

Estimates of the compressibility of the pore space when the effective pressure changes by the example of the Uvyazovskoye UGS

Kuzmin D.K., Zhukov V.S., Kuzmin Y.O.

O.Yu. Shmidt Institute of Physics of the Earth, Russian Academy of Sciences, Moscow, Russia

e-mail: dimak1292@mail.ru

The paper analyzes the effect of reservoir pressure on the volumetric compressibility of gas reservoirs on the basis of experimental results of changes in their porosity when simulating gas injection and extraction. Based on the existing concepts of rock physics [Zhukov and Kuzmin, 2021], developed mathematical models [Kuzmin, 2020] and the results of core studies, the maximum amplitude of subsidence and elevation of the Uvyazovskoye UGSF land surface, reaching 61 mm when the reservoir pressure changes by ± 5.0 MPa, was estimated.

Models of distribution of vertical displacements of the earth surface for periods of gas injection and withdrawal are constructed, showing that displacements from 5mm and more, which can be obtained by repeated leveling observations, occupy an area of about 96 km² of the UGS territory. The maximum vertical displacements are observed in the direction towards the center of the deposit, which confirms its reliability when compared with field observations at a number of other UGS facilities and hydrocarbon fields [Kuzmin, 2021; Comparison of forecasts, 2021].

The main conclusion of this work is that the methodology of estimation of changes in vertical surface displacements taking into account changes in porosity and compressibility of gas reservoirs depending on the chosen mode of operation of Uvyazovskoye UGS, taking into account the actual data on porosity and compressibility of gas storage facility reservoirs, which can be used at other similar facilities, is proposed and implemented in practice.

Zhukov V.S., Kuzmin Yu.O. Experimental evaluation of compressibility coefficients of fractures and intergranular pores of oil and gas reservoirs // Zapiski Gornogo Institut. 2021. T. 251. № 5. - C. 658-666. - DOI 10.31897/PMI.2021.5.5

Kuzmin Y.O. Actual issues of using geodetic measurements in geodynamic monitoring of oil and gas facilities / Y.O. Kuzmin // Bulletin of SGUGiT (Siberian State University of Geosystems and Technology). - 2020. - T. 25. - № 1. - C. 43-54. - DOI 10.33764/2411-1759-2020-25-1-43-54.

Kuzmin D.K. Modeling of earth surface displacements, received by different satellites with built-in SAR module (by the example of oil and gas fields monitoring) / D.K. Kuzmin // Problems of Subsoil Use. - 2021. - № 2(29). - C. 94-104. - DOI 10.25635/2313-1586.2021.02.094.

Comparison of forecast estimates of seabed subsidence of the Yuzhno-Kirinskoye field / V.S. Zhukov, D.K. Kuzmin, Y.O. Kuzmin, I.V. Pleshkov // IOP Conference Series: Earth and Environmental Science: 4, Yuzhno-Sakhalinsk, September 06-10, 2021. - Yuzhno-Sakhalinsk, 2021. - P. 012019. - DOI 10.1088/1755-1315/946/1/012019.