛОГИЧЕСКОГО РИСКА, ВЫЗВАННОГО УТЕЧКАМИ НА ПОВЕРХНОСТЬ ЗЕМЛИ, ПРИ УВЕЛИЧЕНИИ ОБЪЕМА ЗАКАЧИВАЕМОГО ГАЗА В ГАРАДАГСКИЙ ГАЗОВЫЙ РЕЗЕРВУАР.

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АННОТАЦИЯ

В статье отмечается, что поддержание сейсмичности и геолого-тектонического строения подземных газовых хранилищ, имеющих исключительное значение в национальной экономике, является одной из важных проблем и всегда находится в центре внимания Азербайджанского государства.

До того, как возникнут экологические риски, возникающие при изменении объемов закачиваемого и отбираемого из пласта газа, предлагается строить карты, отражающие состояние напряженности и деформаций для разных уровней с учетом увеличения и уменьшения эффекта плотности в пласте.

Ключевые слова: сейсмомагнитное воздействие, геодинамический режим, напряженность геомагнитного поля, сила тяжести, напряженность гравиметрического поля, локальная аномалия, инженерно-сейсморазведка

Clarification of the geological and tectonic structure of underground gas deposits, which is of exceptional importance in the development of the oil and gas industry of the republic, is one of the

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important problems and is constantly in the focus of attention of geologists and geophysicists. The volume of gas pumped into the Garadagh gas storage facility does not always remain stable depending on the season.

In summer, the volume of gas injection into the reservoir increases. Seismic risk, seismic zoning work and the activation of tectonic faults in this territory must be constantly monitored in order to avoid environmental hazards during the further exploitation of gas fields, which will expand and increase in capacity.

One of the most current problems of our time is the study of factors for preventing danger that may arise as a result of an increase in the anomalous energy of geodynamic stresses in gas-injected layers and the assessment of environmental risk. The Garadagh gas field is located 30 km southwest of the city of Baku. There are mud volcanoes Akhtarma (96 m) and Osman-Bozdagh (384 m) in these areas. In these volcanoes, activation is observed from time to time (Fig. 1).

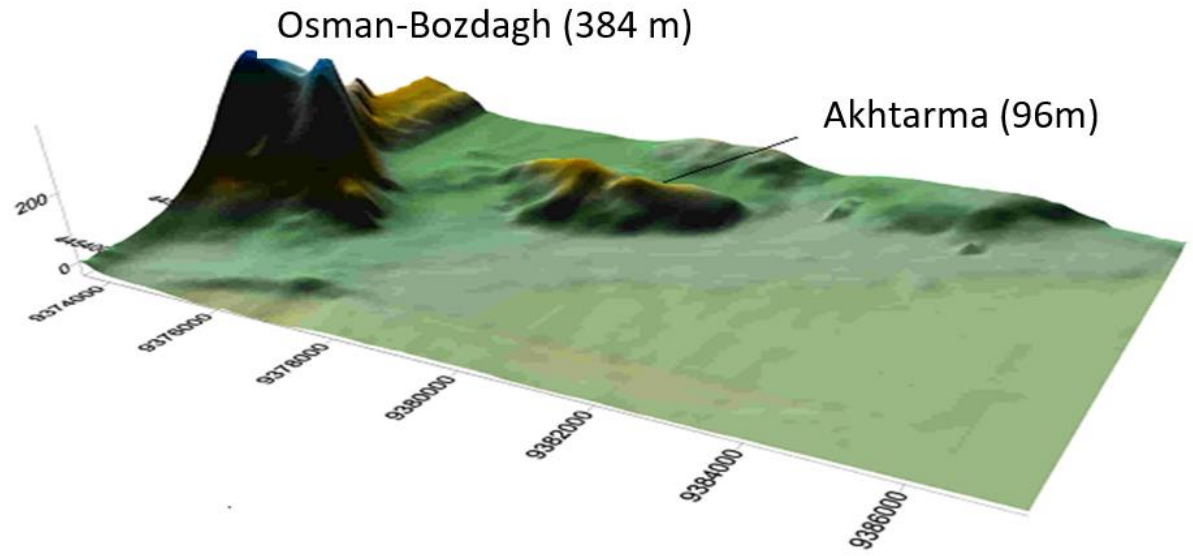

Figure 1. Three-dimensional relief map of the study area.

