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Groundwater and level in open pit mining at mining enterprises

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Abstract: At present, in the process of open mining of ores, mining enterprises need to have information about the hydrogeological conditions of the mine, the flow and level of underground water. Based on research on determining the amount of underground water that has decreased in 2 consecutive stages during the implementation of extraction processes in mining enterprises, the cases of the decrease in the level of underground water in the mine have been proven by means of formulas. In open pit mining, measuring the level of groundwater and determining its direction plays an important role in the extraction of minerals. Water level monitoring in mining operations is related to water flow and level stimulation when a well needs to be installed. If a small diameter production well is satisfactory for use in aquifer testing, it can be installed by connecting lengths of tubing together. jet point and move it forward to the ground through the jet process. When the required depth is reached, the resulting well is completed by raising and pumping. Reactive equipment can be used to obtain underground geological data. It has also proven useful in cleaning and dewatering large diameter wells.
Keywords: Open pit mining, groundwater, hydrogeological research, hydromechanization equipment, filtration, flow direction and speed, groundwater level.

Introduction

Currently, the dynamics of water level changes in most mining enterprises are of great importance in the exploitation of rocks and minerals by determining hydromechanization equipment in the conditions of the deep operation of processes aimed at increasing the efficiency of hydrogeological research in open-pit mining enterprises. Based on the world experience of determining the inflow of underground water into the mines based on the hydrogeological conditions of the mines, it is necessary to constantly monitor the mining works with the help of hydromechanization equipment. Methods of calculating the groundwater level and flow direction have been developed. The results of the study show that we can monitor the situation of underwater mining and water table decline using rock and ore mining processes to determine the impact. Also, the use of hydrocon in the development of sedimentary deposits has a number of features. Due to the hydrogeological conditions of the region, mining operations are minimal. However, the use of dredgers to dig ore sand leads to a decrease in the water level. As the water level in the excavation decreases, the groundwater flow increases. However, if the water withdrawal is greater than the input flow , in which the water level can fall to the roof of the ore in the excavation, which will stop the operation of the mine and cause disruption to the work schedule of the enterprise as a whole. Taking into account the above, the research problem arises from the need to determine the required level of water in the excavations mined by the dredger. 'to provide, is decided by. It consists in calculating the time for the water level to fall to a given mark and determining the speed of the flow direction. Only in this case they recommend using hydromechanical equipment. It is not possible to apply this criterion in the development of pits in mines, because the water is not on the surface of the ore deposit, but in aquifers. Therefore, certain use creates the need to justify the water balance in the pit, which is to ensure the continuous operation of the mining equipment. The authors also proposed the use of a dynamic programming model with two uncertainties. The determination of simultaneous optimal modes of mining operations developed by them, taking into account the water requirements for the continuous operation of mining processes in mines, in hydraulic mechanization of mining equipment and sedimentary rock washing studied the studies in the case. Groundwater can negatively affect the stability of slopes during open pit mining. Fluid pressure acting within rock discontinuities and pore spaces reduces the effective stress, resulting in reduced shear strength. Therefore, identification and characterization of the hydrogeological regime at the initial stage of any project is of great importance, requiring a well-organized approach to data collection and conceptual hydrogeological modeling. The development of a conceptual hydrogeological model to support slope design

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analysis and depressurization program is discussed in Fig. This section focuses on field tests and procedures used to collect raw hydrogeological data. It describes the main approaches to data collection and then describes the nature of each relevant test method. It is necessary to collect preliminary data.

Materials and methods

In any mining operations involving significant deepening of the earth and penetration into its various layers, including aquifers, groundwater flows into mines. Part of them flows from the surface of the earth and is sediment absorbed into the ground, and the second part is only underground water, the amount of which depends on the hydrogeological conditions and seasonal characteristics of the area where the mine is located. The volume of water that flows into all mining operations associated with a single mine per hour or day. coming Miners have another concept related to underground water - the relative abundance of water, measured by the amount of water that falls on 1 ton of mined material. During mining in arid regions, mine owners must consider not only the cost of drilling rigs and other special equipment, but also the cost of mine drainage to prevent collapses, floods and other unpleasant consequences caused by uncontrolled groundwater. If we evaluate mine waters according to the amount of dissolved minerals and organic substances in them, they can be divided into hard, desalinated and acidic waters. Hardness is affected by the presence of lime in the water. If this parameter exceeds 30 mg / l, the hardness is considered very high. A lot of dissolved sulfuric acid in acidic water is the enemy of metal structures, with which there are many mines: rails, pipes, pumping equipment, loaders, etc. Acidic waters begin to be considered extremely harmful if they exceed 10 mg. / l of free sulfuric acid. After washing with such water, a person risks burning his eyes, therefore contact with underground water in mining operations should be done carefully, drinking it should be completely excluded. Identifying previously unsolved parts of the overall problem in opencast mining processes in mining companies shows the issues. In general, the inflow of groundwater into a pit is a constant function of the characteristics of the aquifers subject to filtration, the size of the pit, the reduction of the level and the loss of water. Also, the time period during which the water level in the pit is restored plays a decisive role. It is a generally accepted method of determining the flow of underground water during mining operations. "Flow level" method, in which the radius of RK is given by the formula:

$\mathbf{R_K=P/2\pi-N(K1-K2)}$: (1) , P - perimeter of the pit on the water supply contour, m

Without taking into account the infiltration feed, the water flow Q for an unconfined aquifer in the plan is determined by the following formula:

$\mathbf{Q= 2.73TS_K/(lg\,R_K+\pi at^{1/2})/R_K\ *100\%(2):\ m^3}$

Here T is permeability, T = k·m, K is the filtering coefficient, m is the thickness of the ore layer, m; S - decrease in level, m; a - hydraulic diffusivity, $1\cdot10^3$ m^2/day.

