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Application Strategy of Hydraulic Environmental Technology in Geological Disaster Prevention and Control

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Abstract

The geological disaster of mine hydraulic environment will not only cause safety accidents, but also affect the development progress and reduce the development level of mineral resources. In order to ensure the safety of mineral resource development and improve the level of mineral resource development, it is necessary to use appropriate means to assess the risk of geological hazards in the mine's hydraulic environment, and to determine the safety of the development area according to the assessment results. With the development of the times and the progress of society, it is necessary to continuously improve the risk assessment measures of mine hydraulic environment and geological disasters, so as to strengthen the assessment effect and provide effective and scientific guidance for the development work.

Keywords

Hydraulic and environmental engineering; geological environment; disaster prevention and control

1. Overview of research on risk assessment of mine water, engineering, environment and geological hazards

1.1 The role of risk assessment for mine water, engineering, environment and geological hazards

The hydrogeology of mines is complex. Under the influence of various factors, the hydrogeology of mines is prone to some dangerous factors, which greatly threaten the safety of mineral resource developers and affect the development level. By conducting a risk assessment of the hydrogeology of mines, we can better understand the hydrogeology of mines and understand the dangers of development work. At the same time, we can also build a development plan based on the information of the risk assessment of the hydrogeology of mines, and then scientifically guide the actual work. In this case, not only can the safety of developers be guaranteed, but also the development effect can be guaranteed. To this end, we must recognize the role of the risk assessment of the hydrogeology of mines in the development of mineral resources and actively promote this work [1].

1.2 Current status of risk assessment of mine water, engineering, environment and geological hazards

hydrogeological hazards in mines involves exploration, analysis, and research in hydrogeology, engineering geology, and environmental geology. When conducting risk assessment of hydrogeological hazards in mines, it is necessary to consider all factors and strictly implement the work to ensure the effectiveness of the assessment. At present, China has achieved some results in the risk assessment of hydrogeological hazards in mines. However, there are also some problems that affect the level of assessment. For example, the overall quality of the assessment personnel needs to

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be improved; the exploration technology used needs to be updated; and there is a lack of in-depth analysis of the geological environment and hydrological environment. If these problems are not solved, it is easy to increase the risk of mineral resource development. Based on this, reasonable methods should be studied to efficiently solve these problems [2].

2. Key points for risk assessment of mine water, engineering, environment and geological hazards

2.1 Construction of the water conservancy and environmental geological disaster assessment unit model

In the work of risk assessment of mine water conservancy and environmental geological hazards, we must continuously break through traditional assessment methods and improve the accuracy of assessment. By dividing the assessment area into appropriate units, the accuracy of the assessment can be greatly improved. To this end, the unit division work must be done well. After the unit division is completed, a unit model must be constructed to guide the assessment calculation work. Using a 2.5 km × 2.5 km grid structure to construct an assessment unit model can ensure the assessment effect, so the grid structure of this specification can be used to construct an assessment unit model.

2.2 Geological hazard risk assessment based on weighted assessment

Geological disasters are not caused by one factor, but by multiple factors. If only one factor is considered in the risk assessment of mine water, engineering and environmental geological disasters, it is undoubtedly impossible to obtain scientific and accurate assessment results. Therefore, it is necessary to comprehensively consider various factors and then conduct comprehensive and accurate assessment work. By applying the weighted assessment method to conduct risk assessment in the mining area, various factors can be taken into account to ensure the assessment effect [3].

2.3 Classification of risk areas and disaster levels for mining water, engineering, environment and geological hazards

mine water conservancy and environmental geological disasters is divided into four levels, namely, high-risk disaster level: that is, areas prone to geological disasters, and the risk of areas prone to geological disasters is relatively high. Generally speaking, high-risk disaster areas will be marked in red. Medium-risk disaster level: that is, geological disasters will also occur in this area, but the number of geological disasters is less than that in high-risk disaster areas. The staff will use orange to mark the medium-risk disaster area. Low-risk disaster level: that is, geological disasters rarely occur in the area. The staff will use yellow to mark the medium-risk disaster area. No-risk disaster level: that is, geological disasters will not occur in the area under normal circumstances. The staff will use green to mark the medium-risk disaster area. Relevant staff should be clear about the meaning of the mine water conservancy and environmental geological disaster risk level and the different levels of mine water conservancy and environmental geological disaster risk areas represented by different colors, so as to conduct scientific assessment work.

