The Enlightenment on Emergency Management of Chemical Parks

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Abstract. Under the trend of large-scale industrial production, the construction of chemical parks is booming. With the hot topic in the field of safety accidents in chemical parks, the public awareness of emergency management has increased remarkably. In response to the current fragmentation dilemma of chemical industry in China, it is necessary to improve the emergency management mechanism. In the paper, four evaluation strategies are proposed on the basis of existing research for the construction of emergency management system in China Chemical Industry Park.

1. Introduction
The chemical park is composed of various chemical companies, which has all kinds of high risks, such as flammable, explosive and toxic. As a high concentration of those hazards in a limited space, chemical parks will cause a chain reaction in the event of an accident. Therefore, Ministry of Emergency Management has formulated risk-inspection guidelines for chemical parks and hazardous chemical companies[1-2]. Confronted with the requirement of the emergency response capability, chemical companies should fully understand the severe challenges, the change of the Regulation on the Safety Administration of Dangerous Chemicals, though chemical parks have achieved positive result in the risk control[3-5].

In this paper, the shortcomings of chemical parks emergency management are reviewed from kinds of literatures, accident reports, news, etc. In order to improve the emergency management system, four evaluation strategies are proposed to predict the accident risk, which is dealing with the probability analysis model in big data process.

2. Development in China
With the acceleration of urbanization, the number of chemical parks in China is growing rapidly at a rate of about 5% every year[6], as shown in Figure 1. But some chemical companies focus on economic benefits, ignoring safe production and emergency management. Once a sudden safety accident occurs, it will not only affect the company, but also threaten people's lives and property[7].
Figure 1. Distribution of the number of chemical parks in China from 2014 to 2020

In order to strengthen the emergency management of these chemical parks, the Chinese government issued relevant laws and regulations, as shown in Table 1. China’s emergency management can be traced back to 1986. The “Regulations on Emergency Measures for Acute Poisoning Rescue of Chemical Enterprises of the Ministry of Chemical Industry” issued by the former Ministry of Chemical Industry formed the initial emergency plan. In 1994, the Shanghai government established an emergency-rescue network, laying a solid foundation for the implementation of national emergency management. In 2005, the Administration of Work Safety designed an emergency-rescue system for production safety, which includes an emergency-rescue organization system, a support guarantee system and an operating mechanism[8-9]. Subsequently, the Administration of Work Safety in 2006 compiled the "Guidelines for the Preparation of Emergency Plans for Work Safety Accidents in Production and Business Units", which is an enterprise-level emergency plan and has limited emergency-rescue capabilities. In response to the new requirements of emergency management, various provinces have introduced supporting implementation measures. For example, eight provinces including Shanxi and Guangdong government put forward "Administrative Measures for the Certification of Chemical Parks"[10-12].

Table 1. Laws and regulations on emergency management of chemical parks

| Year | Bill Name | Content |
|------|-----------|---------|
| 1986 | Provisions of the Ministry of Chemical Industry on Emergency Measures for Acute Poisoning in Chemical Enterprises | Constitute a preliminary emergency plan |
| 1996 | Notice on the establishment of "Chemical Accident Emergency Rescue System " | Establish "Chemical Accident Emergency Rescue System" |
| 2005 | Guidelines for the preparation of emergency rescue plans for hazardous chemical accidents | Guidelines for the preparation of emergency rescue plans for hazardous chemical accidents |
| 2013 | Guidelines for the preparation of emergency plans for work safety accidents in production and business units | Analyze the phased characteristics of the current emergency plan system construction |
| 2013 | Guiding Opinions on Strengthening the Safety Management of Chemical Processes | Strengthen the basic work of safety production in chemical enterprises |
In the past ten years, the government has continuously strengthened safety of chemical parks, and established Chemical Accident Emergency-Rescue System. However, there are still many problems in emergency management. Major safety accidents of hazardous chemicals still occur from time to time, and the situation of chemical production safety remains severe.

