CSPMS supported by information technology

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Abstract. This paper will propose a whole new viewpoint about building a CSPMS(Coal-mine Safety Production Management System) by means of information technology. This system whose core part is a four-grade automatic triggered warning system achieves the goal that information transmission will be smooth, nondestructive and in time. At the same time, the system provides a comprehensive and collective technology platform for various Public Management Organizations and coal-mine production units to deal with safety management, advance warning, unexpected incidents, preplan implementation, and resource deployment at different levels. The database of this system will support national related industry's resource control, plan, statistics, tax and the construction of laws and regulations effectively.

1 Introduction

The issue of coal-mine safety production is a rigorous society problem confronted by world wide countries especially by developing countries like China. Many countries invest a large number of labor power, material resources and financial strength to solve this problem, however recurring mine accidents cause huge losses to society. Nowadays, with the fast-speed development of information technology, it is a significant research topic to construct the new Coal-mine Safety Production Management System (CSPMS) using achievements of information technology wisely. Among systems that have been developing or have been put into practice presently, most of them depend on production units, searching and processing the production site information to proceed the purpose of warning and supervision.

This paper will describe an idea that putting all levels of production units and government management organizations into a collective platform, adopting the four-grade automatic triggered warning system, ultimately accomplish the goal that information transmission will be smooth and in time to the maximum extent. This system can truly attain informatization of coal-mine safety

management, supervision and Administrative &law enforcement work, provide a new solution for government and various mines to handle things such as real-time accident prediction, eliminating hidden dangers, safety production trend analysis, dealing with serious unexpected incidents.

2 Basic structure of the CSPMS

The CSPMS consists of following parts: Data Acquisition, Database and Data Analysis System, and Four-grade automatic triggered mechanism.

2.1Data Acquisition

Data acquisition, which mainly includes: all kinds of safety monitoring indicators on coal-mine production site, production and management data (such as underground safety production and monitoring data, mining volume, inventory, etc.) , is the basis of the whole system's ordinarily running. And the veracity of data directly influences the system's accuracy of advance warning and decision-making. All application data of system is collected in the field of coal-mine production site, using two different collect methods: automatic collection and artificial acquisition. Automatic collection refers to the collection that is done by acquisition instrument which has been tested and approved by production units, and automatic collected data will be input to system. Artificial acquisition is done by qualified individuals on the production site and then input the data to system in time.

To protect the originality and accuracy of data, responsibilities had to be signed to specific staff, and all data can not be updated and revised once they entered system. Time will be automatically recorded by systems, necessary changes will be proceeded by the way without covering the original data.

2.2 Database and Data Analysis System

Database is made up of production site collected data, comparative data and various preplans. Comparative data mainly come from all kinds of laws, regulations, technology standards, safety indicators system, and production units' characteristic safety production data in the actual production. Preplans are constituted by relevant government department based on laws and different situation in different area.

Data analysis system analyzes all kinds of real-time data on the production site according to the comparative data. Based on each grade's trigger point that has been pre-set, system will react different warning up to different grades and activate the preplans. Data analysis can also analyzes original data request to demands, to fulfill the government's demands of resource controlling, deployment, statistic, planning, etc.

2.3 Four-grade automatic triggered mechanism

Based on the demand of coal-mine safety production management and the actual situation of our country's present system, this system adopted four-grade automatic triggered mechanism. System pre-set the four automatic trigger points in accordance with comparative data, and when the real-time data has been input into the system, data analysis system will analyze at the very time: (1) Once production site has troubles, data anomalies activate first-grade trigger; (2) Once data analysis suggest approaching the risk critical point, second-grade trigger will be activated; (3) when common accident happened, third-grade trigger will be activated; (4) when serious accident happened, fourth-grade trigger will be activated.

When the first-grade trigger is activated, which means unusual situation of the production site, main managers of the production unit are informed, then they will activate preplan and deal with the situation immediately, until trouble is solved and system is back to the normal condition; When the second-grade trigger is activated, which means the risk critical point is approaching, the managers of production unit and managers in the high level (county, city level) of safety supervision and government's safety production management department should be informed at the same time, preplan will be activated and executed by the managers of higher level of safety supervision and government's safety production management department. The two kinds of trigger point is used for eliminating hidden danger and advance warning, and most problems generated in the actual production can be handled by using them.

