

Construction of University Laboratory Safety Management System

-- Taking Youjiang Medical University for Nationalities as an Example

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Abstract: The laboratory is an important place for cultivating talents' practical ability and innovative thinking in medical colleges and universities. However, due to the limitation of management concepts and conditions, there are many problems in laboratory safety management, which seriously affect the safety of campus and the life and health of teachers and students. Aiming at various problems in the laboratory safety management, this article is based on the connotation of the laboratory safety management system in colleges and universities, combined with the specific practical experience of the laboratory safety management of Youjiang Medical University for Nationalities, from the four aspects of improving the organizational structure and responsibility system of laboratory safety management, strengthening the construction of laboratory safety management system, standardizing laboratory safety education and training, implementing laboratory routine inspection and hidden danger rectification, build a sound laboratory safety management system for medical colleges, and improve the science of laboratory safety management level.

Keywords: Laboratory Safety; Management System; Safety Awareness.

1. Introduction

The importance of university laboratories has gradually attracted the attention of university administrators. As an important base for cultivating compound application-oriented talents in response to social needs, it is the main place where college students' learning ability and hands-on ability are cultivated and innovative thinking is developed, and it is also an important carrier for practicing the scientific spirit [1-2]. But it will also become a hidden danger that will cause heavy property losses, endanger the lives of teachers and students, and cause adverse social impacts. In order to establish the concept of safe development of the education system in colleges and universities across the country, and promote the idea of life first and safety first, the Ministry of Education issued the "Opinions of the Ministry of Education on Strengthening the Safety Work of College Laboratories" in 2019 to guide colleges and universities to effectively strengthen the safety management of college laboratories, to ensure the safety and stability of the campus and the safety of teachers and students. Today, when laboratory safety accidents occur frequently, as a manager of a university, how to maintain laboratory safety is worthy of deep reflection and great attention.

2. Connotation of laboratory safety management system

He zhankui consider that system refers to the fact that many things form an organic whole with specific functions through a certain scientific combination in a certain interrelated form and structure. In the campus security system of colleges and universities, the laboratory safety management system is undoubtedly an important part. University laboratory safety work involves multi-departmental cooperation and has

specific objective laws. Only by comprehensively optimizing the design of all links involving laboratory safety in personnel training, teaching and scientific research activities in colleges and universities, so that the organizational structure, management system, mechanism guarantee, publicity and education, safety inspections, emergency plans, etc. in colleges and universities are interconnected and interact, promote each other to form a whole, in order to form a laboratory safety management system with a relatively complete structure and function, so as to achieve the goal of safe and efficient operation of the laboratory [4-5].

3. Current status of laboratory safety management in colleges and universities

In 1999, with the expansion of colleges and universities, Chinese higher education began to enter the stage of popularization, and the state's investment in infrastructure construction in colleges and universities increased year by year, and Chinese higher education undertakings developed rapidly. With the vigorous development of universities and disciplines, the construction scale of university laboratories is also expanding, and the growth rate of laboratories at all levels is rapid. University laboratories show a large number of scales, diverse categories, concentrated expensive equipment assets, and complex personnel structures, the relative concentration of risk, and the relatively lagging safety management. Any small mistakes in the management process, may evolve into major safety accidents, endangering the lives of teachers and students and the harmony and stability of the campus. In recent years, university laboratory safety accidents have occurred from time to time, making the safety of university laboratories become the focus of widespread attention of the society and the public.

3.1. Basic situation of laboratory safety

Our school currently has 16 experimental teaching centers, among which the clinical skills training center, the morphological experimental teaching center, the human anatomy experimental teaching center, and the functional experimental teaching center belong to the provincial experimental teaching demonstration centers, accounting for 25% of the total. It has 215 teaching laboratories with a total area of 18126.79 square meters. As of 2021, there are a total of 16,383 pieces/sets of teaching and experimental equipment, with a total asset value of 189.5458 million yuan. It has undertaken the teaching tasks of 30 full-time ordinary undergraduates, junior college majors, and 5 postgraduate majors in our school.

The school currently has 93 scientific research laboratories, including 1 third-level laboratory of Chinese medicine scientific research of the State Administration of Traditional Chinese Medicine, 2 second-level laboratories of traditional Chinese medicine scientific research of the State Administration of Traditional Chinese Medicine, 1 clinical research center for liver and gallbladder diseases in Guangxi, 1 provincial key laboratory, 1 Guangxi engineering research center, 4 key laboratories of universities in Guangxi, 5 key laboratories of the Health Commission, 6 school-level key laboratories of molecular pathology of hepatobiliary diseases, 1 clinical pathological diagnosis and research center and 1 clinical laboratory diagnosis center.

