



## Major accident analysis and prevention of coal mines in China from the year of 1949 to 2009

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### ABSTRACT

From the year of 1949 to the present, the China national coal output has been increasing quickly and became first in the world in 2009. But at the same time, major coal mining accidents still exist nowadays. In order to review the overall situation and provide information on major accidents of coal mines in China, we investigated 26 major coal mining accidents in China between the years of 1949 and 2009 through statistical methods, each of which led to more than 100 fatalities. Statistical characteristics about accident-related factors such as time, death toll, accident reasons, characters and nature of enterprise were analyzed. And some special conclusions have been achieved. For example, although we have made great progress, the safety situation in China coal mining industry is still serious, and the reasons for the mining accidents are all human errors which are not inevitable. Such results may be helpful to prevent major accidents in coal mines. Moreover, based on both the knowledge of other countries which have good safety situation nowadays and the safety management situation of China, we made suggestion on safety management of China coal mining. In conclusion, countermeasures were proposed in accordance with the results of statistical studies and the analyses of problems existed in coal mines, including the perfection of safety supervision organization, the establishment of cooperating agency among government, coal mines and workers, the perfection of safety rules and regulations, the improvement of safety investment, the enhancement of safety training, the development of safety technique, and the development of emergency rescue technique and equipment.

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### 1. Introduction

Coal mining is playing an important role for the economic development of China. With the improvement of technology and use of mechanized equipment both imported and manufactured locally, the production increases quickly. At the same time, many coal mining accidents especially major ones have occurred, causing heavy damage to workers, companies and the whole society. Often this time, materials, equipments and teams are called upon to rescue the injured. Following the accuracy of an accident, there are many consultations and safety measures are made. Scientists all over the world have paid much attention to coal mine accidents and obtained a lot of knowledge about the mine safety management, accident analysis and prevention, and safety evaluation. One kind of coal mine accidents such as coal dust explosion accidents that occurred in China between the years were investigated through statistical methods and the characteristics of the accident-related factors were studied. Statistics about all the coal mine

accidents during several years of China were made from which factors influencing accidents and methods to mitigate accidents could be drawn. Many management theories and methods about the risks of accidents have been put forward [1–60].

Nevertheless all the above efforts have not prevented accidents to a great extent as in other main coal producing countries such as USA, Australia, India do, which makes us nervous.

In order to try to find out the root causes which can help to prevent the coal mine accidents, firstly analyzed the characteristics of coal mine accidents and the condition of safety management of China; secondly be aware of some developed countries' coal mine accident conditions and know their expertise; finally, based on the above information, much deeper study should be made to find the existed problems in China and establish a set of safety management system which involves the perfection of safety supervision organization, the establishment of cooperating agency among government, coal mines and workers, the perfection of safety rules and regulations, the improvement of safety investment, the enhancement of safety training, the development of safety technique, and the development of emergency rescue technique and equipment.

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This paper counted up the number of accidents, time and death toll of 26 major accidents with more than 100 fatalities each in China from the year of 1949 to 2009, the accident main reasons, characters, and nature of enterprise of 12 major accidents each with more than 100 fatalities in China between the years of 2000 and 2009, and analyzed the safety management conditions. By contrast, the safety management experiences of developed countries such as USA, Australia and India are studied. Then the comparison of safety condition between China and other developed countries, and the problems that existed in China were studied. According to the above analyses, some measures are made.

## 2. Condition of coal mines in China

### 2.1. Safety condition

From the foundation of the People's Republic of China (in 1949) to the beginning of reforms and opening up (in 1978), the national coal output per year has increased from 30 to 618 million tons. In 1997 it broke through 1 billion tons, from the year of 2000 it goes up rapidly with 0.2 billion tons growth annually and it exceeds 3 billion tons in 2009. The coal yield of the whole country from the year of 1949 to 2009 is shown in Fig. 1 [8,64].

In 2009, there were 10 countries in the world each with national coal output exceeding 100 billion tons, and their total takes up 89.5% of the global yield. China produced 3.05 billion tons (is it 3.05 or 305 billion tons) in the year of 2009, occupying number 1 with the percentage of 43.94%. The world coal output of the top 10 countries in 2009 is shown in Fig. 2 [64].

