Research on Safety Management of Small and Micro-sized Mining Enterprises

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Abstract: In view of the characteristics, status and present situation of small and micro-sized enterprises and small and micro-sized mines, this paper investigates the common safety problems or hidden dangers of small and micro-sized mining enterprises on the basis of practice, analyzes their causes, discusses the current safety management system and operation mechanism of small and micro-sized mines, and puts forward various effective ways to improve the safety management of small and micro-sized mines. It has strong practical and theoretical significance for mine safety.

1. The concept, characteristics and status of small and micro-sized enterprises

According to the Circular on the Issuance of Standards for the Classification of Small and Medium-sized Enterprises(No. 300) (2011) of the Ministry of Industry and Information Technology, the National Bureau of Statistics, the National Development and Reform Commission and the Ministry of Finance, by industry category, big category, middle category and combination category, according to employees, operating income, total assets and other indicators, the enterprises in China are divided into four types: large, medium, small and micro-sized. Among them, operating income is equal to and more than 3 million yuan and less than 20 million yuan, employees are equal to and more than 20 people and less than 300 people belong to small enterprises; operating income is less than 3 million yuan, employees are less 20 people, belongs to micro-sized enterprises. Small enterprises and micro-sized enterprises, are collectively known as small and micro-sized enterprises. Overall, there are a large number of small and micro-sized enterprises, a wide distribution of industries. They are of small scale, little capital, backward technology, weak management, poor adaptability, poor viability and weak profitability [1]. Small and micro-sized enterprises are the light cavalry of China's economic development, are the capillaries of China's economy, are the breeding base of large and medium-sized enterprises, which increase social employment, enrich the lives of the masses, optimize industrial structure, promote economic growth, play an important role [2]. According to 2012 statistics, there are about 10 million small and micro-sized enterprises, their total industrial output value, sales income, realized profits and taxes account for about 60%, 57% and 40% of China's total economic output respectively, 75% of urban employment opportunities are provided [3].
2. Present situation, status and characteristics of small and micro-sized-mining enterprises
Mines are an important part of industrial enterprises, most of them are small and micro-sized. At present, there are more than 4500 mines in Yunnan Province, mainly are building materials mines (quarries, sand mines, stone mines), ferrous metal mines, non-ferrous metal mines, gold mines and chemical mines. They are widely distributed in all parts of Yunnan. There are at least 20–30 mines, more than 100 mines in each county. They play an important role in national economic construction and social development, especially building materials mines, are an important private economic organization in local villages and towns, serving local engineering construction, are indispensable. Most of them are of small scale, backward technology, little capital, weak management, poor adaptability, poor survival ability, short life cycle and prominent safety problems. Small and micro-sized mines are one of the major objects of national safety production supervision.

3. Safety problems or hidden dangers of small and micro-sized mining enterprises
A large number of mine surveys and safety inspection practices have proved that mine safety problems or hidden dangers are mainly manifested in these aspects:
(1) Mine infrastructure is not strictly completed in accordance with mining design, safety facilities have not strictly been implemented according the three simultaneous system;
(2) Failure to establish and improve mine safety management system and to implement various safety management systems;
(3) Incomplete, expired or lack of mining, safety production or business licences or lack of basic design information for mining;
(4) The safety management system is not complete, is not suitable for the mine actual situation, the operation is not normal;
(5) Relevant staff members operating without a certificate or without training qualified post;
(6) Construction site management confusion, various operations are not standardized;
(7) In the process of production, the hidden dangers can not be found and eliminated in time (such as non-stratified mining, super high step, insufficient step width, too large slope angle, loose stone, and insufficient safety protection);
(8) Fire fighting facilities are not equipped or regularly tested or expired, such as fire extinguishers, emergency lights, etc;
(9) Use obsolete equipment and production technology, such as dry drilling, wood support, bottom mining;
(10) Inadequate safety facilities, such as lack of safety gates, drainage facilities, flood dams, dump sites, tailings reservoirs, spare equipment, etc;
(11) Safety inspection, safety management is not in place or in time;
(12) Power transformation and distribution, mechanical and electrical equipment, engineering equipment safety protection measures are not in place;
(13) Insufficient safety precautions, safety signs and safety protection measures;
(14) Insufficient safety input, safety education, safety training and safety contingency plans;
(15) Safety protection of site workers is not in place, not the correct use of labor protection equipment, such as not wearing a helmet or dustmask;
(16) Safety management lacks timeliness, pertinence, standardization, systematicness and long-term nature, and management records are confused or untrue;
(17) Safety management personnel at all levels have unclear responsibilities, poor coordination, safety responsibility implementation is not in place.

