Professional Synergetic Management and Control Mode of Major Hazard Sources of Coal Mine Gas

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ABSTRACT

Achieving advanced control of major hazard sources of gas is an important basis to ensure sound development of coal mining industry. With the gradual strengthening of the national demand for coal mine safety, the traditional mode of coal enterprises in cooperation with scientific research institutes has been difficult to adapt to it. In order to solve this problem, influence factors of professional synergetic management and control of major hazard sources of coal mine gas were analyzed. Then its evolutionary process was studied. On this basis, Professional synergetic management and control mode of major hazard of coal mine gas was proposed creatively. And the operating system which matched the pattern was established. The demand of both coal enterprises and research institutes were taken a full consideration in this mode. And new ways of deep collaboration of production and research of it was provided, which opened up new roads to speeding up transforming scientific and technological achievements. This mode has been successfully used and promoted in Shenhua group, which made significant economic and social benefits.¹

KEYWORDS

Cooperation Model; Coal Enterprise; Scientific Research Institution; Major Hazard Sources; Gas; CLC: F270  WM: A

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INTRODUCTION

With complicated coal seam occurrence conditions, more than 95% of the coal mine adopting underground mining, and most of them affected by the gas disaster, our country is one of the countries most affected by the gas disaster in coal mine in the world [1-3]. Although the security situation has improved in recent years, major and extraordinarily serious accidents represented by gas accident still happen. How to achieve advanced control of major hazard sources of gas is a significant problem of coal mine safety production urgently needs to be addressed [4-8]. As with many other coal enterprises, gas control is also the difficult technical problems in coal mine safety production of Shenhua group, the largest coal enterprises in our country, in which, the high gas and gas outburst coal mines account for 32% at 56 production mines.

Malignant accidents had happened in history, such as gas explosion accident caused by spontaneous combustion of coal seam in Baijigou coal mine on October 24, 2003, which made the roadway been destroyed and the mine been forced to close. An active exploration has been made to solve technical problems of gas control facing in the safe production of coal mine in Shenhua group and through special research study on gas control problem restricting coal mine safety production, cooperating with scientific research institutes, some effects have achieved. But the cooperation mode between coal enterprises and scientific research institutes, which mainly provide a single gas control technology by scientific research institutes exists the following main drawbacks.

(1) Only direct at a short time "peer-to-peer" modality to analyze the specific issues in the form of a certain nature of passive management, which has a certain nature of passive management and cannot achieve advanced control of major hazard sources of gas through pre-control and long-term planning.

(2) Systemic, reliability and sustainability is not strong, so that it often cause repetitive construction and repetitive economic investment, and is difficult to produce continuous effects.

(3) With the efficient development trend of coal mining enterprises, the single technical advisory services mode with the characteristics of short-term, innocent and passiveness already can't satisfy the requirement of effectively control of the major hazard resource.

(4) There exists a certain gap in practical application between scientific research achievements supplied by scientific research institutes and requirements for the gas control of major hazard of coal enterprise so as to make a low conversion rate for the scientific research achievements and difficult to implement.

In view of the above reasons, directing at its own characteristics for coal mine gas disasters, Shenhua group chooses to cooperate with Chongqing Research Institute, who has an advantage of technology and talent in gas control. Then Northwest Academy of Safe Production was set up between two parties to explore deeply cooperating ways for coal enterprises and research institutes, with the
purpose of achieve effective management and control of coal mine engaged by Shenhua group and besides, at the same time, in dealing with good control of gas disaster in coal mine of Shenhua group, to explore a new university and research cooperation mode suit for gas prevention and control in coal mine.

PART 1 PROFESSIONAL SYNERGETIC MANAGEMENT AND CONTROL MODE OF MAJOR HAZARD SOURCES OF COAL MINE GAS

Evolution Law of Professional Synergetic Management and Control Mode of Major Hazard Sources of Coal Mine Gas

Researches show that, evolutionary process of professional synergetic management and control mode of major hazard sources of coal mine gas, such as from point to point to regional services, from a single service to the whole system, from passive service to active service, from technical advice to the specialized coordination control, etc., all these are the result of comprehensive shaping of many factors. In the process of evolution and development, these factors mainly include external impetus and internal motivation. External factors mainly include the change of market environment and technology environment, the orientation of national policy, etc. and internal motive mainly includes change of the main-body role of coal enterprises and research institutions, differences of concept of the partner, influence of the benefit drive, etc. Evolutionary dynamics analysis framework and evolutionary process of professional synergetic management and control mode of major hazard sources of coal mine gas are shown in fig. 1 and fig. 2 respectively.

