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A STUDY OF THE CURRENT SITUATION OF CHEMICAL LABORATORY SAFETY MANAGEMENT IN LOCAL COLLEGES AND UNIVERSITIES AND SUGGESTIONS FOR IMPROVEMENT

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Abstract: This paper discusses the importance of laboratory safety management in local universities and proposes some countermeasures for improving the level of safety management in the laboratory. The paper argues that laboratory safety management is an important guarantee measure to ensure the quality of education and safety of colleges and universities. The paper also points out that there are some problems in the management of chemical laboratories in local universities, such as the lack of a clear safety management system, the lack of safety awareness among teachers and students, and the inadequate safety facilities. The paper then proposes some countermeasures for improving the level of safety management in the laboratory, such as establishing a clear safety management system, improving safety awareness among teachers and students, and providing adequate safety facilities.
Keywords: laboratory safety management, local universities, safety management system, safety awareness, safety facilities

Introduction

With the rapid development of our country's higher education, the scale of teaching and scientific research in universities had continuously increased, the number of chemical laboratories had gradually emerged with the strong support of the state. The laboratory safety management had become increasingly important. The importance of laboratory safety management was self-evident. Laboratory safety issues involved the safety of schools, teachers, and students' lives and property, as well as the smooth and orderly process of scientific research. Laboratory safety management had become an important issue. Laboratory safety management was an important guarantee measure to ensure the quality of education and safety of colleges and universities. Local colleges and universities also payed more and more attention to the safety management of the laboratory. Therefore, this article conducted analysis of problems in the management of chemical laboratories in local universities, and combined advanced management experience of foreign countries to propose countermeasures for improving the level of safety management in the laboratory.

1. The current situation of safety management in chemical laboratories in domestic universities

The university laboratories carried the mission of cultivating innovative talents and technological innovation in the new era. They were the foundation of technological development and a window for promoting mutual exchange and opening up of research in various fields. With the increasing of universities size and the number of

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students, the investment in laboratories was increasing. And laboratory safety management would face greater challenges and the safety hazards were becoming increasingly prominent. The construction and management of laboratories were constraining the rapid and healthy development of higher education. Therefore, it was urgent to explore a scientific, efficient, and safe laboratory management method that can ensure the safe and stable operation of the laboratories.

2.1. Incomplete management system and management system

The imperfect laboratory safety management system was an important issue faced by local universities in laboratory safety management. Many universities had long established management systems, and there were still many gaps in laboratory safety management systems. However, laboratory safety management was a constantly evolving and changing process. If the safety management system cannot be updated in a timely manner, there may be situations where the system lags behind actual needs. And they may unable to meet the pluralistic and interdisciplinary scientific research work and diverse laboratory requirements, as well as the laboratory safety issues under the rapid development of scientific research [1].

Local colleges and universities lacked the normality and targeted management of laboratory personnel, causing some laboratory managers being unclear about their responsibilities. And they cannot handle it as soon as possible when there was an emergency [2].

There was no efficient organizational structure between schools, secondary colleges, and laboratories, which resulting in the inadequate implementation of school regulations and arrangements, delayed feedback on laboratory issues, the low laboratory safety management efficiency and disordered management work.

2.2. Insufficient ideological awareness and weak safety awareness

With the emphasis on the teaching and scientific research experiments and the development of disciplines continues to develop in domestic universities, the number of laboratories in each school had continued to increase, teams engaged in experimental research had continued to expand, and the risk had also increased relatively. Some of the experimental personnel who entered the laboratory paid relatively little attention to the safety work and environmental awareness of the school laboratory. Teachers and students faced the great pressure in scientific research and learning [3]. They often focused on the output of results, while neglecting laboratory safety operations and hidden dangers. They should improve safety awareness.

In addition, the laboratory safety management personnel were also responsible for experimental teaching, platform construction of experimental bases, and laboratory safety management. The laboratory safety management full-time personnel were not equipped.

2.3. Multiple types of hazards and high difficulty in management

The Universities had a wide range of disciplines and majors, and the laboratories were the main venues for scientific research in universities. Experiments were innovative, exploratory and with high unknown risks [4].

There were many types of hazardous sources distributed widely, including chemicals, gas cylinders, special equipment, and hazardous waste. The chemicals used in university laboratories had the characteristics of multiple types, wide distribution and frequent use. There were management difficulties such as excessive storage, non-standard storage and inconsistent accounting. Dangerous gas cylinders had a large volume, non-standard storage and use, difficult to detect leaks, difficult emergency response, large damage areas and significant life-threatening

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hazards. The hazardous waste generated in the laboratory had the characteristics of complex composition, diverse types and high difficulty in treatment. At present, most universities in China generally do not have the ability to dispose of hazardous waste. They need to transfer laboratory hazardous waste to companies with disposal qualifications for waste disposal. Before the final transfer to the disposal unit, it was necessary to scientifically classify, collect, and store laboratory hazardous waste. And they should indicate its composition on the hazardous waste label to reduce adverse effects on the environment and ensure the personal safety of teachers and students.

