Academic Journal of Materials & Chemistry
ISSN 2616-5880 Vol. 1, Issue 1: 11-18, DOI: 10.25236/AJMC.010102

Construction of Dangerous Chemicals Safety Management System Based on Digital Signature

Bin Tan [1,*], Xin Wang [2], Hongguang Jiang [3]

[1] *Qingdao Sikeer Security Technology Service Co.,Ltd., Qingdao, 266000, China*
[2] *Qingdao Yuehuijin Fire Protection Co.,Ltd., Qingdao, 266000, China*
[3] *Qingdao Qingke Security Technology Service Co.,Ltd., Qingdao, 266000, China*
**Correspondence: tan13130934@gmail.com*

ABSTRACT. *With the development and application of science and technology, chemicals have become indispensable means of production and consumer goods in modern society. By analyzing the harm degree of dangerous chemicals and the forms and types of accidents of dangerous chemicals in colleges and universities, this paper puts forward the safety management system of dangerous chemicals in colleges and universities based on digital signature. The technologies of identity authentication, electronic signature and electronic signature based on digital signature are adopted. It can effectively prevent major security issues such as fraudulent use of identity, denial of responsibility, and unauthorized operation; Provide strong data support for accident analysis and prediction, safety evaluation, etc.*

KEYWORDS: *Digital signature; Hazardous chemicals; Safety management*

1. Introduction

Dangerous chemicals refer to highly toxic chemicals and other chemicals that are toxic, corrosive, explosive, burning, combustion-supporting and harmful to human body, facilities and environment [1]. Chemicals not only bring benefits to society, but also bring increasingly severe environmental problems, which are mainly manifested in three categories: physical hazards such as explosiveness and flammability; Health hazards such as acute toxicity, chronic toxicity and triple toxicity [2]; With the increasing task of teaching and scientific research in universities of science and engineering, the number of comprehensive and research laboratories is increasing year by year, the scale is expanding and the functions are gradually improved. The diversity of research topics, the higher-level personnel entering the laboratory for research, the dense and mobile personnel, the wide variety and large quantity of hazardous chemicals involved, and the frequent use of laboratories all make it more difficult for the safety management of hazardous chemicals in universities of science and engineering.

ISSN 2616-5880 Vol. 1, Issue 1: 11-18, DOI: 10.25236/AJMC.010102

Dangerous chemicals have great harm and potential harm, which makes their safety management become the focus of attention in many countries [3]. The EU has implemented various laws, regulations and treaties to manage the whole life cycle of hazardous chemicals scientifically and effectively. In this paper, by studying the experience and development trend of chemical safety management in EU, combined with the current situation and existing problems of chemical management in China, it is proposed to establish a chemical safety management system suitable for China's national conditions, so as to improve the safety management level of hazardous chemicals in domestic universities.

2. Problems in the management of hazardous chemicals in colleges and universities

At present, most universities pay more attention to teaching and scientific research than safety work. Insufficient understanding of the importance of laboratory safety work, especially the safety management of hazardous chemicals. The means of collecting and sending safety accident information are relatively backward, and the collection, classification, filing and sending of accident information are completely completed by managers, which is very inefficient; At present, GPS, GIS, RFID technology, video technology and network technology have been preliminarily applied in all aspects of hazardous chemicals production and management, and the depth and breadth of application are expanding, and the theory and practice of safety accident analysis, risk assessment and emergency system construction have also been developed and improved [4]. Due to the lack of attention, the management staff is insufficient and the implementation is not in place; In addition, the situation of laboratory management in colleges and universities is complicated, with a large number of laboratories, scattered distribution and various types and quantities of hazardous chemicals.

3. Safety information management mode

3.1 Traditional safety information management mode

Safety management information is very important, but for a long time before computers were widely used, people managed safety information mainly by manual labor, and there were inevitably many problems in the process of management. The management system of laboratories in different universities is different, so it is difficult to manage with a unified model. By strictly defining the scope, subject and object of application, the EU is gradually establishing a complete system of registration, evaluation, approval and restriction of chemicals to ensure that the responsibilities and obligations of various stakeholders such as the government, chemical manufacturers and importers, and downstream users are clearly defined in actual implementation [5]. At present, the common problems in the management of dangerous chemicals in colleges and universities are: paying attention to safety in a gust of wind, coping with surprise inspection, lacking a long-term mechanism of

ISSN 2616-5880 Vol. 1, Issue 1: 11-18, DOI: 10.25236/AJMC.010102

safety management, emphasizing the protection of laboratory material and hardware conditions in the management system, ignoring the concern for people and the environment. The mobility of laboratory personnel is large, some colleges and universities have not invested enough in security, laboratory building materials, instruments and equipment are aging, and safety facilities are not fully equipped, which exposes many potential safety hazards.

