

ABSTRACT

"Improved methodology for determination of the geological and geotechnical parameters of the ore-bearing rocks according induction logging"

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As the worldwidedemand for uranium for civilian nuclear industry is growing, mining uranium expands with each passing day. Today in Kazakhstan uranium reserves amount to about 1.7 million tons, about 80% of which are concentrated in the sandstone-type deposits in water-saturated permeable rocks.

This type of field is processed with the most environmentally preferred method of in-situ leaching (ISL), which provides low cost of production and minimum damage to the environment.

Relevance. The main problem with the implementation of ISL is that at the moment, it is impossible to get sufficiently reliable information on the structure of the ore body to regulate the process in order to maximize the extraction of useful component and reduce production costs.

Previous geological and geophysical work at uranium deposits indicates that a complex of geophysical methods do not fully provide the solution of some problems in determining the geological and geotechnical parameters of technological blocks. For instance, when calculating the reserves of uranium there are difficulties with the calculation of mining mass (MM) and the determination of the effective power unit (EPU). Currently, in practice, there are different methods for determining EPU: they are given in this paper. Unfortunately, these methods do not always give correct results in determining EPU. For the most accurate EPU it is advisable to perform induction logging (IL) of supervisory, control and process wells after the acidification of the unit periodically. The interpretation of the obtained IL data after the acidification of the unit will provide a new quality of information on the movement of leaching solutions in the ore-bearing formation, their distribution in the interwell space. On this basis, it is possible to determine the geological and geotechnical parameters of the process unit and to evaluate of the effectiveness of mining.

The aim of the study is to improve the efficiency of geological geophysical survey on the infiltration type uranium deposits in Kazakhstan by calculating the geological and geotechnical parameters for the calculation of reserves of uranium from geophysical data.

The main tasks of research.

1. Geophysical Monitoring of existing mines uranium deposits of Kazakhstan and analysis of the data;
2. Determination of the effective power of the test process unit based on IL data;
3. Calculation of geotechnical parameters based on GIS data and analysis results with respect to the process conditions of ISL.
4. Determination of the errors that occur in the calculation of stem and block stocks;
5. Development of methods to eliminate or reduce the likelihood of error in the calculations;

The results of the research.

Based on the comparison and interpretation of results of the induction logging carried out before and after the acidification of the unit, the method of determining the effective capacity of the unit, which allows to increase the accuracy of calculation of geotechnical parameters, such as mining the mass and volume of the leach solution was proposed. These parameters are key in the calculation of the maximum flow rate for the acid extraction of uranium from the depths. On the example of Inkai and Kharasan deposits, it is proved that the induction logging data will not only observe the movement of operating sulfuric acid solutions, but will correctly calculate the geological and geotechnical parameters of the ore-hosting environment, and will enable the adjustment of production to better coverage of the ore deposit.

The results of the research were published in 11 scientific papers: 4 of which are articles published in journals recommended by the Committee of Oversight and certification of MES; 1 work were published in the international scientific journal that is part of the Scopus and Thomson Reuters company's database; 3 reports were published in collections proceedings of international conferences held in Bulgaria, the United Arab Emirates and Kazakhstan.

Application area - geology and geophysics.

The scientific importance is to develop and offer an efficient method of determining the effective power unit according to the induction logging carried out before and after the acidification of the unit. The method of calculating the geological and geotechnical parameters of the blocks based on induction logging data interpretation, which allows you to increase the efficiency of the decision of geological problems in the comparative analysis of the effectiveness of methods used for the calculation of reserves unit, is shown.