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Discussion on Evaluation and Strategy for Safety Current Status of Certain Coal Mine

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Abstract

Through the investigation and analysis on the actual situation and management status for the safety production equipment and facilities of coal mine, this paper comprehensively analyzes the various dangers and hazardous factors for this coal mine. It divides this coal mine into 14 evaluation units, and determines its risk degree through the analysis method of combining the qualitative and quantitative evaluation, as well as provides an objective evaluation to its safety management status. It raises the reasonable and feasible safety strategies, measures and advice to the existing issues, urges the mine to carry out the modification so as to effectively serve the safety management work of mine.

Keywords

Coal Mine Safety, Safety Evaluation,Safety Production.

1. Introduction

Along with the rapid development of mining industry in our country, the mine enterprises have paid more and more attention to the safety issue. The coal mine production system is one complex and comprehensive system composed of "person-machine-environment". The production environment of mine is different and the reason for various accident is different, so that the various dangers and hazardous factors are interconnected, mutually cooperated and influenced. Therefore, it is required to perform the qualitative and quantitative analysis through the effective safety comprehensive evaluation. It is required to seek the key factors, take the safety measures and put them into place so as to ensure the safety of employees and guarantee the economic benefit of enterprises.

2. Content and Method

2.1. Evaluation Scope

The evaluation scope is the production system relating to one extraction working face and three driving working faces within one field scope delineated by 9 inflexion coordinates in the Mining License of this coal mine.

2.2. Evaluation Content

It mainly performs the systematic evaluation to the evaluation units of coal mine e.g. development and mining unit, ventilation unit, gas prevention unit, water rescue and dust prevention unit, fire prevention unit, water prevention unit, safety monitoring and personnel location and communication unit, explosive storage, transportation and use unit, transportation improvement unit, compressing and hedging unit, electric unit, emergency rescue unit, safety management unit, heat damage prevention, occupational hazard management and health supervision unit etc.

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2.3. Evaluation Method

According to the national relevant laws, legal regulations and technical requirements etc., it adopts the field investigation method, analogy inference method, expert review method, safety inspection sheet method, accident tree quantitative evaluation method etc. safety evaluation methods.

3. Introduction of Evaluation Subject

The evaluation subject is one coal mine with the designed production capacity is 300,000 t/a. The mining scope for this coal mine is delineated by 9inflexion coordinates with the average length of mining area is 1.0km, the average inclined width is 1.1km, the area is 1.763km2, and the mining elevation is from 1780m to 1250m.

4. Introduction of All Main Evaluation Units

4.1. Development of Mine

The development method is the inclined shaft development with three shafts to be arranged, including the main inclined shaft, auxiliary inclined shaft and return air inclined shaft. The mine is divided into three levels with the average elevations for the levels are respectively＋1640m, ＋1515m, ＋1400m; Currently it is mining the second level. This coal mine is divided into 9 mining areas, currently it is mining the second area and fifth area. The mining method is the longwall mining method, and the extraction process is the fully-mechanized coal mining; 52001 return airway and 52001 transportation roadway driving working face adopt the fully-mechanized extraction.

4.2. Ventilation System

This coal mine applies the centralized juxtapose ventilation. The main working method of ventilator is the exhaust ventilation, the ventilation method of coal working face is U-type ventilation, and the ventilation method of local ventilator of heading end is the blowing ventilation.

Currently the return air adit ground ventilator room is equipped with two mine flame-proof counter-rotating axial-flow ventilators of model FBCDZNO30/2×450 (one for use and one for standby); The driving working face applies the flame-proof counter-rotating axial-flow local ventilator of model FBDN06.3/2×45 (one for use and one for standby), and applies the mining fire-retardant air stack of 600mm. The extraction working face applies “U” type ventilation, and the driving working face applies the blowing ventilation.

4.3. Hoisting and Transportation System

The main inclined shaft is installed with the belt conveyor of model DTL100/63/2×160S to transport the coal and undertake the transportation task of raw coal for the mine. The auxiliary shaft is installed with the single-drum hoisting winch of model JK-2.0×1.5P to undertake the auxiliary transportation task of the coal gangue, materials and equipment etc. The auxiliary inclined shaft is installed with one mining aerial passenger device of model RJKY37-18/650 to undertake the task of personnel transportation.