In recent years, the school has continuously increased the investment in laboratory safety funds and equipped with laboratory safety management personnel. In 2021, the school has invested a total of 350,300 yuan in teaching laboratory safety construction funds, which are mainly used for the renovation of laboratory hardware facilities, laboratory informatization construction, repair and maintenance of dangerous chemical warehouse facilities, and personnel safety training. At present, there are 84 full-time laboratory technicians in the laboratories of the whole school, and there is a large gap in laboratory safety management personnel.

3.2. Problems Existing in Laboratory Safety Management

3.2.1. The use of the laboratory is confused, and there are great hidden dangers in safety management

Due to the lack of funds for running schools, there is a general shortage of teaching, scientific research and experimental rooms in local ordinary colleges and universities, which leads to great pressure on school laboratory management. With the increase in the number of students and the continuous improvement of the requirements for teaching innovation capabilities, the number of teaching laboratories is insufficient, and the problem of slow replacement of teaching equipment that cannot meet the teaching requirements has become increasingly prominent. The school can only open some scientific research laboratories as teaching laboratories [2 - 3], and then there are the following safety management hidden dangers: First, the conflict between teaching and scientific research time. When carrying out undergraduate teaching experiments, the scientific research personnel of the laboratory were forced to leave, and the scientific research personnel could only use the evening or even late night to conduct experiments, but the professional laboratory technicians responsible for laboratory safety could not be present to provide technical support and

safety guidance; the second is laboratory personnel access requirements cannot be implemented in place. Most undergraduates have basically not received corresponding safety training and lack experience in safe operation. During teaching activities, a large number of undergraduates enter the laboratory, causing safety hazard to the safety management of expensive instruments and equipment, dangerous reagents, and precious samples in scientific research laboratories. The third is that the teaching and scientific research experiment projects do not match the safety risk level of the laboratory. In the first-level safety management laboratory, a research group or multiple research groups simultaneously carry out high-risk experimental projects and low-risk general experimental projects. Some instructors which have a weak sense of responsibility were not accompanied throughout the project, when conducting low-risk general experiments, that will increase the risk of students touching high-risk equipment or reagent consumables.

3.2.2. There is a big conflict between management and scientific research consciousness, and security management is difficult to implement

Due to the shortage of professional and technical personnel in the laboratory, most of the scientific research and experimental projects are operated by the teachers of the research group and their students entering the laboratory, which leads to the separation of the right to use and the right to manage the laboratory. On the one hand, the safety management tasks of professional and technical personnel in the laboratory are heavy, and at the same time, the responsibility is huge, the laboratories should be managed in strict accordance with relevant management regulations. On the other hand, some scientific research experiments require high requirements, expensive safety equipment, and cumbersome application procedures. In order to obtain scientific research results, some scientific research teachers with weak safety awareness took chances and violated the regulations. The conflict between the safety management awareness of laboratory professional technicians and the output awareness of teachers' scientific research results has intensified the contradiction between the two sides. However, under the influence of the interests of scientific research results and humble concepts, the professional and technical personnel in the laboratory are in a weak position. They can only compromise on safety hazard that have not yet occurred in accidents, and it is difficult to strictly implement the relevant laboratory safety management rules and regulations of the school, which is the same as Su Yuan's conclusion.

3.2.3. The safety awareness of operators is weak, and with a fluke mentality

The vast majority of students and even instructors who enter the laboratory to carry out scientific research experiments mainly focus on the progress of the experiment itself, while ignoring the safe operation in the laboratory. The following behaviors are often found in the routine inspection of the laboratory: the safety protection measures are not in place during the experimental operation, the lab coat, gloves, masks and goggles are not worn according to the laboratory safety level requirements; the experimental operation of toxic and volatile reagents was not carried out in the fume hood as required; when using high-temperature heating equipment such as ovens and high-pressure steam sterilizers, experimenters leave at will; when experimental projects involving the use of flammable, explosive, strong acids and alkalis, etc. the ingredients and content are not effectively

marked on the container, and reagent consumables are placed randomly; illegal items such as drinks and food are brought into the laboratory without permission. Experience has proved that behind every laboratory safety accident there are operators' fluke mentality and willful behavior. Weak safety awareness is like a ticking time bomb, which brings a huge burden to laboratory safety management.