3.2 Digital signature technology guarantees system security

Digital signature based identity authentication and electronic signature, signature can achieve the following functions: through the double factor strong authentication mode login system, to protect regulatory information and enterprise information from being illegally stolen by hackers. On the one hand, it lies in the internal supervision of enterprises, on the other hand, it is the external supervision of relevant departments. From the internal point of view, the enterprise rules and regulations are not perfect, not willing to invest in safety management. On behalf of the laboratory safety administrator who signed the relevant safety responsibility letter with the school, assist the leader in charge of laboratory work to do the daily management of laboratory safety and environmental protection in the unit; Generally, it is advisable to establish a safety management system for the management and supervision of hazardous chemicals by various functional departments in charge of schools and colleges. Use electronic signatures and seals to achieve the same signing and stamping effects as handwritten signatures and traditional seals; The use of DC can effectively prevent supervisors and enterprise personnel from denying their various operation behaviors.

4. Build a safety management system and improve the management system

4.1 Construction of safety management system for hazardous chemicals

The establishment of hazardous chemicals management system in colleges and universities is the foundation of hazardous chemicals safety management. The state needs to greatly increase the overall investment in the construction of emergency system; At the same time, for the rapid response and correct disposal of dangerous chemical accidents, the training of accident emergency disposal must be done well, including the general mobilization of the whole society. For example, the dean and the in-charge dean sign a safety responsibility letter, the in-charge dean signs a safety responsibility letter with the security department, and the security department signs a safety responsibility letter with relevant departments to establish a chemical virtual warehouse [6]. For chemicals such as precursor and explosive, the application and approval system is implemented, and the most popular identity authentication technology based on digital signature, electronic signature and signature technology are adopted in the system security design. The reasonable and easy-to-operate hazardous chemicals safety management architecture is shown in Figure 1.

ISSN 2616-5880 Vol. 1, Issue 1: 11-18, DOI: 10.25236/AJMC.010102

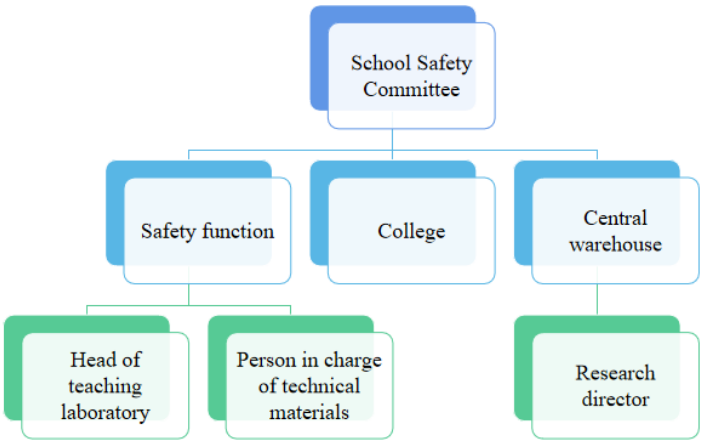

Figure 1 Safety management system structure of dangerous chemicals in colleges and universities

The regulations on the safety management of hazardous chemicals and the list of hazardous chemicals should be revised as soon as possible according to the actual development situation, so as to improve the reporting and supervision of new chemical substances. We should follow the basic laws of market economy, give full play to the role of government, market and people, and establish a new safety management system of hazardous chemicals with "government supervision, market regulation and social supervision". Through the information query module, the enterprise can query the policies and regulations of the higher authorities, the notice announcement and rectification announcement of the safety supervision department, and can also complete various status queries of licenses. Establish archives and systems and formulate emergency rescue plans for hazardous chemical accidents to ensure the safety management of hazardous chemicals.

By studying the current situation of chemical safety management system in EU, we believe that we must rely on safety science and technology strength and high-quality safety supervision team to implement advanced management and process control for safety business, facilities status and emergency mechanism of enterprises, which can also provide technical support for scientific formulation of laws and regulations and standards [7]. They made clear the check link, check duty, check operation mode and check assessment mode in cross-cutting work, effectively improved the check quality, and carried out strict assessment. Such as hazard overview, first-aid measures, fire-fighting measures, operation, disposal and storage, personal protection, waste disposal and other information [8]. It is posted on each bottle by the supplier before delivery. According to the scanned QR code, the legal source of the controlled chemicals can be ensured, and abnormal channels, loss of

ISSN 2616-5880 Vol. 1, Issue 1: 11-18, DOI: 10.25236/AJMC.010102

reagents or random disposal can be avoided.