2.4. Insufficient funding and unclear rewards and punishments

While universities were expanding their laboratory scale, various problems were also highlighted. The expansion of personnel and the purchase of hardware equipment both require additional funds. However, some universities had insufficient laboratory funds, and even some laboratories may experience budget reductions, making it difficult to introduce professionals with rich specialized knowledge. Some school laboratory management personnel also hired part-time personnel with different majors, resulting in various problems in laboratory management.

Due to limited funding, schools often allocated more resources to the procurement of experimental instruments and invested more energy in cost-effective construction. Therefore, the investment in laboratory protective facilities would be ignored, resulting in insufficient fire-fighting facilities, untimely updates of emergency equipment, non-standard chemical storage facilities, improper disposal of waste gas, liquid waste, and used experimental materials. These had laid hidden dangers for the smooth progress of experimental research and the personal safety of researchers [5].

In addition, some university laboratories lacked a clear reward and punishment system for management personnel. It leaded to outstanding talents not receiving the rewards they deserve and problem personnel not receiving the punishment they deserve. It also promoted the tendency of laboratory management personnel to be lazy and perfunctory.

3. Current Situation of Safety Management in Chemical Laboratories in Foreign Universities

3.1. Experience in laboratory safety management in American universities

American universities attached great importance to safety management and had accumulated rich experience in laboratory safety management. They usually established an Environmental Health & Safety (EHS) department to be responsible for and manage campus environment, public health and safety work. They prevented environmental or safety accidents caused by human operational errors and reduced the negative impact of experiments on the environment and safety. EHS members were composed of technical personnel with relevant educational backgrounds. They were grouped according to the type of safety work. And they were responsible for targeted safety supervision and management in the corresponding field according to their work direction. Although this required a lot of investment, its management effectiveness was significant and efficient [6].

American university laboratories implemented strict safety training systems. They provided different safety training programs for different personnel. For different types of personnel such as newly enrolled faculty, graduate students, and undergraduate students who were about to enter the laboratory, clear training and examination requirements would be given based on their respective majors. It would also require everyone who may come

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into contact with hazardous materials to participate in laboratory safety training. For all hazardous materials, it was required that the experimenter must be aware that these materials were harmful or could cause harm. And they would understand the correct use of these hazardous materials through training.

The management of EHS integrated the health and safety of teachers and students with the campus environment, and had developed sound regulations. The safety management system had strong systematicity.

3.2. Experience in laboratory safety management in England universities

British universities usually established a health and safety management committee responsible for formulating guidelines and policies for school health and safety management. They set a health and safety advisory committee composed of representatives from different professions as well as, to provide advice and suggestions for improving health and safety policies.

The leaders of each department were fully responsible for the safety of all faculty, staff, and work environment (including laboratories) within the department. Each department employed a full-time safety officer and multiple part-time safety officers to assist the school in implementing relevant safety management systems in each department. Under the framework of the general principles of health and safety, British universities had successively introduced specific safety regulations and rules covering various laboratory safety fields, including equipment safety, chemical safety, mechanical processing safety, radiation safety, biological safety, special work safety and accident prevention [7].

British universities would also conduct risk assessments of the experimental process and developed corresponding plans to avoid harm. The comprehensive safety framework, supervision system, and emphasis on operability in all aspects of British university laboratories enabled the effective operation of the safety system. The safety expert evaluation team in various professional fields also played an important role in the continuous improvement of laboratory safety work.

3.3. Experience in laboratory safety management in Japanese universities

Japanese universities had advanced environmental and safety concepts as well as rigid management systems. Japanese universities attach great importance to environmental protection and safety work. They had invested a large amount of funds in the construction of environmental protection and safety hardware and software. Japanese universities strictly governed their schools in accordance with the law, and formed a scientific and standardized management system for laboratory safety and environmental protection.

Japanese universities had strict laboratory admission systems and offered specialized laboratory safety education and training courses. Laboratory safety education and training courses were not only mandatory for students, but also required new teachers and researchers to undergo strict safety education and training before taking up their positions. The school also offered safety and environmental protection courses with varying depths in various departments based on students' grades and subject characteristics, which further deepening laboratory safety and environmental protection education.

Japanese universities had rigorous management of hazardous chemicals and hazardous chemical waste in their laboratories. The laboratory supplied of some Japanese universities were uniformly purchased by qualified institutions designated by the school, effectively avoiding the uncontrolled quantity and quality of hazardous

chemicals caused by multi-channel purchases, and reducing the existence of safety hazards from the source. For the large amount of hazardous chemical waste and other laboratory waste generated in the laboratory, it was necessary to classify, collect, and organize them in each laboratory according to the waste disposal instructions, and then have them recycled by the school's specialized agency, and handed over to relevant national institutions for treatment [8].

