

The cultivation of the ability and quality of graduate students is not only reflected in the stance in laboratory safety management

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Abstract: Laboratory safety is the basic guarantee for the smooth development of scientific research, and the safety management of laboratories is an important work for universities and research institutes. Based on the analysis of the current situation of laboratory safety, operational characteristics and difficulties in safety management, this paper fully combines the advantages of graduate students in laboratory safety management, and proposes that the postgraduates assist in laboratory safety management, and fully mobilize postgraduates to participate in the safety management of laboratories by formulating supervision content, examination method and incentive mechanism, to ensure the full-time management in the whole process of the laboratory safe operation, in order to provide new ideas and new methods for the safety management of laboratories.

1. Introduction

The laboratory of scientific research institutes and universities is an important place for scientific research and postgraduate teaching, as well as an important base for scientific and technological innovation and high-end talent training. With the rapid development of education in China, during the 13th Five-Year Plan period, the number of graduate students will reach 3 million [1], and with the increase of research funding, it can be predicted that the opening time and use frequency of the laboratory will continue to increase. At the same time, the safety problems of the laboratory will become increasingly prominent [2-3]. At present, China's laboratory management system pays more attention to the construction of the two levels of the school and the research room, but still pays less attention to the most basic link of laboratory.

Graduate students are the main force of scientific research and the longest team in the laboratory. They know the potential safety hazards and problems in the laboratory very clearly. However, it is difficult for the teacher to ensure full participation in the whole process of the laboratory management [4]. It can be seen that it is very necessary to explore how to establish a team of laboratory safety personnel with graduate students as the main body, which can fill the gaps in the grassroots links of the laboratory management system, and ensure the management and safe operation of the whole process of the laboratory.

2. Problems in laboratory safety management

2.1. The postgraduates' awareness of laboratory safety is not strong.

As the main force of scientific research laboratory, in the process of scientific research, graduate students will encounter many types of safety problems. To a large extent, the level of their safety awareness and the strength of their sense of responsibility will directly affect the safety status of the laboratory [5].

The lack of graduate students' laboratory safety awareness is mainly due to insufficient safety knowledge and poor safety habits. In recent years, 88% of laboratory safety accidents in Colleges and universities are caused by man-made disasters [6], such as fire, explosion, poisoning, infection,

corrosion and burn, hazardous chemicals leakage and mechanical damage, and the safety incidents in our laboratories occur from time to time [7]. According to the analysis, the main causes of these accidents are poor operation ability of students, lack of safety knowledge, poor emergency response ability, operation error of main instruments and equipment, off-the-job in the experimental process, no interruption of water and power supply, random placement or treatment of experimental drugs, etc.; In addition, after the accident, most students do not know the escape route of the laboratory, and do not use basic fire-fighting equipment, and do not know the location of the laboratory first aid station and contact information [8].

The occurrence of laboratory safety accidents tells us a common fact that the weak awareness of laboratory safety is a great potential safety hazard. If graduate students lack a high awareness of safety prevention and responsibility, and cannot use the equipment and drugs correctly, potential hazards associated with these will be induced and may lead to safety incidents.

2.2. The publicity effect of the laboratory safety system is not satisfactory and implementation is not in place.

At present, the system of laboratory safety management in Colleges and universities is relatively sound, and the propaganda usually takes the form of superior to subordinate, teacher to student, and functional department to college. Such propaganda effect is not ideal. In the actual implementation process, due to the lack of supervision of full-time laboratory management personnel, the tutor responsibility system is adopted in all laboratories. Even if the safety accident agreement is signed, the work core of the tutors is in scientific research application and academic exchange, neglecting the supervision and guidance of standardized operation of students. It is always perfunctory even if safety problems are found in the inspection process; and In addition, due to the lack of professional laboratory security administrators, it is impossible to carry out refined supervision,, so it is difficult to find out the direct responsible person, and it is easy to create a vacuum zone of safety management, which pushes each other during the investigation and management of safety hazards in the laboratory. Then a confused account is formed usually. As a result, the system is returned to the system, and the actions are returned to action. Many systems are reduced to nothing and cannot be implemented [8]. In the long run, all the safety hazards that could have been solved in the burgeoning state have resulted in safety accidents, due to inadequate implementation of safety rectification.

2.3. Lack of real-time supervision of the whole process and all aspects of the laboratory.

At present, there is a widespread lack or serious shortage of full-time laboratory safety managers in Colleges and universities. Even if there are security administrators in charge of the laboratory, they are often in the mode of on-duty supervision and off-duty unattended management. And the on-duty supervision is also very limited because they are busy with other things, which result in a certain blind area of security supervision. It is difficult to ensure the management of the whole process in the laboratory, which has become a thorny problem in front of the laboratory managers. According to the survey, only 18.75% of the 32 agricultural and forestry universities have a team of supervisors formed by graduate students, most of which have not been set up. And they have failed to play the supervisory role of the graduate students who have invested the most time in the laboratory [9].

3. Advantages of graduate students' participation in laboratory safety management

As the main researcher in the laboratory, graduate students have the dual roles of “management object” and “manager” in the safety management, which determines that graduate students have their own unique advantages and can play a crucial role in the safety management of laboratories.