4.2 Strengthen the construction of supporting system

It is the requirement of the new system construction to strengthen the construction of supporting system and give full play to the defense function of the system. Use hazardous chemicals in strict accordance with the safe operation procedures, and strictly control the use ways and consumption of hazardous chemicals. Users must fill out the Application Form for the Use of Hazardous Chemicals. Relevant technical institutions can also be entrusted by the government and enterprises to carry out research on chemical safety and harmful evaluation of working conditions, and issue legally effective inspection and certification reports. The safety management of hazardous chemicals should be grasped at different levels, and the responsibility should be implemented to the college and each laboratory. At the same time, the safety functional department should master the basic situation of the variety and quantity of dangerous chemicals used and stored in each independent room; The laboratory (or research group) must identify the corresponding safety responsible person, and sign the relevant responsibility letter with the college on behalf of the laboratory. Continuously improve the laboratory safety and environmental management team, and implement the responsibility system at different levels.

The license management operation includes the following working procedures: registration, application, change, extension and cancellation. The process is shown in Figure 2.

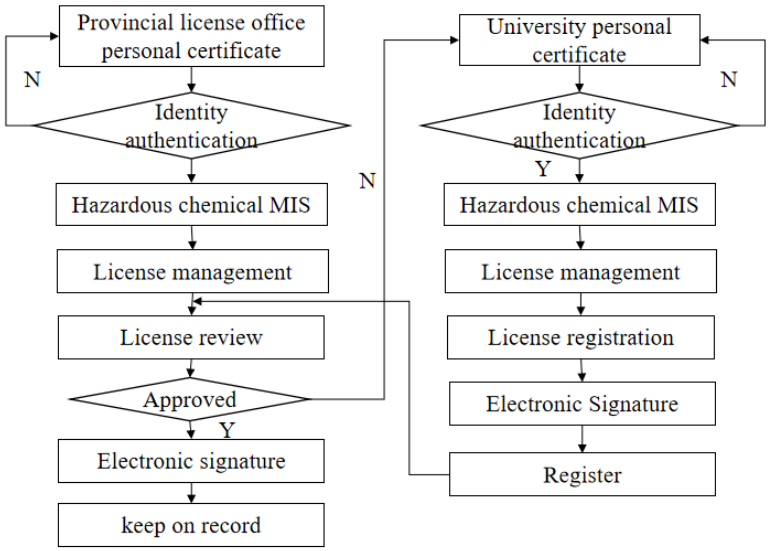

Figure 2 License registration process

ISSN 2616-5880 Vol. 1, Issue 1: 11-18, DOI: 10.25236/AJMC.010102

Under the condition of perfecting the market economy, the government is a "limited government", and there is a huge management and service space between the government management function and the development needs of enterprises. Schools and secondary colleges, colleges and laboratories (scientific research project leaders, teaching leaders), laboratories and experimental sub-rooms or technical materials rooms sign safety responsibility letters layer by layer, and adopt various effective safety precautions to reduce the accident risk of schools. Considering the individual differences of laboratories, a model of "Preventive Measures and Emergency Plans for Laboratory Safety Accidents" has been formulated for reference. Laboratories are required to carry out hazard identification seriously, and prepare practical preventive measures and emergency plans for safety accidents according to the specific conditions of the hazards in their laboratories, and post them in conspicuous places of laboratories.

Establish a public information platform for the use of hazardous chemicals, and supervise the production, storage, operation, use and waste of hazardous chemicals within the jurisdiction in real time. Unified assessment of laboratory safety, unified rectification of laboratory problems, in order to eliminate the hidden dangers of accidents of dangerous chemicals. License registration is mainly for valid licenses that have been successfully applied through the traditional application process, which can be directly filed with the provincial licensing office by colleges and universities through this system. It covers the training and examination of undergraduates, postgraduates, recent teachers and laboratory safety administrators in the whole school in stages, batches and levels, and implements and implements the laboratory personnel access system in all directions and at multiple levels.

4.3 Establish a whole-process supervision system for hazardous chemicals

Dangerous chemicals involve many departments, industries and links, so the government and enterprises should register and manage all dangerous chemicals. Investigate the root causes and related factors of accidents and major near misses in hazardous chemicals management in time, and determine the corrective measures or preventive actions needed to reduce the recurrence of such accidents and related accidents. Therefore, introducing social supervision into the safety management system of hazardous chemicals and giving the public equal supervision power to safety management will help prevent the occurrence of "government failure" and "market failure", thus truly forming a management system in which the government, the market and the people restrict and coordinate each other. Make every employee clearly aware of their responsibilities in the purchase, use and storage of hazardous chemicals and implement institutionalized management.