Figure 1. Evolutionary process influence factors block diagram of professional synergetic management and control mode of major hazard of coal mine gas.
The evolutionary process of professional synergetic management and control mode of major hazard of coal mine gas is a process of inheritance and change that the coal enterprise and scientific research institution both keep the original technology, the advantages of the manpower and resources to achieve business goals and make readjust and change in constantly developed and changed internal and external environment to realize healthy and safe development for coal enterprise and technology innovation for scientific research institution.

**Professional Synergetic Management and Control Mode Establishment of Major Hazard Sources of Coal Mine Gas**

Coal enterprises taking advantage of technology and talent in the field of coal mine safety scientific research institute owned to develop wide cooperation, its goal is to ensure safety for the coal enterprise itself by way that scientific research institute provides professional synergetic management and control service. Therefore, a reasonable working goal needs to be established under the principle of win-win for both parties.

In order to adapt to the demand of both sides of the coal enterprise and scientific research institution in the current field of coal mine safety and further promote production-study-research cooperation mode to carry out, professional synergetic management and control mode of major hazard sources of coal mine gas was established on the base of illustrating the evolvement rule of professional synergetic management and control mode of major hazard sources of coal mine as shown in fig.3.

The primary demand that coal enterprise claimed on scientific research institutes is to realize "safe production". So it demands scientific research institutes give full play to the technological advantage and dominated by "technical services and collaborative control", this demands both parties must determine a reasonable work target. As a result, scientific research institutes must cooperate with coal enterprise’s coal mines to make professional synergetic management and control of major hazard sources of coal mine gas and provide powerful technology guarantee of coal mine safety to put an end to coal mine gas accident.
Set Up Organization

On the base of making full use of their respective advantages, seeking co-development and equally consultation, professional synergetic management and control organization was set up which was unify managed by both parties as shown in fig.4. To solve the larger problem in the process of operation, communication and coordination team made up of leaders on both sides was accordingly founded.

Build Up Talent Team

After the completion of the organization to establish, the scientific research institutions must build up high-caliber professional technical service persons that can satisfy the requirements of professional synergetic management and control of major hazard of coal mine gas by transferring or introducing other domestic person
with a higher level of talent and make the technical team of scientific research institutions join in coal enterprise’s technical expert database.

**Establish Operation System**

According to the actual situation of coal enterprises, operation system of professional synergetic management and control of major hazard of coal mine gas was established as shown in fig.5.

![Operating system of professional synergetic management and control mode of major hazard of coal mine gas](image)

Figure 5. Operating system of professional synergetic management and control mode of major hazard of coal mine gas.

**PART 2 APPLICATION PRACTICES OF PROFESSIONAL SYNERGETIC MANAGED AND CONTROL MODE OF MAJOR HAZARD SOURCES OF COAL MINE GAS**

Beginning in 2009, by taking advantage of technology and talent in the field of coal mine safety especially in prevention and control of gas disaster in coal mine, Shenhua group chooses cooperate with Chongqing Research Institute and an organization named Northwest Academy of Safe Production was established by both partners. Platform for the agency, the professional technology service dominated by gas and supplemented by the ventilation and safety monitoring was provided by Chongqing Research Institute so as to realize professional synergetic management and control of coal mine gas, one of the major hazard sources of Shenhua group. By
this way, professional synergetic management and control mode of major hazard sources of coal mine gas gets very good application practice.

For more than 5 years, through the development of expert consultation for coal mine safety, larger potential safety hazards or problems existed in coal mine have been found and solved. Through specific project technology research on gas control, the technological level for gas control got a significant boost, which laid a foundation for the systematic research and refining of scientific and technological achievements. To carry out daily technical service for gas control and safety monitoring and control, it effectively promoted the safety and high effective product of service coal mines. By making major technical problem research put into effect, the scientific and technological achievements have been strengthened so as to form an important integration technical. Through professional technical training or talent training, the management level for gas control has been effectively increased. In General, large accidents of gas prevention and control haven’t appeared and the accident casualty rate is 0 at the coal mines on which Northwest Academy of Safe Production provides ongoing service. As a result, the application practices of professional synergetic management and control mode of major hazard sources of coal mine gas offers guarantee for safety and high effective product of service coal mines, implements the goal of reliable system and effective monitoring and effectively assists Shenhua group to realized professional synergetic management and control of major hazard sources of coal mine gas.