3.2.4. The rights and responsibilities of the responsible subject are not clear, and laboratory managers are walking on eggshells

Ministry of Education has always attached great importance to laboratory safety, and relevant management agencies have also formulated detailed management rules and regulations, but when implemented in ordinary local university laboratories, the effect is greatly reduced. Restricted by the lack of hardware and software conditions in the school laboratory, the professional and technical personnel in the laboratory are faced with the following dilemmas: First, there is no corresponding punishment right for illegal operations, and the irregular operations of students with no safety operation experience and weak safety awareness or some scientific research teachers are prohibited but not stopped. Second, there is no dominance over laboratory planning and management. Teaching and research laboratories are mixed, high-risk equipment and conventional equipment are in the same room, and scientific research teachers are equipped with unsafe electrical equipment at will, which increases safety risks and increases difficulty in safety management; third, there is no veto power for unreasonable experimental projects, and scientific research teachers carry out high-risk experiments without reporting and emergency plans. Due to the huge influence of scientific research results, as long as there are no safety accidents, the reasonable suggestions of laboratory professional and technical personnel are ignored.

However, the first person responsible for laboratory safety accidents is the laboratory professional and technical personnel. Often when students ignore the safety warnings caused by laboratory safety accidents, the professional and technical personnel in charge of the laboratory often become "jointly responsible persons", and are in an embarrassing state of "management without authority, but responsibility is mine". This makes the professional technicians in the laboratory forced to give up the main responsibility of the operation of the experimental project. The main energy of the working hours can only be put in the laboratory management affairs of inspection and repeated supervision and correction. Over time, in order to avoid safety accidents, laboratory professional technicians would rather not carry out experimental projects, be forced to give up their main business, and carefully maintaining the fragile balance between laboratory security and open sharing. The strict laboratory safety management rules and regulations restrict only the time and energy of laboratory professional technicians, but cannot eliminate the factors that really cause laboratory safety hazards.

4. Construction of laboratory safety management system

4.1. Organizational structure and responsibility system of laboratory safety management

Our school establishes and implements a three-level

laboratory safety management responsibility system composed of "school-secondary unit-laboratory" in accordance with the principle of "Who uses, who is responsible, who is in charge, who is responsible", and implements the responsibility system step by step. A school-level laboratory safety work Leading group has been established at the school level, with the secretary and principal as the team leader, the deputy vocational school leader as the deputy team leader, and the heads of relevant functional departments are members of leading group such as the Security Office, the Academic Affairs Office, the Science and Technology Office, and other heads of secondary units. The leading group is responsible for coordinating the work of the school's laboratory safety management, establishing and improving the laboratory safety responsibility system and rules and regulations, organizing, coordinating, and supervising all secondary colleges and experimental centers to do a good job in laboratory safety work, and implementing laboratory safety responsibility system, organizing laboratory safety management supervision and inspection, and organizing the implementation of safety hidden danger rectification work. Each secondary unit establishes a laboratory safety working group headed by the main person in charge of the party and government. Fully responsible for the specific work of the laboratory safety management of the college, responsible for formulating detailed rules for the implementation of laboratory safety management regulations for secondary units, conducting internal laboratory safety inspections, and organizing the implementation of hidden danger rectification work. The laboratory director is specifically responsible for the daily safety affairs of the laboratory, and conducts self-examination and self-correction of laboratory safety management and daily safety of the experimental laboratory. The person in charge of experimental safety is the person directly responsible for the safety work of the laboratory, and has direct management responsibility for the safety work of the laboratory it manages. Each laboratory can carry out division of labor according to the actual situation of the specific laboratory, clarify the safety work responsibilities of their respective laboratory personnel, assign responsibilities to individuals in detail, and investigate the responsibility of units and individuals that have laboratory safety and environmental protection accidents. Ensure the orderly and effective implementation of laboratory safety management, effectively prevent and reduce safety accidents.