In the given formula (2), the reduced radius of the well is assumed to be unchanged, that is, the well is cylindrical in size. However, the walls of the resulting pit are curved and therefore I believe that the above equation is incorrect in practice. Therefore, when it is necessary to take into account the reduction of water during the mining process when conducting research, the level will be accompanied by a decrease in the area of the water table, which will depend on the perimeter of the pit and the correspondingly reduced radius. Therefore, it is suggested to divide the process of groundwater level change into elementary segments of time in the excavation of very gentle slopes by the finite difference method of determining the water flow. In order to solve this problem, it is necessary to determine the following: the volume of water and the mined rocks, the flow direction and speed developed for the unit of time; it is also necessary to determine the time when the water level in the drainage will fall to 10 m, then which mining operations will be stopped and the time for the recovery of the water level during dredging. In the development of flooded ore deposits, the mining layer is carried out directly without the involvement of additional sources of water supply. The task of determining the dynamics of the water level decrease during the excavation works is divided into time segments with the same period during the research by the method of creating a sum for the solved time units. According to the calculations when working, we can take the time interval DT = 0.1 days. In the following calculations, the value of DT is determined in days, the filtration coefficient is calculated in meters, and the water supply is taken as m2/day. The volume of extracted water and mined rock per unit of time DV is defined as follows:

$\mathbf{\Delta V = Q_0*DT\ (3)\ m^3}$,

where Q_0 is the volume of excavated rocks and water per unit of time, m3.

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The recommended method of calculating groundwater flow in mining enterprises is the following sequence:

1. If the groundwater does not go into the pit, the water level will be relatively low if the excavation value is low:
2. **$\Delta S_0 = \Delta V/F = (const)$, m^3 (4)**

where F is the area of water flow in the pit determined by the mine, based on geodetic documents, m2.
A decrease in the water level in the excavation leads to flooding, which is determined by the formula:
$Q_1 = 2.73 * K * m * \Delta S_0 / ((lgR_K + (\pi a \Delta T)^{1/2}) / R_K)$, (5) m^3/kun
where k is the filtration coefficient, 12.7 m / day; m is the thickness of the flooded part of the mine, Rk is the equivalent radius of the pit; a - hydraulic diffusivity, $1 \cdot 10^3$ m^2/day.
In the implementation of open-pit mining processes, it will initially consist of the introduction of a hydrological database, which can be expanded during the project implementation based on the technical documentation of the mine. Many operators use a single database for deep hydrogeological information, general dewatering and environmental management systems. In some cases, the database is integrated with geological modeling, geotechnical database and mine planning software. An overview of the groundwater flow system to provide detailed information on conductivity during drilling* to describe the characteristics of groundwater flow during injection testing or pump well installation and permeability and storage tests, and conducts pump tests for evaluation. Hydrochemical sampling and analysis of monitoring wells and pumping wells to characterize changes in groundwater quality that may aid in the interpretation of groundwater flow system. Effective water control is an important factor in both open pit and underground mining. Mines cannot be mined without draining them, which lowers the groundwater level around the mine. Properly installed water pumps usually include constant level monitoring. The pumping process is important for several reasons: Ensuring the stability of shaft walls during and after excavation. In open pit mining, the water table is very high and can destabilize mine walls, haulage and machine slopes. Water pressure affects the stability of the walls: materials on the slopes can start to slide and clash. Water flow must be controlled to prevent flooding in underground mines. However, a balance must be maintained to avoid lowering groundwater levels unnecessarily.

Conclusion

Determining the dynamics of the water level in the pit and its subsequent restoration, the task was initially solved by the continuous operation of the dredger. According to the technical indicators in the accounts, the water level has decreased - 10 m. After that, the dynamics of recovery with the restored part of the water level in the pit was observed. We explained the amount of decrease in the level of underground water in mines in 2 successive stages using formulas. The developed method of calculating the water flow can significantly reduce the time of excavation hydraulic calculations and ensure continuous use of the pit. Optimization of mining operations and cost reduction. Intermittent pumping processes can dry out the mine site, so materials such as sand, gravel and clay can be safely recovered without expensive blasting and drilling. Equipment wear and corrosion is minimized, and pump shutdowns due to overheating are eliminated. In addition, the cost of transporting materials that are not wet with moisture is much lower than the transportation of water-saturated cargo. All this is achieved with the help of accurate calculations for work on lowering the level of groundwater.

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