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Analysis of Accident Source and Preventive Measures in Local Coal Mine

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Abstract. In view of the current situation of frequent accidents in local coal mines, this paper analyzes the fundamental causes of frequent accidents from five aspects: personnel composition, safety input, machinery allocation, information technology, safety supervision, and puts forward corresponding preventive measures.

1. Introduction

Coal is the main energy in China, accounting for 2/3 to 3/4 of China's primary energy production and consumption structure. According to the statistics of the ministry of coal industry, there were 219 accidents and 375 deaths in national local mines in 2017, with the mortality rate of 1 million tons decreasing by 30 cases and 151 men, down by 12% and 28.7% respectively^[1]. The situation of coal mine safety production has been improved. However, the safety level of China's coal mine production is uneven, and there are many serious accidents, such as "Henan Jan. 4 gas outburst" and "Hunan Feb. 14 explosion".

As the de-capacity policy continues to be promoted, the number of coal mines in China has decreased from 10,800 in 2015 to more than 7,000 by the end of 2017^[2]. But, there are only about 1,200 coal mines with capacity of more than 1.2 million tons of a year. Although the small and medium-sized local coal mines have been sharply closed down in recent two years, the proportion of coal output from local coal mines still cannot be ignored. Local coal mine is a coal mining structure with Chinese characteristics formed in China. Therefore, the safety production of China's coal industry can be fundamentally improved only by curbing local coal mine accidents.

2. Analysis of local coal mine accident source

Local coal mine is difficult to achieve equipment and technical conditions required for safe production. The update of backward equipment is not timely, with the talent bottleneck, low quality of personnel, the lack of capacity to deal with major disasters, a serious shortage of safety investment, and the lack of information technology. The lack of safety production guarantee and hidden danger of safety production accidents are in reciprocal causation, resulting in a vicious circle.

2.1 Shortage of talents, a severe shortage of professionals

In local coal mines, there is a general contradiction between overpopulation and structural shortage. In particular, there is an extreme shortage of technicians in "mining, digging and opening", and the age structure of personnel is generally aging. Local coal miners are overwhelmingly farmers, some even migrants from remote and poor areas. The poverty forces them to accept the hard work of miners rather than ordinary career options. Therefore, local miners are mostly seasonal and migrant workers,



did not receive formal training before entering underground operation, with a low level of education, lack of teamwork spirit and safety awareness, exist a fluke mind in work and do not follow operating procedures, extremely, a serious lack of knowledge and skills to prevent and respond to accident.

2.2 Insufficient safety input

The coal market has been sluggish since 2012, and the phenomenon of postponing and reducing coal mine safety production cost is common. The national coal mining enterprises reduce input, especially in local coal mine, the renovation fund of many local mines continues "zero input", a serious shortage of safety investment. Many coal mine electromechanical equipments are aging and disrepair seriously, the degree of safety guarantee for coal mine has been greatly reduced, all kinds of hidden safety problems appeared increasingly, bring enormous pressure to the production of safety.

2.3 Low mechanization level and poor mining equipment

China's local coal mine economic capacity is relatively limited, mechanized level of mining is low, equipment is poor, and there is a clear gap with state-owned coal enterprises. In addition, the reliability of local coal mine equipment is low, the parts have short life and are easy to be damaged. In order to reduce the input cost, enterprise managers fail to timely replace or repair the equipment and parts that are already in the state of potential accident, making the equipment is easy to become a factor leading to accidents.

2.4 Insufficient application of information-based data

In the increasingly fierce market competition, information technology is of vital importance. However, due to the limitations of management thoughts, operating conditions and staff quality, the large amount of daily data and monitoring data collected by local coal mines are only stored in the database and not fully utilized. The backward processing method in data management makes a large amount of basic data of safety production cannot be processed in time, which often leads to the phenomenon of incomplete decision data, inaccurate data of safety production status and delayed information. At present, the informatization level of China's local coal enterprises is still in the primary stage, the application of informatization data has not been popularized, and the informatization level needs to be improved.

2.5 Inadequate supervision of safety production

The technical staffs of the local coal mine supervision organs are in serious shortage, and the work routines are aging, which are not adapted to the increasingly heavy safety supervision work. Inadequate supervision equipment, low treatment of law enforcement personnel, and even the absence of post allowance and down-well subsidy for some local coal mine supervisors, resulting in low enthusiasm of supervision personnel and insufficient safety supervision. The relationship between different levels of coal supervision departments is mixed, the supervision functions are overlapping and interlaced, and the coordination mechanism of the supervision work is not yet perfect, resulting in repeated management and inefficient management of the supervision departments, leading to the situation of unclear power and responsibility among departments, which is not conducive to the safety production of coal mines ^[3].

