

**ABSTRACT**  
**of the dissertation for the degree of Doctor of Philosophy (PhD) in**  
**specialty 6D070700 – Mining**

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**OPTIMIZATION OF WELL DRILLING PROCESSES IN THE**  
**PRODUCTION OF COALBED METHANE IN THE KARAGANDA BASIN**

**Relevance.** The problem of ensuring safe working conditions at coal enterprises in Kazakhstan and other CIS countries has become increasingly acute in recent years. Intensive mining of coal seams is accompanied by abundant methane emissions into mine workings. This is evidenced by major accidents with group accidents that have recently occurred in the mines of Kazakhstan, Russia, and Ukraine.

Improving safe working conditions and increasing the productivity of coal enterprises is an urgent task in all coal-mining states in the development of seams with significant natural gas content.

Coal seams of the Karaganda coal basin have very low parameters of gas permeability and gas recovery, which does not allow underground degassing to maximally reliably ensure the safety of miners. Extraction of methane gas by drilling directional wells will reduce the natural gas content of coal seams and increase the productivity of mining operations in coal production.

**The purpose of the work.** Development of technological solutions for drilling directional wells to extract methane from coal seams with significant gas content.

**The idea of the work** is to determine the location of an inclined well according to the mining and geological characteristics and properties of the coal seam, using the electromagnetic resonance method, as well as developing a method for extracting coal bed methane.

**The object of study.** Directional wells for coal bed methane production

**Research objectives:**

- to conduct studies of mining and geological conditions of occurrence, properties, coal seam K12 of the Taldykuduk section of the Karaganda coal basin, using the electromagnetic resonance method to determine the location of wells;
- to investigate the filtration-capacitive properties of unloaded coal seams of the Taldykuduk area;
- to assess their prospects for methane extraction using directional drilling technology and to conduct a preliminary assessment of the recoverable methane reserves at the site;
- to develop a method for extracting coalbed methane at the Taldykuduk area.

**The research methodology** consists of: on the basis of the analysis of domestic and foreign experience, literature and stock materials, the results of laboratory and experimental observations, modern methods of computer modeling,

design solutions for the development of the site were substantiated and calculations of the structures of directional wells were made.

**Scientific novelty.**

The validity of the application of the method of electromagnetic resonance, when choosing the location of the well, for the extraction of methane gas by directional wells drilled from the surface, to reduce the natural gas content of coal seams in the Karaganda coal basin.

**Main scientific provisions to be defended:**

1. Regularities of changes in saturation of the K12 seam of the Taldykuduk area of the Karaganda coal basin with methane and water from the depth, determined by the method of electromagnetic resonance.

2. Methodology for calculating coal bed methane reserves in perspective areas of the Karaganda coal basin, based on desorption analysis.

3. Methane extracting method from coal seams, including directional drilling of wells from the surface along a productive coal seam, based on the fact that the upper interval of the well has a vertical profile, and the lower one with a deviation of the wellbore from the vertical along the strike of the coal seam, parallel to bedding.

**Practical significance of the work.** The research results can be used in calculating the reserves of methane gas resources, in determining the location of wells. The developed method for extracting methane from coal beds will reduce the natural gas content of coal seams and increase the productivity of mining operations in coal mining.

**Personal contribution of the author.**

The author took part in research work on the development of coalbed methane, implemented by "IPKON" LLP, "KazTransGas" JSC in the Karaganda coal basin.

**The structure and volume of the work.** The dissertation work consists of an introduction, 4 chapters, a conclusion, a list of sources and applications. The work is presented on 101 pages, contains 29 figures, 17 tables and 111 used sources.

**Approbation of the work and publications.** The main provisions of the work were reported and approved: at the scientific seminar of the RMPI department, at the scientific and technical council of KSTU, the research results obtained in the dissertation were introduced into the educational process in the core disciplines of the specialties "Mining", "Oil and gas business" for bachelors.

The main provisions of the dissertation work are reflected in 27 scientific works, including 2 of them published in journals included in the Scopus database, 10 in publications recommended by the Committee for Control in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, 2 monographs in co-authorship, 13 works in materials of foreign and international conferences.

During the training, he completed the following internships: "Technology of drilling oil and gas wells" at the National Mineral Resources University "Gorny" (St. Petersburg 2016); "Innovative training technologies in the field of training specialists for the development of unconventional natural hydrocarbon deposits" Russian State University of Oil and Gas named after Gubkin (Moscow, 2016).

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