The development of coal mining industry in China has come with increased mining accidents causing heavy damage to the society. Between the years of 2000 and 2009, the statistics of accident number, death toll, and death rate in million tons coal production are shown in Table 1. The death rate in million tons coal production from 1949 to 2009 is shown in Fig. 3 [64].

Although the coal mine industry is becoming safer than before, many accidents still exist nowadays and the situation is more severe than before. Between the years of 2000 and 2009, 391 accidents happened and 7902 people died, each of which led to death toll above 10 people. From the time of establishment of the state, 26 extra large accidents occurred with more than 100 people's death in every accident and 4228 people in total lost their lives. The 26 accidents are shown in Table 2.

Time statistical analysis was given at year level, which is shown in Fig. 4.

Death toll statistical analysis of major accidents is displayed in Fig. 5.

Compared to miner accidents, major accidents always led to much heavier damage like people's lives, families, factories, and af-

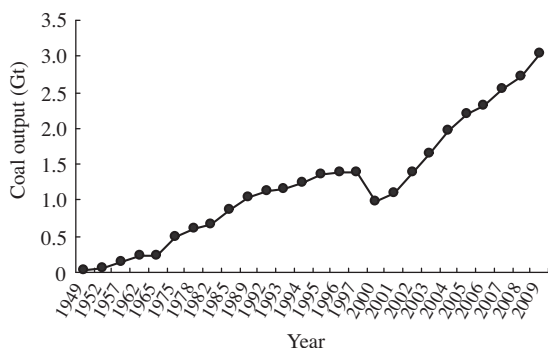


Fig. 1. National coal output (unit: 100 million tons).

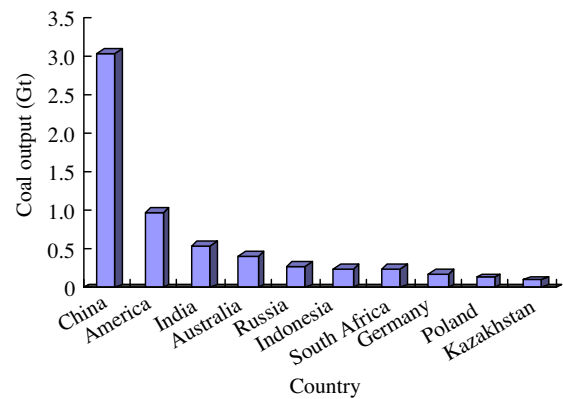


Fig. 2. National coal output of global top 10 countries in 2009 (unit: 100 million tons).

Table 1  
Accident statistics.

Year	Accident number	Death toll	Death rate in million tons coal production
2000	2863	5798	5.710
2001	3082	5670	5.070
2002	4388	6995	4.640
2003	4143	6702	3.710
2004	3639	6027	3.080
2005	3341	5986	2.840
2006	2945	4746	2.041
2007	2420	3786	1.485
2008	1953	3092	1.182
2009	1616	2631	0.892

ected the development of the whole society. The main reasons of 12 major accidents with more than 100 people's death in every accident from the year of 2000 to 2009 are displayed in Table 3.

### 2.2. Safety management

This paper analyzes the safety management of China from two points, one is the establishment of safety rules and regulations, and the other is safety supervision and emergency management.

#### 2.2.1. Safety rules and regulations

In order to improve the safety condition of China, many laws and regulations connected with coal mines have been enacted, which can be divided into four categories: the basic law, laws and regulations, administrative laws and regulations, and safety technical standards. Some of them are shown in Table 4 [61–63].

#### 2.2.2. Safety supervision and emergency management

China has set up a State Administration of Work Safety, which mainly includes Department of Policies, Laws and Regulations; Production Safety Emergency Rescue Office; Department of Safety Supervision and Management; Department of Occupational Health and Safety Supervision and Management; State Administration of Coal Mine Safety; National Workplace Emergency Management Center; and other departments and organizations. Also, coal mine safety supervision organizations of 27 provinces have been established [65].

In China four emergency rescue bases have been created. The National Workplace Emergency Management Center has set a database management system about the emergency response plan and emergency resource, and a mine medical aid center [65].

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