### 3. Challenges and Opportunities

Although the emergency management work has a certain foundation, it has not yet been able to establish a complete emergency system. Related research is still in the exploratory stage. There are mainly the following challenges:

Firstly, the chemical park lacks comprehensive risk identification. Some chemical companies prioritize economy over safety and fail to fully assess the risks of the entire chemical park. Therefore, safety management capabilities need to be improved urgently.

Secondly, a complete emergency management system of chemical parks has not been established. The emergency-rescue system is currently mainly reflected at the enterprise-level, and it is urgent to improve the emergency-rescue system at park-level and national-level. Relevant departments need to improve China's emergency management of chemical parks as soon as possible.

Thirdly, the content of the emergency plan is broad and its operability is poor. The existing emergency plans rely too much on experience and cannot be unified. The form of the emergency plan is greater than the content, which only describes the framework of the emergency plan.

Fourthly, there is a shortage of compound emergency management talents and teams. They should have risk judgment ability, environmental adaptability, decision-making ability and good psychological quality, which can adapt to complex emergency management work.

Fifthly, there are major shortcomings in the investment of emergency funds and the reserve of emergency supplies. The chemical park should speed up the establishment of special emergency funds, with the purpose of supporting emergency rescue work in a timely manner.

### 4. Evaluation Strategy

There are several ways to improve China's emergency management of chemical parks:

Firstly, it is necessary to establish a complete emergency management system in China. There needs to improve emergency plan laws and regulations, and emergency capacity building in the early warning stage. The risk awareness of safety managers and front-line operators needs to be gradually improved. In emergency response stage, chemical companies conduct the risk identification on equipment and establish comprehensive risk control measures. Only when the chemical park completes the emergency rescue system and clarifies the responsibility system can the accident response capability be improved.

Secondly, it is imperative to build an emergency response plan that combines enterprise and government levels. According to the "Production Safety Accident Emergency Response Regulations" and the "Production Safety Accident Emergency Response Plan Management Measures", the chemical park should improve the emergency response plan. In emergency monitoring and emergency evacuation, enterprise-level and government-level emergency plans must cooperate and coordinate with each other. The company combines actual experience to systematically and accurately describe.
Furthermore, the government has formulated targeted emergency response content and clarified what each department is responsible for. By strengthening emergency rescue equipment and improving emergency response plan, the regional coordinated rescue capability can be improved.

Thirdly, it is very important to cultivate compound emergency management talents and emergency rescue teams, as shown in Figure 2. The training of emergency management personnel can rely on key chemical companies, chemical parks or third-party professional institutions to establish internship bases. Subsequently, emergency rescue is a complex and meticulous work, which requires the cooperation of the national comprehensive rescue force and the professional rescue force of hazardous chemicals. Emergency rescue team requires the cooperation of Special Equipment Supervision and Inspection Institute, Emergency Communications Bureau, Emergency Management Agency, Environmental Emergency Monitoring Agency, and Medical Emergency Agency. According to different chemical raw materials and different geographical locations, emergency management talents should be arranged on the emergency rescue team.

![Figure 2. Formation of emergency rescue team](image)

Fourthly, the government should promptly approve the financial funds proposed by the emergency management department. This approach can not only improve the public safety system, but also reduce the probability of accidents. More financial funds are invested in emergency management training, drills and publicity. Additionally, it requires increasing investment in emergency management equipment and emergency rescue talents in order to improve the emergency rescue information system.

5. Conclusion
Taking an overview of the emergency management situation in the chemical park, it presents a constantly improving situation, but the overall situation is still grim. Some chemical companies put economic efficiency as the top priority, but neglect emergency management, safe production, and environmental protection. It can be seen that once a sudden safety accident occurs, the safety of life and the ecological environment will definitely be endangered. Therefore, the emergency management system needs to be improved jointly by chemical companies, the government, and people from all walks of life. Only in this way can we jointly promote the emergency management system and improve the performance of safe production.

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