4.4. Drainage System

The central water pump station is installed with four water pumps of model 150D-30×8 with the motor power is 200kW, drainage capacity is 155m^3/h and flow is 155 m^3/h, as well as two rows of drainage pipes of φ159.

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4.5. Dust-proof and Fire-proof System

The mine adopts the centralized flame-proof water barrier, the mining and transportation equipment are all equipped with the spraying dust-proof device; Currently the mining and evaluation of coal seam underground fire sprinkler and water rescue system is the integrated pipe network system.

4.6. Gas Prevention and Gas Drainage System

In terms of the gas drainage system, the mine is installed with two high negative pressure gas drainage pumps, and the parameter of high negative pressure gas drainage pump: water-ring vacuum pump of model 2BE4-670, four low negative pressure gas drainage pumps, two water-ring low negative pressure vacuum gas drainage pumps of model 2BEC52 and two water-ring vacuum pumps of model 2BE4-670.

The fully-mechanized coal mining face of mine applies the mining of protective layer and the bedding drilling pre-extracting the coal-seam gas of extraction area for the outburst prevention. The driving working face applies the method of directional long-drilling pre-extracting the coal roadway and strip gas+normal bedding drilling pre-extracting gas for the outburst prevention.

5. Evaluation Conclusion and Advice

5.1. Evaluation Conclusion

(1) Identification of Major Danger and Hazardous Factor

Under the current production conditions and management status, the risk degrees for the major dangers and hazardous factors of this coal mine from high to low are in order as below: coal and gas outburst (28 scores), gas explosion (26 scores), fire disaster (24 scores), roof fall and rib spalling (22 scores), and flood (20 scores). It is at the levels of relatively risky and very risk.

(2) Evaluation Conclusion of Each Unit

Through referring to the safety production industrial standard Detailed Implementing Rules for Safety Acceptance Evaluation of Coal Mine Construction Project (AQ1096-2014), as well as applying the evaluation score of evaluation unit and key index, this paper divides the evaluation conclusion of all units into four levels from high to low are in order as below A→B→C→D. In which, the score is higher than 90 is A, higher than 70 is B, higher than 60 is C and lower than 60 is D.

According to the on-site situation, this paper applies the inspection sheet scoring method to grade 15 units. See Table 1 in detail.

Table 1: Comprehensive Evaluation Results

System (Unit) Name	Evaluation Score	System (Unit) Name	Evaluation Score
Mining Unit	76	Transportation and Hoisting Unit	77
Ventilation Unit	78	Compressed air system and Emergency Hedging Unit	74
Gas Prevention Unit	74	Electric Unit	80
Water Rescue and Dust Prevention Unit	77	Emergency Rescue Unit	75
Fire Prevention Unit	78	Safety Management Unit	82
Water Prevention Unit	74	Hygiene, Health Care and Health Monitoring Unit	74

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Safety Monitoring, Personnel Position and Communication Unit	73	Heat Damage Prevention	85
Explosive Storage, Transportation Unit	77	Mine Comprehensive Evaluation	73

According to the evaluation results for each unit, take the lowest grade among the evaluation grades of all units as the comprehensive evaluation grade of mine. The evaluation should take the lowest score of 73. If the safety class of evaluation unit reaches B grade, it has the basic safety production conditions.

5.2. Advice and Strategy

(1)If taking the directional long-drilling bedding pre-extracting coal-seam gas and the large-power driller pre-extracting coal-seam gas with the drilling trace measurement function, which should be taken as the main outburst prevention measure of area upon the expert argumentation and reported to the safety supervision department of coal mine for the registration.

(2)According to the evaluation results, it is required to take two “Four in One” comprehensive outburst prevention measures strictly in accordance with the Detailed Rules for Preventing Coal and Gas Outburst in the course of production of coal mine.

(3)It is required to combine the qualitative and quantitative evaluation on the basis of identification and analysis of danger and hazardous factor, safety facility evaluation, legality evaluation of safety production etc. so as to construct and optimize the method system of safety evaluation for coal mine, as well as effectively serve the safety management industry of coal mine [1].

(4)The safety work should focus on implementing, deepening, site and timeliness. In order to well perform the safety production work of coal mine, it is required to adhere to “addressing both symptoms and root causes, and focusing on addressing root causes” [2]. It is able to carry out the intrinsically safe cold mine construction work in the coal industry with one position for particular responsibility, which is the important means and method of realizing the fundamental improvement of safety production trend for the coal mine [3].

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