4. Analysis of causes of safe problems of the small and micro-sized mines
The small and micro-sized mines themselves are small, weak and scattered, and the safety problems are more prominent. The reasons are external and internal, and the internal reasons are the main ones. The external reasons are mainly lax, untimely and inadequate safety supervision and management of relevant departments of local governments; substandard and improper engineering safety quality of
cooperative units; weak safety awareness or unconscious dangerous behavior of local people as third parties. The internal reasons are mainly due to the lack of safety awareness, safety management ability and safety technical ability of mine owners and responsible persons; incomplete or inappropriate safety management system and poor operation mechanism of safety management, insufficient management ability of safety management personnel and poor management in time; weak safety awareness and poor professional skills of ordinary employees; poor coordination of safety management between the upper and lower levels; non-standard operation and unsafe behavior; improper repair and maintenance of mechanical and electrical equipment, unsafe state of things; confusion of operation site management, serious deterioration of the working environment, etc.

5. Safety management system of small and micro-sized mining Enterprises
The general management organization of small and micro-sized mines is simple, often composed of mine responsible person (safety responsible person), safety administrator (part-time safety administrator) and workers. Most small and micro-sized mines lack special safety management organization. Because most of the mine leaders have no engineering technology and management professional background, their safety awareness and management ability are generally not high, vary from person to person and the difference is huge, the mine safety management as a whole is relatively backward. The safety administrators are mostly persons with low education level, although trained by the local safety supervision and management department and obtained the qualification certificate of safety administrator, their actual level and ability are limited. Workers are mostly migrant workers, they are of low education, weak safety awareness and lack of professional skills. Therefore, there is a need for long-term professional skills, technical and safety training to continuously improve their technical and safety management capabilities.

6. The safety operation mechanism of small and micro-sized mining enterprises
Most small and micro-sized enterprise organizations are simple, few levels, centralized power, high efficiency of administrative command. Mine leaders can be strictly followed and rapid response, this is its advantage. However, their decision-making and management is lack of scientific, arbitrary, strong dependence on individuals, lower staff enthusiasm and initiative is poor, up and down coordination is not good, lack of standardization and institutionalization. Therefore, the key of mine safety management is the implementation of safety responsibility system, safety reward and punishment system and safety operation mechanism. Only by defining the objectives of enterprise safety management, defining the safety responsibilities of everyone at all levels, setting up the concept of safety first, carrying it out layer by layer, timely inspection and feedback according to the PDCA cycle, achieving comprehensive coverage, the whole process, full participation, long-term persistence, unremitting efforts and continuous improvement can we effectively promote and improve safety management, reduce and prevent the occurrence of safety accidents[4].

7. Ways to improve the safety of small and micro-sized mines
The safety management of small and micro-sized mines has always been the difficulty and key point of local safety management. Both the government safety supervision department and the mine owners and managers should attach great importance to it and take practical and effective measures to ensure the safety of production. Consideration could be given to improving mine safety in the following ways:

1. Strengthen supervision and administration of production safety by relevant government departments. The government should first improve the professional level of management, understand technology, guide and serve small and micro-sized mining enterprises. The relevant government departments should carry out regular and irregular safety inspections, find problems in time, order rectification and reform in time, urge mines, be precautious beforehand, adopt the safety standardization certificate system, and guide mines to continuously improve their safety management.