Emergency rescue work should pay attention to the implementation of the government's main responsibility, improve the plan system, carry out risk analysis, strengthen training and drills, improve the level of science and technology and carry out emergency education for the whole society [9]. Make emergency rescue plan, post emergency rescue plan in laboratory, and contact information of main responsible departments, responsible persons and relevant institutions (public

ISSN 2616-5880 Vol. 1, Issue 1: 11-18, DOI: 10.25236/AJMC.010102

security, fire control, medical treatment, etc.). In case of leakage, poisoning, explosion and other accidents of hazardous chemicals, the emergency rescue plan shall be started immediately. See Figure 3 for the specific process.

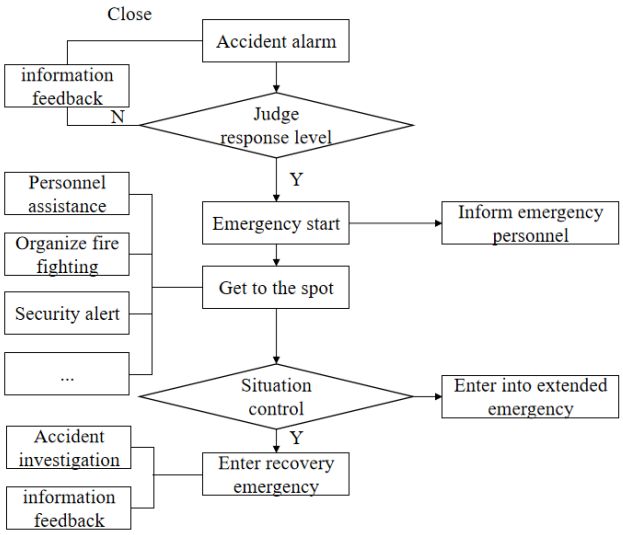

Figure 3 Emergency rescue plan for hazardous chemicals

The ways of public participation include direct supervision, letters and visits, supervision by public opinion, government organizations, non-governmental organizations and legal proceedings. Among them, the active participation of the news media has strengthened the supervision of the safety management of hazardous chemicals. Combined with my own experience in organic chemical synthesis, I explained the basic safety knowledge in chemical experiments and the measures that should be taken to deal with various safety accidents.

5. Conclusion

With the rapid development of China's economy, accidents of dangerous chemicals occur frequently. The main reason is that the current safety management system of hazardous chemicals is not suitable for the development of market economy, and even there are loopholes in management. The safety management system of hazardous chemicals based on digital signature overcomes various drawbacks of the traditional supervision mode of hazardous chemicals, enhances the timely interaction between enterprises and safety supervision departments, fully realizes the integrated process management, and can greatly improve the efficiency of safety management of hazardous chemicals enterprises. Training teachers who operate hazardous chemicals and enhancing the safety awareness of teaching staff

ISSN 2616-5880 Vol. 1, Issue 1: 11-18, DOI: 10.25236/AJMC.010102

will certainly contribute to the construction of harmonious and safe campus and harmonious society.

References

[1] Shi Aiju, Zhang Lili, Mou Shaomin. Discussion on the safety management of hazardous chemicals in chemical laboratories of universities [J]. Shandong Chemical Industry, 2020, v.49; No.379(09):291-292.
[2] Zuo Jiasheng. Safety management and production safety accident prevention in hazardous chemicals production enterprises [J]. Chemical Management, 2020, No.553(10):151-152.
[3] Xia yi, Wang maoxiang, Zhu xiangbin. present situation and countermeasures of safety management of hazardous chemicals in China [J]. safety, 2017, 07(No.452):6-8+12.
[4] Luo Danbo. Talking about the grass-roots safety management of hazardous chemicals production enterprises [J]. Small and medium-sized enterprise management and technology (next issue), 2017, 000(033):23-24.
[5] Xiong youqiang. discussion on safety management of hazardous chemicals in chemical plants [J]. chemical management, 2020, 000(009):103-104.
[6] Huang Bingbing. study on fire safety management of dangerous chemicals storage [J]. Journal of Jiamusi vocational college, 2019, 000(004):P.250-251.
[7] Sun Yongming. Risks and Countermeasures of hazardous chemicals storage safety management in electronic information industry [J]. Chemical Management, 2018, 000(004):134-136.
[8] Wang Zhaohu. Problems and Countermeasures of Safety Management of Dangerous Chemicals [J]. Commodities and Quality, 2019, 000(003):255,275.
[9] Tian Guobin. Analysis of the problems and suggestions in the safety management of hazardous chemicals production enterprises [J]. Chemical Management, 2020, No.548(05):84-85.