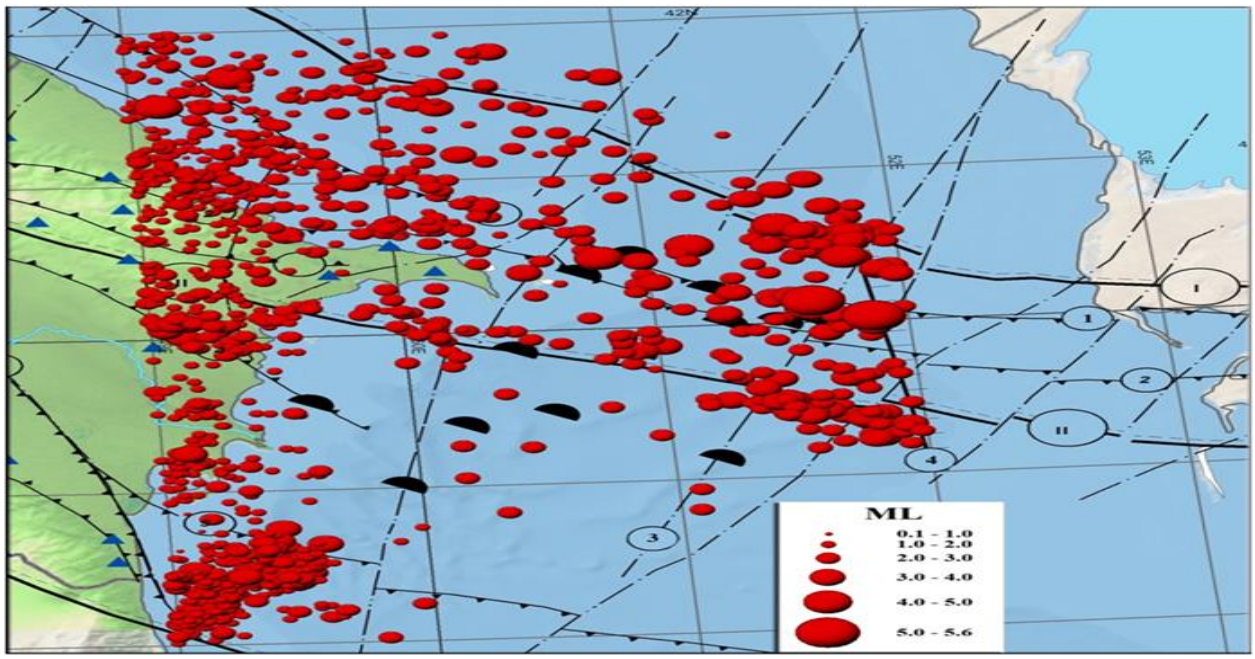

Figure 2. Map of epicenters and deep faults of earthquakes that occurred in the Caspian Sea and nearby territories in 2014-2022 [4]

Due to the high seismic activity of the area where the Garadagh gas field is located, a number of deep faults pass through it. On maps of seismic activity in recent years, an increase in the dynamics of the internal structure of the earth in these areas is observed (Fig. 2). Strong earthquakes occurring in fault zones running through the territory pose a high seismic hazard for the Garadagh and Galmaz gas fields. The Caspian earthquake that occurred on November 25, 2000, consisted of two seismic shocks (M=5.8 and M=6.2) and was accompanied by thousands of aftershocks.

On the territory of the Garadagh gas field, the earthquake was felt with a force of 6-7 points on the MSK-64 scale. Taking into account the above, the increase in reservoir capacity should be adjusted in such a way that changes in geodynamic-tectonic conditions at depth do not cause anomalous activation of the surrounding mud volcanoes, and also do not activate tectonic faults passing through the territory. From the study of strong earthquakes and analysis of the results, it is known that the magnitude of earthquakes is large and the depth is relatively small, which leads to the formation of cracks on the earth's surface in the pleistoseist zones. At this time, gas leakage from such cracks onto the earth's surface is very likely. The large ridge of the Garadagh mud volcano, located in the area of the Garadagh gas field, forms a general uplift.