4. Countermeasures for Improving Laboratory Safety Management Ability

4.1. Establishing a sound laboratory safety management system

Establishing a sound laboratory safety management system was the foundation for local universities to improve their laboratory safety management capabilities and was also the key to ensuring laboratory safety. By drawing on the management experience of first-class universities both domestically and internationally, local universities can establish a scientific and reasonable laboratory safety management system, including laboratory management, safety education, accident reporting, and emergency response. This can effectively improve the level of laboratory safety management and ensure the safety and health of all teachers and students [9-10]. Local universities should attach great importance to institutional construction. They should promote safety management systems as a long-term task, continuously improve and update the systems, and provide solid support for laboratory safety management. Only by establishing a comprehensive laboratory safety management system can we ensure the healthy and orderly development of laboratory safety management work. And also providing a strong guarantee for the sustainable development of education and scientific research in universities.

4.2. Promoting the professional construction of laboratory safety management teams

Local universities should equip relevant professional management personnel for different types of laboratories. So that they can play a role in their areas of expertise and improve the efficiency of management work. Local universities should also make reasonable use of special laboratory funds to introduce talents in laboratory management. And they should provide appropriate rewards for outstanding management personnel.

At the same time, laboratory management personnel need to improve their comprehensive management abilities. Universities should regularly organize training for management personnel, encourage them to participate in meetings and activities related to laboratory construction and management. And Universities also help them apply for projects related to laboratory management. Laboratory management personnel should also communicate and learn from each other, and strengthen communication and cooperation among laboratory management teams.

4.3. Strengthening safety education and training for teachers and students and enhance safety awareness

Strengthening teachers and students training and safety awareness education was an important link for local universities to improve their laboratory safety management capabilities. Laboratory safety was a complex and important task that required laboratory members to possess certain professional knowledge and skills. Strengthening safety training for laboratory personnel can enhance their awareness and understanding of laboratory safety management. They can also master necessary safety operating procedures and emergency response skills. So that they could enhance their initiative and subjective initiative in safety management.

Universities should emphasize the safety awareness education of laboratory members, improve their vigilance against safety risks and enhance their awareness of complying with safety regulations and rules.

Safety training and education should develop different training plans and educational content for different laboratory members. For new laboratory members, comprehensive safety training should be conducted, including laboratory safety regulations and operating procedures. For teachers and technicians with certain work experience, targeted safety education should be carried out. It should be emphasized that the responsibility and importance of laboratory management. In security training and education, local universities can use advanced technological means to improve the effectiveness of training and education. For example, by using online education platforms and offering online security courses, laboratory members can easily learn security knowledge at any time. Virtual laboratory technology can also be used to simulate and practice safe operations. It can improve the operating skills of laboratory members. Only by improving the safety awareness of teachers and students can accidents be prevented and the safe and stable operation of the laboratory be ensured.

4.4. Establishing a sound laboratory safety risk assessment and emergency response mechanism

Improving laboratory safety risk assessment and emergency response mechanisms was an important measure for local universities to improve their laboratory safety management capabilities. Laboratory safety risk assessment was an effective means of preventing and reducing laboratory accidents. Local universities should establish a scientific and reasonable laboratory safety risk assessment mechanism. They should use systematic and quantitative methods to assess laboratory safety risks and clarify safety responsibilities. In the meantime, universities should also develop emergency plans to cover different types and levels of laboratory accidents. And universities also should clarify the procedures and steps of emergency response, and designate emergency response personnel and tasks. They need to ensure the orderly organization of emergency work.

Local universities should regularly organize laboratory safety drills, simulate various laboratory accident scenarios, and test the effectiveness and implementation of emergency plans. Through laboratory safety drills, laboratory members can become familiar with emergency response processes and skills, enhancing their confidence and ability in emergency response. The ability to respond to emergencies still required continuous training and improvement. Local universities should provide training on emergency response skills, including fire escape, first-aid measures, spill handling, etc., to enhance the emergency response capabilities of laboratory members.

4.5. Improving the quality and maintenance level of laboratory safety facilities

Local universities should attach great importance to the construction and updating of laboratory safety facilities, increase funding investment. And ensure that the quality and performance of laboratory facilities and equipment meet the requirements of safety management. With the continuous progress of technology, new safety facilities and equipment with higher safety performance and functions were constantly emerging, which can better meet the safety management needs of laboratories. Local universities should pay attention to new technologies and products in laboratory safety facilities, and timely update and improve equipment. Local universities should establish a sound facility maintenance system, clarify the responsible departments and personnel for maintenance, and develop detailed maintenance plans.

5. Conclusions

The safety management of chemical laboratories in local universities faced some challenges. However, by drawing on the successful experience of foreign universities and adopting corresponding strategies, we are confident in improving the level of laboratory safety management. Establishing a sound laboratory safety management system, strengthening personnel training and safety awareness education, improving laboratory safety risk assessment, optimizing facilities and equipment, and increasing financial investment would help ensure the safety of teachers and students, as well as ensure the smooth progress of experiment and teaching. It can also promote the sustainable development of local university education. Meanwhile, with the continuous development of society and technological progress, laboratory safety management needs to be continuously improved and innovated to ensure that university laboratories become an important support for knowledge innovation and academic development.

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