

Research on Safety Management of College Laboratory

Lijuan Sun^{1, a,*}, Yina Qu^{1, b} and Yue Xi^{1, c}

¹School of Information Science and Engineering, University of Jinan, Jinan, Shandong, China

^a20979280@qq.com, ^b58250530@qq.com, ^c1602969943@qq.com

*corresponding author

Keywords: College Laboratory; Laboratory Safety; Safety Management

Abstract: As one of the important part of "safe campus", the safety management of college laboratory is an important guarantee to promote the benign operation of laboratory and to ensure the smooth development of college teaching and scientific research. It is related to the safety of all teachers and students, and is an important part of maintaining the college and social stability. This paper analyzes its present situation, characteristics and the causes of laboratory safety accidents and proposes some countermeasures. Moreover, it discusses and studies the measures to strengthen the safety management of college laboratory.

1. Introduction

When it comes to "safety", what is its definition? The definition of "safety" in the national standard (GB / T 28001) is to avoid the unacceptable risk of damage. Others have proposed that safety refers to the ability to control and take risks. In the system operation, when the possible damage to human life, property and environment is controlled below the human acceptable level, it is considered as "safe". As an important part of college teaching, practice and scientific research, the laboratory is the main working platform to conduct practical and experimental teaching and scientific experimental research. To promote the benign operation of laboratory and ensure the smooth development of college teaching and scientific research, the laboratory safety construction is an important part of the safe campus. It is related to the safety of all teachers and students, and is an important part of maintaining the college and social stability. In recent years, as the Ministry of Education focuses more on the safety of college laboratory, a series of laboratory safety documents, like "Index System of College Laboratory Safety Inspection", "Opinions on Strengthening the Safety Work of college Laboratory" have been issued. These put forward more specific requirements for college laboratory safety, and have important guiding significance for its safety management^[1].

2. Characteristics and Security of College Laboratory

As a place for experiments, the laboratory is not only an important base for talents training and scientific research, but also a necessary place for training students' hands-on ability, practice and experimental ability and collaborative innovative ability^[2]. According to the college list of announced by the Ministry of Education in 2019, there are 2,956 colleges and universities in the country, with nearly 40 million students. Now, the characteristics of college laboratory include large number, large area, wide distribution, many disciplines involved, strong expertise, large number and variety of equipment, large electrical load, and frequent personnel replacement. Due to the large number of innovative research laboratory, its safety has high risk, complex environment, strong technology of safety management, and high requirements for safety management. Besides there are still some problems like inadequate or even lack of laboratory safety training and education, and lack of accident emergency response and self-help skills^[3].

3. Analysis on the Causes of Laboratory Safety Accidents

With the development of college laboratory in China, laboratory safety accidents have occurred frequently in recent years, which has brought property and physical injury to schools, teachers and students, and also a bad impact on society. The causes of these safety accidents are complex and diverse, not only for education, technology, and physical reasons, but also for ideological, management, and institutional reasons^[4]. Firstly, excessive pursuit of economic interests, ideological neglect of safety, lazy political thinking are the root causes of confusion and lack of laboratory safety management. Secondly, the subject of safety management responsibility of college laboratory is unreasonable and unclear; Safety management does not cover all aspects, and the whole process; Safety management is overlapping and has many leaders, and its process focuses on examination and approval rather than supervision, which leads to formalism and lack of independence; Meanwhile, the laws and regulations are not perfect to deal with the main problems in the safety management of college laboratory; Besides, there are many variables in the laboratory, professional complexity, lack of technical standards and specifications, and other deficiencies and imperfections in the safety system. Moreover, in order to deal with the superiors, public opinion, formalism like "safety inspection" after accidents and the neglect of safety quality of laboratory managers are the reasons for the frequent occurrence of safety accidents^[5].