3. Preventive measures

The study on the preventive measures of mine accidents is to take timely measures to eliminate the unsafe behavior of people and the unsafe state of things. The safety production was changed from traditional accident analysis to accident prevention, from the traditional passive safe production object to the safe production power, from the traditional static safety production to the modern safety dynamic production, from the traditional passive, auxiliary and lagging production safety to the modern active, essential and advanced production safety ^[4].

3.1 Firmly eliminate backward production capacity

We will resolutely eliminate backward production facilities. For coal mines with productivity less than 300,000 tons of a year and major production safety accident, or with productivity less than 150,000 tons of a year and larger production safety accident, or adopting coal mining methods and technologies prohibited by the state and failing to carry out technical transformation, or refuse to suspend production and rectify production still organized, to resolutely eliminate^[5].

3.2 Strengthen talent construction and strictly enforce the access system for employees

Local coal mines offer unified knowledge and professional skills training to in-service staff, guide them to learn laws, regulations and standards carefully, and constantly enhance the awareness of the workers and grassroots groups that "grasping production means grasping safety", laying a solid foundation for coal mine safety production. Strict personnel access system, establish safety quality access system for underground coal mine employees, and formulate safety quality standards and assessment system of different scales and disaster types^[6]. Local coal mining enterprises shall, in accordance with the regulations, appoint managers of safety production such as the chief mining officer, chief engineer, as well as professional engineers and technicians in coal mining, tunneling, mechanical and electrical transportation, ventilation and geological survey, etc. The manager of a coal mine and the personnel in charge of production safety must pass the examination of the knowledge and management ability of production safety organized by the safety supervision department. Professionals must have a technical secondary school degree or above related to coal mine or a certified safety engineer qualification, and have more than 3 years of underground working experience^[7].

3.3 Increase input, upgrade the level of mine equipment

Mechanization of mining is an important way to improve the efficiency of mining, reduce the labor intensity of workers, reduce the number of working face, increase safety factor and reduce accidents and casualties. Coal mining enterprises should increase their input, adopt advanced technical equipment according to the actual conditions of their respective mining environments, further narrow the gap between local coal mines and state-owned coal mines, and speed up the process of transforming the development mode of local coal mines from backward and extensive mode to advanced and intensive mode. Local coal mines should give high priority to fully mechanized mining and popularize it, push ahead in an all-round way the reform of mechanized mining methods, raise the level of mining technology, and implement the goal of "replacing people by mechanization, reducing people by automation."

3.4 Strengthen the supervision and control of coal mine safety production

Local coal mines in China have the characteristics of "many, scattered and small", and the structure is similar to rural areas. The management of local coal mines, a very special part of the coal industry, should give full play to local administrative functions and combine with the reality of local coal mines. Local coal mines should gradually improve the safety supervision network at all levels, perfect and streamline the supervision system, so as to form a full-coverage coal supervision system covering both horizontal and vertical aspects. Coal mine safety regulators at all levels should strengthen the construction of political ideology, work style and business, improve their ability to fulfill their supervision responsibilities in accordance with the law, and make the supervision detailed, practical and effective.

The safety supervision must deal with the relationship between the key points and the general ones, and don't focus on one thing and lose another. The managers should carefully and comprehensively pay attention to the safety supervision and preventive measures of each stage and each link. To strengthen the implementation of a series of procedures for production safety supervision, for example, collecting data in coal mine production and work-related casualties data, conducting regular inspections of each mine, issuing a control command after the risk is found to be beyond acceptable,

investigating illegal activities and punish the offenders, etc.

3.5 Firmly strengthen informatization construction, improve the level of safety forecast

Local coal mines should make full use of the existing network platform to timely process the monitoring data of coal mine safety system, and clarify the safety degree of each region of coal mine production. Ultimately, through the analysis and synthesis of the current safety state, the law of accident occurrence is mastered, the future safety state of the coal mine production system is predicted, and the safety management idea of "safety first, prevention first" is implemented.

4. Conclusion

Local coal mine safety accidents often occur. In the final analysis, the lack of safety production guarantee and hidden danger of safety production accidents are mutually causative, resulting in a vicious circle. Coal mining enterprises and administrative departments at all levels should suit the remedy to the case, resolutely eliminate backward production capacity, strengthen the construction of workers' quality, strengthen the supervision of production safety, strengthen the application of informationized data, increase security investment, improve the level of mechanization, and fundamentally solve the problem of the lack of production safety guarantee, as far as possible to reduce production safety accidents, and achieve "zero accident" safe production target.

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