3. Application of hydraulic engineering and environmental technology in geological disaster prevention and control

3.1 Surface and underground backfill combined with drilling and grouting

In response to geological disasters in mining areas, this article considers adopting a construction plan of surface and underground backfilling combined with drilling and grouting for geological management. The construction measures in the plan are as follows: For wide ground fissures and collapse disasters on the surface, the existing gangue in the mining area is first compacted and covered with soil, and the surrounding management area is comprehensively reclaimed; for large-scale goafs, the goafs are backfilled with gangue using tunnels and pits as the main entrances. In goafs in some difficult-to-access roads, rivers and other locations, it is necessary to design the construction of feeding holes, use gangue or waste rock for irrigation and backfilling, build artificial protection columns, and directly green the surface ecological damage and repair the cultivated land; for rivers near the riverbed and below which are goafs, necessary interception and diversion work can be carried out in the dry season, and water-proof layers and waterproof rolls can be set up and laid (with clay materials as water-proof layers), and flood control structures on both sides can be built. This water conservancy and environmental protection technology solution can consume the existing waste rock in the mining area to a large extent, restore the surface topography as much as possible, avoid secondary disasters caused by waste rock, and avoid water environment pollution caused by rainwater leaching of waste rock. Subsequent waste rock treatment measures (drainage ditches, retaining walls and other structures) can also be appropriately simplified, and the remaining waste rock field can be simply covered with soil to form forest land and cultivated land [4].

3.2 Technical requirements

(1) Technical requirements for backfilling and reclamation of subsidence pits. There are 6 subsidence pits in the mining area, of which the subsidence pits numbered 1 and 2 have been backfilled, and the remaining 4 subsidence pits need to be backfilled. The total backfill volume is 532.4m3, and the total area reaches 87.8m2. The ground fissure numbered 6 is 0.4m wide, 10m long, 4m2 in area, and 5m3 in volume. The backfilling of existing ground fissures and collapse pits requires the boundary approval of the ground fissures and collapse pits to ensure the safety of the backfilling construction. After the boundary is determined, the construction method can be adopted from the outside to the inside, backfilling and construction, and continuously going deeper into the inside. The nearby waste rock materials are used to backfill the ground fissures and collapse pits. After the backfilling and compaction, it needs to be 1m away from the surface. The soil needs to be planted about 1.5m near the backfilling position to achieve surface leveling. The upper part also needs to be covered with 1m thick clay. After the surface is compacted, restoration farming or greening and tree planting are carried out. The constructed clay layer can effectively prevent the infiltration of surface water, protect the goaf, and provide the necessary water and nutrients for vegetation. When there is a possibility of collapse in the tunnels and goafs, warning signs should also be set up around them to remind people approaching.

(2) Reclamation and greening of waste rock piles. The five waste rock piles in the mining area need to be fully reclaimed and greened. The management of waste rock piles should follow the principle of combining transportation, compaction and leveling, and greening. In the process of covering with imported soil, it is necessary to first treat a 0.5m thick clay layer and a 0.1m thick cultivated soil, and then adopt a hole-loading method with a size of 0.5m×0.5m×0.5m for greening. On-site waste rock can also be reused for a second time. It can be crushed and used in brick factories to make bricks or cement to form building materials, such as waste rock piles No. 1 to 3 in the mining area. Waste rock pile No. 4 is located within the planned cultivated land area. Part of the waste rock materials are used for backfilling, and the excess waste rock materials need to be fully compacted and leveled in combination with the existing landforms and terrain, generally forming a slope with a slope angle of 30°. At the No. 5 waste rock pile on one side of the river channel, a flood control structure with a width of 0.4m, a bottom width of 0.8m and a height of 1.5m needs to be built. The flood wall is built with rubble silica to prevent the waste rock from being washed away when the river flow rate is too high. The length of the flood control structure is 500m, the total amount of construction earthwork is greater than 520m3, the buried depth of the structural foundation is greater than 0.5m, and the foundation earthwork volume is greater than 250m3. Two drainage pipes with an inner diameter of 15cm need to be constructed inside the flood wall, set every 3m.

(3) Water environment protection projects. The existence of large-scale mined-out areas has a great impact on the surrounding rivers and groundwater. For example, the decline in groundwater levels causes rivers to infiltrate and flood into mined-out areas, and mining wastewater causes pollution of rivers or groundwater. For ground fissures, collapse pits, tunnels, and mined-out areas, long-term dynamic monitoring is not required after the treatment construction is completed, and groundwater filling and extraction treatment is no longer carried out. This helps to maintain the stability of the groundwater level and avoid pollution of nearby rivers. Mined-out areas near the riverbed and below the riverbed need to be backfilled in a timely manner. The riverbed waterproof layer (clay + waterproof membrane) can be set up in combination with flood control wall construction to prevent river water from infiltrating into the mined-out areas. The pumping project needs to be stopped after the treatment is completed. The reduction of groundwater filling can weaken groundwater runoff and control the pollution of mining wastewater [5].

3.3 In-depth analysis of geological and hydrological environment

In the process of assessing the risk of mine water, engineering and environmental geological hazards, it is necessary to conduct in-depth analysis of the geological environment and the hydrological environment. From the perspective of the geological environment, when analyzing the geological environment, it is necessary to go deep into the actual site, understand the geological environment, and compare the obtained geological environment data, information and other materials with relevant standards to determine the risk level of mine water, engineering and environmental geological hazards. For example, if a mining collapse pit is found at the construction site, its risk level can be increased. From the perspective of the hydrological environment, when analyzing the hydrological environment, it is also necessary to go deep into the actual site, understand the hydrological environment, and then compare the obtained data, information and other materials with relevant standards to determine the risk level of mine water, engineering and environmental geological hazards. For example, if carbonate karst water is found at the construction site, its risk level can be increased. It is worth noting that in the entire geological environment and hydrological environment analysis work, the actual obtained data and information should be used as the basis for analysis and research, and analysis and research work should not be carried out arbitrarily [6].