4. Measures to Strengthen Laboratory Safety Management

4.1. Constructing and Improving Laboratory Safety Management System

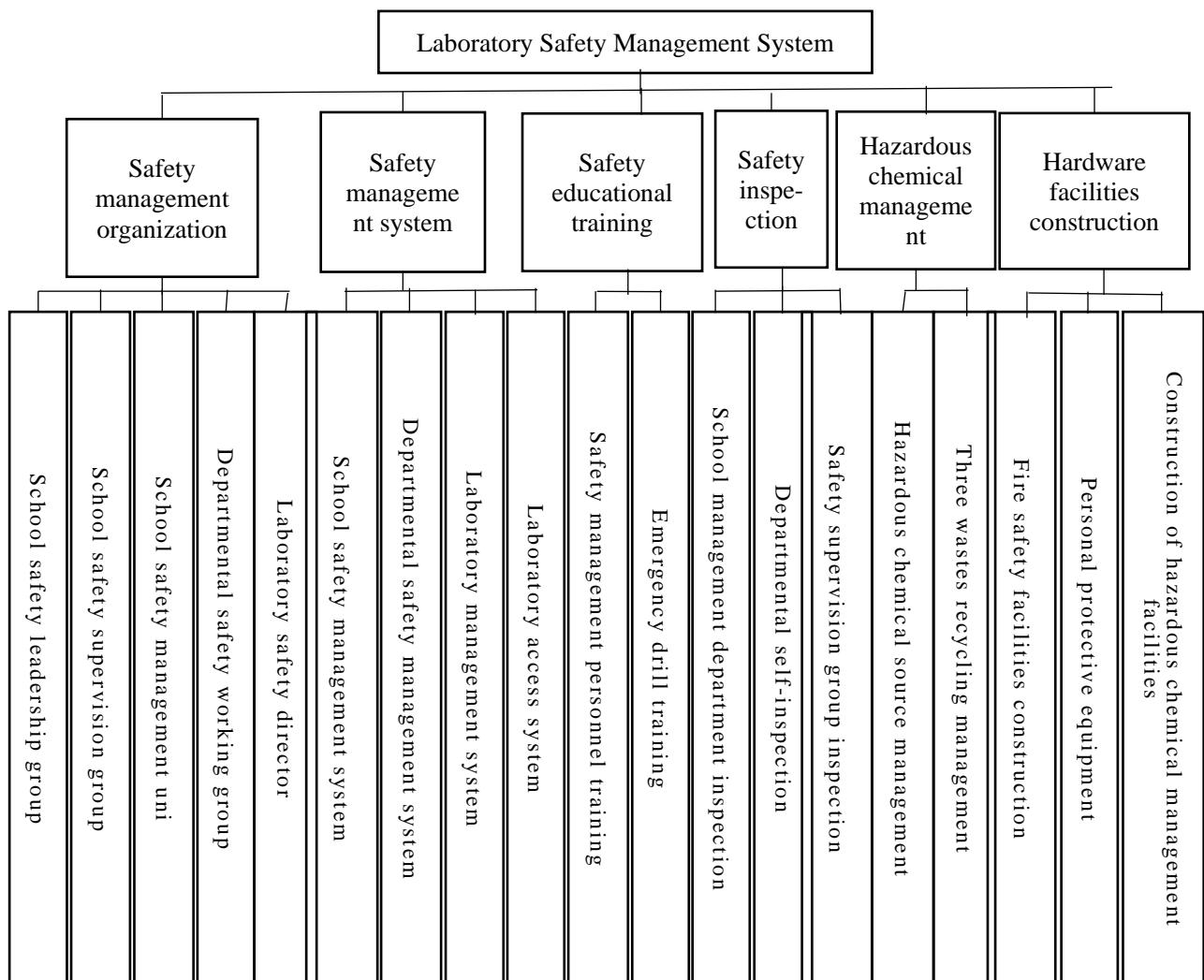


Fig. 1. Diagram of Laboratory Safety Management System

At present, the characteristics of the domestic college experiment determine that the construction

of the safety management system needs to be distinguished from the methods of safety management in other places and become a relatively independent system. It requires comprehensive professional knowledge, laboratory safety technology and management experience to conduct professional and improved construction to better meet the individual needs of college laboratory safety management. Besides, it also needs to be highly inclusive, including not only the basic experimental operation, but also the supervision and management of experimental equipment and participants. To reduce the occurrence of safety accidents, we must strictly conduct the construction of safety system, regard safety regulations as a systematic project, and comprehensively strengthen the construction of its safety management system^[6].

Laboratory safety management system is a huge system^[7]. It includes organization and system construction, personnel education and training, safety inspection, management system and laboratory hardware construction, as shown in Fig. 1.

4.2. Strengthen Laboratory Safety Inspection

According to "Ohain's Law" and "Heinrich's Pyramid", it is revealed that the occurrence of safety accidents must be the result of quantity accumulation. There must be many signs behind a major accident. Removing all potential hidden dangers in advance is an important means to implement safety measures and prevent safety accidents. To prevent dangers, build a safe campus, doing well in safety inspection in the college laboratory safety management is important, which is an effective form in its safety management.

The forms of safety inspection should be diversified, including school inspection, departmental inspection and laboratory self-inspection; The content should also be comprehensive and detailed, including special safety inspection, regular or irregular comprehensive safety inspection. Safety inspection should cover all aspects like rules and regulations, daily management and implementation, laboratory goods and personnel management, laboratory environment, laboratory foundation and safety facilities, so as to keep "safety" at all times.