When the third-trigger is activated, which means common accidents happened, at this time, Ministry of Supervision, relevant Ministries and Commissions Directly under the State Council and lower level government departments are informed at the same time, preplans will be activated and executed by province government or by departments of Ministry of Supervision that are at the same level with province government.

When the fourth-trigger is activated, which means sudden serious accidents happened, Ministry of Supervision, relevant Ministries and Commissions Directly under the State Council and lower department should be informed at the same time, preplan will be activated and executed by Ministry of Supervision and relevant Ministries and Commissions Directly under the State Council.

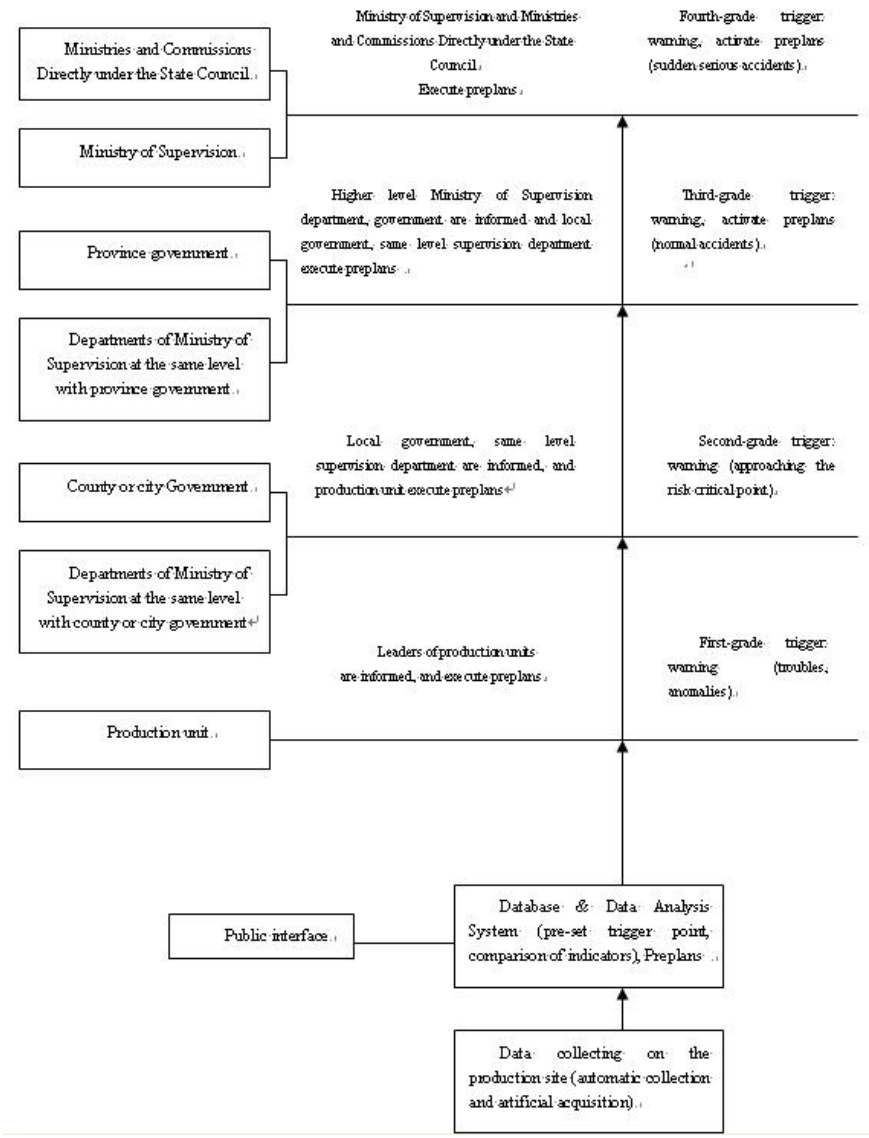

Fig 1. Four-grade automatic triggered mechanism

The third and fourth grade triggered points are used for advance warning and activating or implementing emergency preplans

All conditions and data of execution of preplan after the activation of four-grade automatic trigger mechanism will be recorded in the system in time.