3.4 Establish and improve the survey management system

By establishing and improving the survey management system, the survey work can be effectively guided and the level of survey management can be improved. For the risk assessment of mine water, engineering, environment and geological disasters, the construction of the survey management system can be carried out from the following perspectives: First, build a survey management responsibility mechanism, clarify the survey management responsibilities, and urge relevant personnel to implement the work. Second, build a survey instrument and technology application system to optimize and guide specific survey work. Third, build a survey unit selection mechanism to better select suitable survey units to promote this work. Fourth, build a disaster prevention mechanism to ensure that surveyors master disaster prevention management skills and improve the personal safety of surveyors. In the actual survey management process, it is also necessary to continuously improve and improve the survey management system according to work needs and work requirements. Under this circumstance, the survey management effect can be enhanced.

3.5 Build an excellent team of assessment talents

mine water, engineering, environment and geological hazards is a systematic and complex task. If the professional ability and professional quality of the assessors are low, it will be difficult to fully cope with this work, which is not conducive to improving the level of risk assessment of mine water, engineering, environment and geological hazards. In order to ensure the quality of risk assessment of mine water, engineering, environment and geological hazards, it is necessary to build an excellent team of assessment talents. This paper mainly studies the construction methods of excellent assessment talents from the following aspects: First, increase the intensity of training and education. According to the requirements and work specifications of risk assessment of mine water, engineering, environment and geological hazards, select appropriate training content. At the same time, it is also necessary to understand the quality of the assessors themselves and the training and learning needs, so as to enrich and improve the training content. After that, the training and education work can be promoted. In order to help assessors master more skills in risk assessment of mine water, engineering, environment and geological hazards, the training and education personnel focus on theoretical education for them and also need to lead them to the actual location for educational guidance on practical methods. The second is to do a good job in recruitment. In the process of recruiting assessors, it is necessary to clarify the job responsibilities and list the recruitment conditions to facilitate the recruitment of excellent assessors. In this way, the assessment team can be strengthened and the assessment level can be guaranteed. The third is to formulate a reward and punishment mechanism for assessment work. If the evaluator completes the work efficiently, he or she will be rewarded accordingly; otherwise, he or she will be punished. Under the reward mechanism, the evaluator's enthusiasm for work can be stimulated; under the punishment mechanism, the evaluator can be ensured to reflect on and improve the evaluation work. By carrying out the reward and punishment work, the level of evaluation team building can be improved. Therefore, it is necessary to persist in carrying out the reward and punishment work [7].

4. Conclusion

mine water conservancy and environmental geological hazards is the key point and focus of geological work. In geological work, it is necessary to grasp the key points and focus of mine water conservancy and environmental geological hazard assessment to ensure the effectiveness of the assessment. Since the comprehensive quality of assessment talents affects the level of mine water conservancy and environmental geological hazard assessment to a large extent, it is necessary to focus on improving the comprehensive quality of assessment personnel and improving their ability to deal with various assessment issues. In addition to strengthening the construction of a team of comprehensive assessment talents, it is also necessary to focus on introducing advanced technologies to guide the assessment work. After completing the assessment work, it is necessary to reflect on the work, summarize the experience, and then form a complete assessment work system, thereby laying the foundation for the smooth progress of subsequent assessment work.

References

[1] Zhu Yu. Analysis on the application strategy of hydraulic and environmental technology in geological disaster prevention and control[J]. World Nonferrous Metals, 2020(13):157-158.

[2] Zeng Rong, Bin Yuyuan, Zeng Huimin. Application of hydraulic and environmental geological technology in geological disaster prevention and control[J]. World Nonferrous Metals, 2020(11):233-234.

[3] Qin Chuanglong, Lin Liang. Analysis on the application strategy of hydraulic engineering and environmental technology in geological disaster prevention and control[J]. Jushe, 2020(12):50+71.

[4] Zhang Huan. Application of hydraulic and environmental geological technology in the prevention and control of geological disasters in the new era[J]. World Nonferrous Metals, 2020(04):241+243.

[5] Wang Xin. Application of hydraulic and environmental geological technology in geological disaster prevention and control[J]. Inner Mongolia Coal Economy, 2020(01): 211.DOI:10.13487/j.cnki.imce.016164.

[6] Wang Dong. Analysis on the application strategy of hydraulic engineering and environmental technology in geological disaster prevention and control[J]. World Nonferrous Metals, 2019(18):217-218.

[7] Yang Huihong, Xiao Liquan. Research on the assessment method of geological hazards in mines[J]. World Nonferrous Metals, 2019(12):113-114.