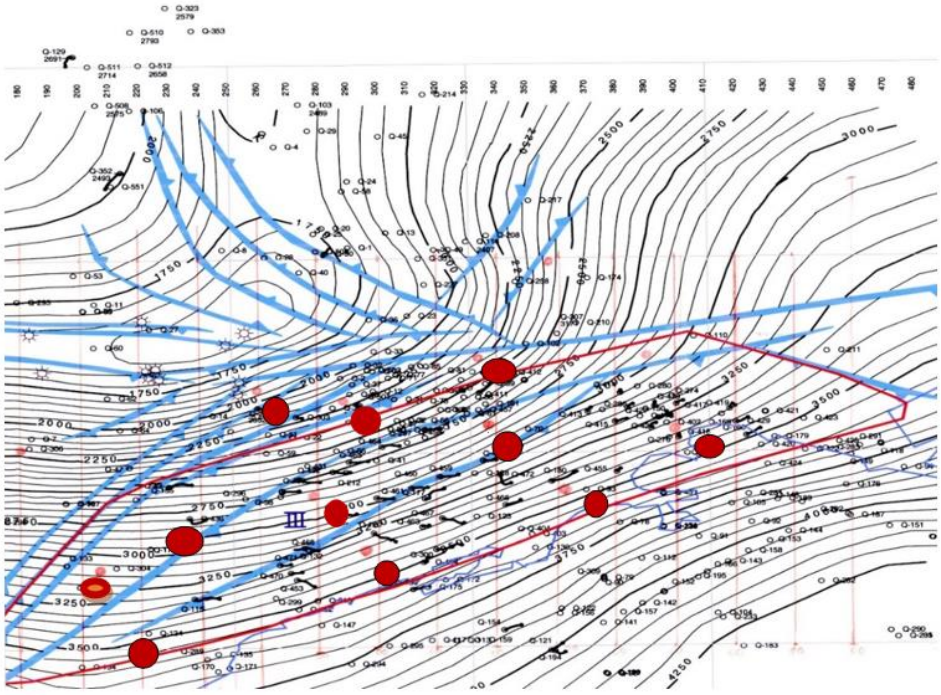

Figure 3. Layout of geophysical (gravimagnetometric) monitoring points planned for creation on the territory of the Garadagh gas field [5].

Territory of the Garadagh gas field

Geophysical monitoring stations

The Akhtarma mud volcano is located in the eastern part of the fold and consists of 6 gryphons, inside of which gas, water and mud are released. Gas was first pumped into the Garadagh field in 1986 and put into operation as a reservoir (VII horizon). This horizon covers the southern flank of the field and has historically contained large gas reserves. Therefore, it is very important to conduct regular geophysical monitoring in the area, depending on the volume of gas injected into the reservoir.

Seismic risk must be regularly monitored to ensure that it does not pose imminent threats to the future environmental performance of increasing and expanding gas fields. One of the current issues is

the prevention of danger that may arise as a result of an increase in the energy of anomalous geodynamic stresses in gas-injected layers.

In order to avoid an environmental disaster, it is necessary to study in detail the possible consequences of earthquakes on gas reservoirs that may occur in the study area and nearby areas. Taking into account the geological and tectonic structure of the gas reservoir, geophysical monitoring work should be carried out on the research territory and adjacent territories. Based on seismic and gravimagnetometric data, it is necessary to create 10-11 gravimagnetometric reference observation points, taking into account the blocks and faults identified to date in the research area (Figure 3). As the volumes of gas injected and withdrawn from the reservoir increase and decrease, it is proposed to construct maps of local anomalies (deformations) for different levels (depths) and preliminary assess the environmental risk taking into account changes in the density effect in the layers.

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