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Study on coal mine macro, meso and micro safety management system^{☆,☆☆}



Longkang Wang^{a,b}, Baisheng Nie^{a,b,*}, Jiabin Zhang^{a,b},
Xiaoqiang Su^{a,b}, Shoutao Hu^{a,b}

^a School of Resource and Safety Engineering, China University of Mining & Technology, Beijing, Beijing 100083, China

^b State Key Lab of Coal Resources and Safe Mining (China University of Mining & Technology), Beijing, Beijing 100083, China

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Summary In recent years, the coal mine safety production situation in our country improved year by year, but severe accidents still occurred; the accidents caused great economic loss to the national economy. According to statistical analysis, almost all of the coal mine accidents will expose the hidden danger in before, most of the accidents caused due to safety management not reaching the designated position and the hidden danger management does not take any decision in time. Based on the coal mine safety management holes in our country, the coal mine macro, meso and micro safety management system was established in this paper, which includes meaning and conception of the theories of the macro, meso and micro safety management, and also includes the matching hardware equipment, in order to achieve the hidden danger's closed-loop control and dynamic early warning in the process of coal mine production.

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* Corresponding author at: School of Resource and Safety Engineering, China University of Mining & Technology, Beijing, Beijing 100083, China.

E-mail address: bshnie@163.com (B. Nie).

Introduction

Coal mine is the main and foundation energy in China. Also, it is the important part of national economy, and it provides the driving force for the rapid development of national economy. The rapid development of national economy promotes the improving of coal mine production situation. In recent years, mortality million tonnes as a measure of coal mine safety production situation, production of million tonnes declined year by year, dropped to 0.892 in 2009 and below to 0.3; for the first time in 2013, it reached 0.293 (State Administration of Work Safety, 2010, 2014). But there is still a large gap compared with developed countries. Taking America as an example, as the world's second largest coal-producing country, the coal output in the past 10 years has been stabilized at nearly 1 billion tonnes, whereas the mortality is about 30 people in coal mine, with mortality million tonnes control a long-term below 0.1. Especially in recent years, mortality million tonnes in American declined to 0.03; Australia is the lowest, at nearly 0.014 (China Coal Network, 2014). The reason is that the hidden danger checking is not comprehensive, and it does not realize the dynamic monitoring, quantitative analysis and dynamic classification early warning in the process of coal mine production in China. Accordingly, the thesis designs the coal mine macro, meso and micro safety management system to improve the level of the scene safety management in coal mine, reduce the probability of the accidents effectively.

Research status

Research status of abroad

Foreign safety experts and scholars study the coal mine safety management system in different angles, Apuma Kumar Ghosh studies on the relationship of coal mine accidents with working condition, coal mine workers' individual factors and enterprise management level by questionnaire method, and concludes that coal mine should prevent the happening of the accidents by improving management quality and working environment, attaching great importance to the workers safety psychological training (Ghosh et al., 2004). Mustafa Kumral uses genetic algorithm to improve the coal mine safety management system through optimizing every subsystem of coal mine (Mustafa, 2005). Paul applies intrinsic safety basic principle to study coal dust explosion preventive methods (Paul and Maiti, 2007). Jeffrey studies on the process of coal mine safety production, by elaborating safety management targets, forces workers to change safety attitudes, implements self-management, in the coal mine production, learns safety skills initiative, improves personal safety quality and achieves coal mine's safety production (Hickman and Geller, 2003). David D. studies the coal mine safety management from the perspective of safety atmosphere, puts forward that safety atmosphere has the effect of coordination to the factors of safety production procession (Dejoy et al., 2004). David L. studies the influence of rules and regulations such as coal mine ownership system to the coal mine accidents, comes out the function of the coal mine ownership system and related systems in the coal mine safety production (Laurence, 2005).

Knegtering studies the three aspects to improve coal mine safety management level, effective safety measurement system, safety training system and safety control system (Knegtering and Pasman, 2009). Amyotte puts forward the process safety management in the coal mine safety production through researching, it includes safety targets, risk assessment, safety standards, the condition of equipment, safety training, safety awareness and safety laws (Khan and Amyotte, 2003; Amyotte and Oehmen, 2002).

Through the research of security experts, the developed countries have formed the more advanced safety management systems. The first one is OSHMS, which is the standard management system, aimed at realizing employees professional safety and healthy. Its core content is the identification, evaluation and control of risk factors; according to this standard, different countries issue corresponding standardization system. NOSA five stars management system is a set of scientific and standardized safety-health-environmental management system which is built by South Africa Nation Occupational Safety Association. The core is that safety-healthy-environment integrates into 5 units, and then subdivided into 72 elements. In that, each element makes safety management; through production practice's testing. The system can effectively reduce the happening of the accident, reduce personnel casualties, reduce the probability that the employees have the occupational disease, improve the work efficiency.

The domestic research status

Our country's coal industry experts formed the following points after years of researching and accumulation. Du Chunyu studies on coal mine intrinsic safety's macro and micro, and provides a new thinking for coal mine safety management (Du et al., 2007). Zhao Xiaoping thinks that the harmonious development of man, machine, environment and management is the premise of coal mine safety production; it is the fundamental guarantee of safety management whether effective (Zhao, 1998). Xiang Jiye analyses the coal mine accident by fuzzy mathematics, it concludes that the main reason to lead coal mine accidents is macro supervision competently and coal mine leaders and workers' low quality (Xiang, 2006). Hu Lijun analyses the coal mine accident by using the method of empirical research; he gets the main reason of coal mine accident is unsafe man behaviour, and unsafe man behaviour is mainly due to coal mine workers' psychological of adventure and luck (Hu and Chen, 2007). Zhao Chaoyi uses the system engineering theory to discuss the essential safety in the process of the coal mine production's man, machine and environment (Zhao et al., 2002). Liu Haibin researches lots of our country's coal mine accident, gets that man behaviour's essential safety is the principal in our country's coal mine intrinsic safety (Liu et al., 2007). Gao Zhuohui thinks that only on the basis of full understanding and mastering traditional safety management and intrinsic safety theory, can we ensure traditional safety management to the essence safety management of a smooth transition in the new situation (Gao and Zhao, 2006). Ou Xiaoying uses the theory of accident numbers, sorts the factors of coal mine accidents, and he concludes the key

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