The whole system adopts downward-compatible set of vertical authority, supervisors can monitor the condition of subordinate departments and production units.

3 Characteristics of the CSPMS

3.1 The accuracy of system information and smooth, nondestructive information transmission

Measures that are taken when acquiring information from the source, ensure the authenticity of the original information. Four-grade automatic trigger mechanism on the collective platform ensures that all levels of government departments and production units can be informed at the same time, and the mechanism greatly enhance the ability of supervision and security execution, make safety management and advance warning be more effective. As a result, phenomena that information has been concealed, omitted, misstated, deferred are avoid drastically.

3.2 Improve the handling accidents efficiency & Guarantee the implementation of preplans

When accidents---especially serious accidents---happen, because all related departments are informed at the same time, repeated communication is avoid and the efficiency and ability of accidents handling are improved. The constitution process of preplan makes all relevant departments doing their own jobs: relevant departments of Ministry of Supervision and coal-mine sectors rescue the injured and take care of accidents' consequence; local governments deploy police, medical and other social resources and public relations and crisis. The accuracy of information and the smooth of information transmission can ensure all kinds of preplans be implemented successfully and ensure that resource allocation can attain a maximum point during the accidents handling, finally, to achieve good results.

3.3 Easy to clarify responsibilities

Stringent control methods and constitution of various preplans in system that have been done on the production site where information is collected, has one of the main characteristics of which is to break down each work and responsibilities to individuals. And system has complete records on the work implementation. So it can trace the specific responsibilities to individuals when the problems arise. Then the situations that nobody or collectivity takes responsibility to the problems will no longer appear.

3.4 Easy for Implementation

This system can be immensely implemented and operated in reality. It is mainly reflected in two aspects:

Firstly, this system has a strong relevance with the existing system of China. In China's current system, the government departments are setting classified in

accordance with the State Council ministries, provinces, cities and counties. All grades of institutions below the State Administration of Work Safety Supervision are also setting according to classification. Meanwhile governments at all levels are responsible for the safe production and positions setting. It is the system that putting production units and all grades of governments, control safety agencies on a common platform. Connect regulatory powers and responsibilities of relevant departments at all levels with one another through the 4 classes trigger mechanism. Thus the system can fully operate normally in our existing institutional framework.

Secondly, the implementation of the system can effectively utilize all existing inputs in information building of all production units and management departments. At present, the information building of all production units and management departments mainly fasten on the hardware, management and the building of locale security indicators monitoring system. This even provides a good foundation for the data acquisition of system.

4 Application and expansion of the CSPMS

The CSPMS is a management system of putting production units and management departments on the same management platform. Therefore, it can not only start implementation from a single mine, but also implement within the big scope. It can add new production units easily. The application is very flexible and convenient.

In the expansion of system functions, we can find the data collection and analysis system for database can provide a powerful function extension: 1) Comprehensive production data collection and analysis can provide the most authentic statistics for national statistics offices. 2) Can provide informative reference for national plan departments, and realize production control and capacity allocation in exceptional circumstances. 3) Can provide authentic reference for national resources control and protect. 4) Can effectively realize the sharing of resources with external management system, such as taxation, environmental protection. 5) Can provide reference materials for relevant industry laws and regulations.

What is more important is that the system is not limited to the application of coal security production management. By changing the source of data and the contrast indexes system of database, the system can be applied to all types of mine production safety production management.

5 Conclusion

Coal-mine safety production has become a very important issue of countries for a long time. Currently, the developed countries represented by Britain and the United States have solved such problems to a large extent, by increasing security funding, enacting complicated regulations and implementing them. However, it also brings increased costs and other practical problems. But limited to the

shortage of funds and differences of social conditions, most developing countries represented by China are unable to apply the methods mechanically of Britain and the United States and other countries. The establishment of CSPMS integrates the management advantage of government agencies and production units. It can meet safety production requirements in a more effective way in the case of limited inputs and achieve a good result.

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