4.3. Strengthen Laboratory Personnel Management

As we all know, laboratory safety management is a professional, long-term and systematic work. Since the subject of safety is human, strengthening the personnel management in laboratory safety management is the first element that cannot be ignored. Previous experience shows that 90% of laboratory safety accidents are caused by human factors. For "safety", negligence, inaction, and insufficient emergency response capabilities of personnel are important causes of safety accidents. Thus, we should strengthen safety awareness, know well about laboratory safety knowledge and protection methods, formulate and implement laboratory safety emergency measures, and strictly follow the principle of "who is in charge, who is responsible; who is in use, who is responsible". Only in this way can most safety accidents be avoided.

4.4. Strengthen Laboratory Safety Education and Training

To do well in laboratory safety prevention, we should not only put the work of "post-processing" into "pre-prevention" and "in-process supervision", so as to prevent accidents before they occur; Meanwhile, we must also know that no matter how perfect the regulations, perfect safety facilities, and good technology are, they cannot replace the role of people's own quality and sense of responsibility in practical operation. While strengthening the ideological understanding of personnel, we must also focus on enhancing their safety ability. Thus, it is an important part of safety management to change the concept, improve awareness, attach importance to safety education and training, and promote the skills of laboratory safety personnel. This education and training need to define the content, use the appropriate way for the dissemination of safety knowledge, awareness and skills^[8]. It can be conducted from the following aspects.

(1) Compiling safety education manuals or teaching materials and opening laboratory safety education courses

We should integrate laboratory safety education into the school education system and cultivate innovative talents with good experimental habits and the awareness of safety and environmental

protection. According to the characteristics of different laboratory disciplines like biology, chemistry, mechanics, electricity, radiation and computer information, different safety education manuals or teaching materials shall be compiled or made, and safety education shall be conducted on different subjects according to different subjects.

(2) Establishing a laboratory safety access system

To establish a "laboratory safety access system", all teachers and students need to pass the examination with the online or offline safety study, and sign a "letter of commitment on safety responsibility" before entering the laboratory.

(3) Conducting various safety education activities

The forms of safety education and training can be implemented in various ways, like "laboratory safety quality month", laboratory equipment safety display, safety education lecture, laboratory emergency evacuation drill and other activities. These can deeply affect teachers' and students' understanding and attention to laboratory safety, learn and improve their safety skills.

4.5. Strengthening Laboratory Safety Input and Hardware Facilities Construction

Apart from the establishment of systems, personnel, culture, etc., strengthening laboratory safety also requires input and construction of laboratory safety hardware. Only by strengthening the construction and use of laboratory safety facilities, equipment and environmental protection facilities can we provide basic conditions and guarantees for school laboratory safety. It includes, like, personal protective equipment and safety protection facilities, fire safety monitoring equipment, recycling and control facilities for three wastes, various safety, sanitation and environmental protection facilities, etc^[9].

5. Conclusion

College laboratory is an important platform for teaching and scientific research. Its safety has got more and more attention, management has been standardized, and safety input has increased accordingly. However, we cannot slack off, and must position safety management as the focus of teaching management. We should use modern information technology to continuously improve the college safety management system and improve the level of safety management. We should also do well in daily safety management, avoid safety accidents, ensure the safety of teachers and students, and maintain social stability^[10].

References

- [1] Wu Zhuwu, Bai Xiangyu, Sun Zhiqiang et al. College Laboratory Safety Management Exploration and Practice[J]. Experimental Technology and Management, 2019, 36(12): 1-4.
- [2] Liu Bing, Chen Zihui, Zhang Hai. Analysis on current situation and research on countermeasure of laboratory safety work in colleges and universities[J]. Experimental Technology and Management, 2019, 36(4): 175–178.
- [3] Jin Rendong, Ma Qing, Ke Hongyan. Research on construction of hierarchical laboratory safety education system[J]. Laboratory Research and Exploration, 2018, 35(12): 4–8.
- [4] Xie Jinyu, Li Jianxin, Weng Tao et al. Safety and Health of Employees[M]. Beijing: Economic Management Press, 1999: 135–147.
- [5] Zhang Haifeng, Zhang Fan, Liu Yi. Problems and countermeasures for laboratory safety education in colleges and universities[J]. Experimental Technology and Management, 2017, 34(9): 244–247.
- [6] Li Fushun. Laboratory Construction and Safety Management in Colleges and Universities[J]. China Modern Educational Equipment, 2020.2(331):27-29.
- [7] Lin Haiyan, Wu Kebin, Wang Ying. Study of safety management for university

research-oriented laboratory under background of opening and innovation[J]. Experimental Technology and Management, 2018, (3):261-26.

[8] Hu Hong. Research on Safety Education and Methodology[D]. Changsha: Central South University, 2010.

[9] Sheng Kai, Zhang Qian, Li Lantao et al. College Laboratory Safety and Protection[J]. Education Forum, 2020.3(11): 389-390.

[10] Xu Hongzhen, Liu Jiaodi, Li Xianxuan. Research on College Laboratory Safety Management and Countermeasures[J]. Education Forum, 2020.3(13): 16-17.