2. Strengthen the safety awareness of owners and mine leaders. Adhering to safety first,
prevention first, comprehensive management, owners should fully realize that safety is first, safety is benefit, safety produces benefit, economic benefit and safety production are organic linked. The person in charge of the mine should realize the identity of the person in charge of safety, tries to improve the level of safety technology and safety management, to fulfill his duties, to strengthen daily safety management, to implement various safety management systems, to find and solve problems in time, and to ensure the safety state of people, things and environment.

(3) Strengthen staff safety training and education, strictly carry out operation procedures. Ensure safety education investment and safety training education institutionalized, long-term and efficient. Ensure that employees receive relevant professional education, familiar with operating procedures, have the ability to work safely, hold certificates, improve safety awareness, reduce unsafe behavior, eliminate non-standard operation, cooperate with each other, that will improve both work efficiency and safety.

(4) Gradually improve the management requirements and technology of small and micro-sized mines. Because of the imbalance of local economic and social development, there are some policies to tilt and take care of small and micro-sized mines, which lower the requirements and standards. With the development of economy and society, small and micro-sized mines are faced with the inherent requirements of transformation and upgrading. Although procedures and technical requirements such as mine mining design, mine safety facility design, soil and water conservation scheme, restoration and control scheme, mine safety pre-evaluation, safety status evaluation and safety acceptance evaluation have been set up, but because many small and micro-sized mines belong to family workshop type, lack of basic professional and technical personnel and management personnel, most of the technical documents are entrusted to do, in some mines even no people can read and understand the technical documents, they can not be implemented and become a mere formality. Therefore, it is necessary to strengthen the training and guidance of geological and mineral technical personnel, to enhance their sense of responsibility, identity and dedication, to add blood transfusion and hematopoiesis to mines, and to enhance their vitality\(^5\). It is necessary to combine the market elimination mechanism with the national compulsory elimination mechanism to make the small and micro-sized mines become bigger and stronger to improve the technology and safety level, and to carry on the transformation and upgrading in order to better serve the local economy.

(5) Strengthen the construction of the safety systems and strictly implementing. Establishing and perfecting various systems is the basis of safety management. Under the strong push of the national safety management departments, except the new mines, all mines have completed the activities of standardization of safety production since 2013, and the safety management of enterprises has been on the track of standardization. Further strengthening and improving the standards will promote the continuous upgrading and improvement of safety management. Safety standardization mines generally have relevant systems and various operating rules with the help of intermediary organizations, such as safety production responsibility system, post responsibility system, equipment safety repair and maintenance system, safety inspection system, safety operation system, safety production accident report and handling system, shift system, safety emergency plan reporting and exercise system, safety reward and punishment system, etc. Only by conscientiously studying the systems, being familiar with the systems, and vigorously enforcing the systems, can the systems on the wall become the code of conduct in work, and can they play their role and effect. All kinds of management records reflect the actual situation of mine system implementation, so strict implementation of the systems is the key. Mine owners, responsible persons, safety administrators and ordinary employees all have safety responsibilities and business, they should maintain the authority of the systems, and consciously abide by the systems and implement the systems.

(6) Establish a two-way mechanism of action for safety management. Safety management requires administrative push lines from top to bottom. Generally speaking, mine owners and responsible persons have more knowledge and attention to mine safety than other employees. They have more needs and motivation to promote safety management. However, safety requires comprehensive, full-staff and full-process management. Lower-level employees are front-line operators and
implementers who act directly or indirectly related to safety. They are visitors, initiators, witnesses and bearers of safety accidents. Many safety hazards are discovered by them first, many emergency measures need their timely action, many safety accidents are the consequences of them to bear. Therefore, it is necessary to take the initiative feedback line from bottom to top. Only one mind, up and down with the linkage, can ensure safety in production. Safety management is a long-term dynamic process. In order to ensure safety in production, appropriate methods and measures should be taken in mines. Effective implementation of the top-down and bottom-up two-way safety operation mechanism should be realized to ensure smooth, timely, continuous and efficient safety management, in order to maximize production safety.

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