4.2. Laboratory safety system construction

Laboratory safety management is an indispensable and important part of laboratory construction and management in colleges and universities. The school takes the construction of the laboratory safety management system as the starting point, and constantly improves the responsibility system and system of laboratory safety work. The "Interim Measures for the Safety Management of Dangerous Goods of Youjiang Medical College for Nationalities", "The Laboratory Safety Management Measures of Youjiang Medical College for Nationalities", "The Laboratory Safety Education Training and Access System of Youjiang Medical College for Nationalities" and "The Laboratory Safety Inspection System of Youjiang Medical College for Nationalities", "Youjiang Medical College for Nationalities Laboratory Safety Accident Emergency Plan", "Youjiang Medical College for Nationalities Emergency Response Plan for Hazardous Chemical Emergencies" and other related management

systems are published. According to the promulgation of the school's relevant laboratory system, the whole school has seriously rectified, strengthened the laboratory safety awareness of students and teachers, supervised rectification, recorded in time, eliminated hidden dangers, and effectively prevented the occurrence of safety accidents. Each secondary unit formulates targeted laboratory safety systems according to the conditions of the professional laboratories, such as: "Laboratory Safety System of Pharmacy Comprehensive Experimental Teaching Center", "Regulations on Laboratory Safety Inspection of Pharmacy Comprehensive Experimental Teaching Center", "Clinical Skills Training Center Safety and Environmental Management Regulations", "Rules for Using Simulation Hospital Teaching Instruments", and "Laboratory Integral Management Measures", etc., criticize students who violate the regulations, and give certain labor penalties, effectively reducing and eliminating laboratory safety accidents happen.

4.3. Laboratory Safety Education and Training

Laboratory safety education is the premise and basis for implementing the laboratory access system, and it is also one of the effective measures to ensure the safe and orderly conduct of experiments and prevent dangerous accidents. The school has carried out a series of training on laboratory safety knowledge at all levels, laboratory emergency safety drills, laboratory safety access level examinations. Use new media to push typical cases of laboratory safety accidents, publicity posters, safety learning months, knowledge competitions and other forms to strengthen the training of teachers and students in safety awareness training and laboratory safety education to form a good safe campus safety laboratory cultural atmosphere. In the beginning of each school year, all new students are given special safety education theory training and fire drills in the freshman admission education arrangement. In the public general education courses, "Safety Education for College Students" is offered for undergraduate and junior college students, and compulsory courses such as "Basic Technical Safety of Medical Experiments" are set up for postgraduate students. At the same time, in the newly revised personnel training program and experimental course syllabus, the teaching content of the laboratory safety education course has been added. Each secondary unit has also carried out safety publicity and education activities and training in line with the safety characteristics of the professional laboratory based on the characteristics of their own laboratory safety management, to enhance the safety awareness of students. The school organizes full-time teachers, experimental technicians and students in various laboratories to carry out special training on laboratory safety through different methods such as online + offline combination. In 2021, 459 faculty members and 10,596 students participated in safety training, which effectively enhanced the safety response and disposal capabilities of teachers and students, and formed a good laboratory safety culture atmosphere in the school.

4.4. Laboratory routine inspection and hidden danger rectification

Our school strictly grasps laboratory safety inspections, and effectively enhances red line awareness and bottom line thinking. The school conducts special school-wide safety inspections at the beginning, middle, end, and major holidays of each semester. Inspections include fire-fighting facilities, water and electricity safety, hazardous chemicals in

laboratories, flammable and explosive materials, and potential safety hazards. Aiming at the potential safety hazards and problems detected, rectification opinions were put forward on the spot and listed in the form of a project list, and corresponding work ledgers were established to form a closed-loop management mode of discovery, reporting, recording, rectification, and acceptance feedback, which greatly improved the integrity of the implementation of potential safety hazard rectification. At the same time, in accordance with the spiritual requirements of the document "Implementation Opinions on Comprehensively Strengthening the Safety Production of Hazardous Chemicals", we actively carry out special inspections on the safety of dangerous chemicals, and regularly organize secondary units to conduct self-examination and feedback on the use and remaining amount of dangerous chemicals, monitor the current status of dangerous chemicals management and use in real time, find out the existing base of dangerous chemicals in schools, and provide scientific data support for the management of dangerous chemicals in schools.

5. Conclusion

The construction and safety management of the laboratory is a long-term work. A well-operated laboratory safety management system is the guarantee for the smooth development of school teaching and scientific research. Organization management is optimized, safety management system is implemented, and safety education and training are taken as the starting point to create a change in the safety awareness of teachers and students from "I want my safety" to "I want safety", and form the closed-loop management mode of "discoveries, reports, records, rectification and acceptance" in the safety inspection work, can plug security loopholes, reduce potential safety hazards, reduce the probability of accidents, effectively protect the personal and property safety of teachers and students, and build a harmonious and safe campus.

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