PART 3 PRACTICE EFFECTS AND PROMOTION OF PROFESSIONAL SYNERGETIC MANAGEMENT AND CONTROL MODE OF MAJOR HAZARD SOURCES OF COAL MINE GAS

Overall Effects of Practice

It is a kind of innovation mode combined enterprises, education and researches that coal enterprise cooperates with scientific research institution to realize professional synergetic management and control of major hazard sources of coal mine gas. In the pattern, both sides of coal enterprise and scientific research institution give full play to their respective advantages, its effectiveness is that the coal enterprise effectively controls major hazard of coal mine gas and solved major issues of coal mine gas 126 items in number so as to offer guarantee for safety production of coal mine. At the same time, find a more efficient way of implement of scientific and technological achievements for scientific research institution and speed up the development of coal industry. Even more important, promote the development of the cooperation pattern between coal enterprise and scientific research institution in the field of coal mine safety. Concrete embodiment was elaborate in the following aspects:
Practice Effect for Coal Industry

A deep cooperation model between coal enterprise and scientific research institution was created which is professional synergetic management and control mode of major hazard sources of coal mine gas. This pattern achieved good practical effect so that provides demonstration for other coal enterprises to cooperate with scientific research institution in professional synergetic management and control mode of major hazard sources.

Practice Effect for Coal Enterprise

(1) It implements the goal of reliable system and effective monitoring for service coal mines and forms technology and management system of management and control of major hazard sources of coal mine gas which is suitable for different service coal mines.

(2) Fatal accidents are never appearing in the coal mines of Shenhua group cooperating with scientific research institution during the periods that professional synergetic management and control mode of major hazard sources of coal mine gas was implemented so that play a role of escort for service coal mines’ safety production.

(3) By the way of specialized technical training and demonstration project, technical personnel doing well in gas control haven been trained for coal enterprise and the technology and management level has been promoted.

(4) It further promoted the concept change of service coal mine for gas disaster control and enhanced the confidence of service business for gas disaster control when professional synergetic management and control mode of major hazard sources of coal mine gas was implemented. Through the engineering practice, the concept of service coal mine for gas disaster control achieved a series of change from point to area, a single technology research to systematic study, short-term management to long-term planning, etc. and at the same time achieved the goal of safety production for service coal mine.

Practice Effect for Scientific Research Institution

(1) A more efficient way of implement of scientific and technological achievements for scientific research institution has been found so as to speed up the achievement transformation and drive the industry development of scientific research institute when professional synergetic management and control mode of major hazard sources of coal mine gas was implemented.

(2) For the first time, a specialized service team to conduct professional synergetic management and control of major hazard sources of coal mine gas has been formed and great innovation has been made on the management system of service organization stationed abroad in the field of coal mine safety.
Popularization and Application of Professional Synergetic Management and Control Mode of Major Hazard Sources of Coal mine Gas

After the successful practice of professional synergetic management and control mode of major hazard sources of coal mine gas in coal enterprises such as Shenhua group, it played an exemplary role in coal mine safety and vigorously promoted the development of specialized service industry in the field of coal mine safety.

Under the impetus of successfully implementation of professional synergetic management and control mode of major hazard sources of coal mine gas, a full implementation of the model was carried out in Shenhua group and by far involves all high gas coal mines and gas outburst coal mines. At the same time, this mode has been applied to the flood and fire prevention and control field. By making full use of the advantages of fire prevention and control of Shenyang Research Institute and flood prevention and control of Xi’an Research Institute, Shenhua group cooperated with the two research institutes successively and jointly established organizations with each other. In this way, major hazard sources of fire and flood of Shenhua group have got professional synergetic management and control and in this way, professional synergetic management and control mode of major hazard sources has been developed further. Through nearly five years of cooperation, disaster prevention and control capability of service coal mine has been effectively promoted and safe and efficient production of service coal mine is guaranteed.

After successfully applying of professional synergetic management and control mode of major hazard sources of coal mine gas to coal mines of Shenhua group, other coal enterprises or ore district such as Shanxi coking coal group, Shanxi Lu’an mining group, Xinjiang Bagang coking coal group, Yunnan Pingqing coal mine, Anhui Huaibei and Xinji coal mine, Ningxia Yinglite coal mine, Guizhou Shuicheng mining area, coal mines in Hunan, etc., have also cooperate with Chongqing Research Institute for this model.

CONCLUSIONS

On the basis of revealing evolutionary process of professional synergetic management and control of major hazard sources of coal mine gas, of which, a mode was created and working system matching the mode was built. Then, professional synergetic management and control mode of major hazard sources of coal mine gas achieved successful application in Shenhua group and solved the problem of control of major hazard sources of coal mine gas. On this basis, a new production-study-research cooperation mode suitable for prevention and control of coal mine gas was explored, which makes full use of the advantage of coal enterprise and scientific research institute, meets the requirements of two sides and opens up a new way of deep collaboration of production and research so as to speed up transformation of scientific and technological achievements. And besides, this
mode provides the demonstration and reference for other coal companies to cooperate with scientific research institutes in the field of coal mine safety.

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