3.1. Graduate students can find hidden dangers in the laboratory in time and prevent the occurrence of safety accidents.

The key to the safety of the laboratory is prevention, and the key to prevention lies in the discovery and investigation of potential safety hazards. As the main researcher of the laboratory, graduate students spend most of their time (including winter, summer vacations, holidays, etc.) in the laboratory. They often deal with instruments, equipment and pharmaceutical reagents, and often capture safety hazards in the first time, which make the passive investigation of the potential safety hazards become the active discovery, report the rectification in time, and nip the potential safety hazards in the bud. They can effectively curb the occurrence of laboratory safety accidents [10].

3.2. It can truly realize the whole process management of laboratory safety and overcome the blind spot of supervision when the laboratory safety staff is not in the laboratory.

Graduate students are the main force of scientific research, and they are the team that has invested the longest time in the laboratory. To some extent, the graduate safety officer can extend the safety supervision time and fill in the blind area of supervision during the period when the teacher is not in the laboratory. They can supervise and urge the standard operation of other members in the laboratory, eliminate the loopholes in safety management and prevent the occurrence of safety accidents, which can truly realize the whole process and real-time supervision of the experiment [11].

3.3. Graduate students can act as promoters of the laboratory safety system, which is conducive to the implementation of the system.

As the main body of the laboratory, graduate students have the attributes of self-education, self-management and self-service. Usually, they can organize more extracurricular activities, which can highlight the boring system in the activities to achieve the purpose of publicity; In addition, the study, life and experiment between graduate students are basically together, they publicize the safety system through oral communication, and based on their self-realization attributes and easy-to-communicate characteristics, students are more easily accepted relevant institutional content. Finally, the promotion of the safety system can achieve twice the result with half the effort and lay a good foundation for the implementation of the laboratory safety system [12].

3.4. It is conducive to the formation and inheritance of laboratory safety culture which can build a good laboratory safety atmosphere finally.

Culture is a kind of accumulation, and it needs a kind of inheritance. As the main body of the laboratory, graduate students are crucial to the formation and inheritance of the safety culture of the laboratory. The safety awareness, safety habits and safety skills of the senior brothers and sisters can have an effective demonstration and incentive effect on Junior brothers and sisters, and which can form the "mentoring" effect [13]. Over time, these safety awareness, habits and skills will solidify a safety culture, and a benign laboratory safety working mechanism will also be applied, which will make a great contribution to laboratory safety.

3.5. It is an important way to comprehensive ability training for graduate students playing as a laboratory safety aid.

The cultivation of Postgraduates' ability and quality is not only reflected in the study of professional courses or knowledge, the completion of experimental tasks and the mastery of scientific research methods, but also depends on the cultivation of their ideological quality and ability, including the training of management and organization ability, the cultivation of public service consciousness and healthy thinking morality, the formation of good communication and communication ability and team cooperation consciousness. The cultivation of the ability and quality of graduate students are not only reflected in the study of their professional courses or knowledge, the completion of experimental tasks and the mastery of scientific research methods, but also the development of their ideological qualities and abilities, including the training of management and organization ability, the cultivation of public service consciousness and healthy thinking morality, the formation of good communication and team cooperation consciousness. During the period of students' study, assistant of safety management is a very good opportunity to exercise and study [14]. By helping and guiding

new researchers, stopping illegal operations, handling emergency accidents and organizing training, they will improve their organizational management capabilities and public service awareness, So that the laboratory can be truly become a platform for them to train themselves and grow up.

4. How to realize graduate students' participation in laboratory safety management system

4.1. Establishing a team of graduate supervisors for laboratory safety management.

First of all, select graduate students as safety support personnel who are diligent, responsible, dedication, communication skills, and have a good sense of safety responsibility, and generally who with 1-2 years of laboratory experience. Due to the relatively strong mobility of graduate students, according to the actual management of the laboratory, it is necessary to find and encourage outstanding graduate students to join the assistant management team in time to ensure the stability of the support team. Define the supervision contents and assessment methods of graduate students in laboratory safety and organize the training of Postgraduates supervisors by the competent department every year to improve their supervision ability and level. From time to time, the symposiums and summary meetings of graduate safety officers are held, which can understand the difficulties and problems encountered in their work in time. Do a good job in supporting the management of students, and ensure the effective implementation of the management assistance.

4.2. Establish an incentive mechanism for safety supervision and fully mobilize the enthusiasm of graduate management.

The participation of graduate students in the safety management of laboratories undoubtedly increases their academic burden. It is necessary to realize the task of assisting the safety management of laboratory under the premise of ensuring the successful completion of the postgraduate main business and the healthy development of ideas, which in order to achieve the goal of win-win [15]. In order to make full play of the management role of graduate students, an incentive mechanism for safety supervision should be established, which combine material incentives and spiritual incentives , give a certain subsidies to graduate students involved in laboratory safety management and add points to the excellent postgraduates in the process of evaluation. The incentive mechanism can fully mobilize their subjective initiative and work enthusiasm to ensure the safe operation of the laboratory.

5. Summary

In short, the safety of laboratory in scientific research institutes of colleges and universities is the top priority of safety management. In view of the unique advantages and important role of graduate students in laboratory safety management, this paper proposes the concept of graduate students participating in laboratory safety management, and fully mobilizes the enthusiasm of graduate students participating in laboratory safety management by formulating supervision contents, assessment methods and incentive mechanism in laboratory safety, truly realizes the whole process management of laboratory safety, and finally forms a good laboratory safety culture atmosphere.

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Reference

- [1] Gu, H., Cao, Q., Sun, Z.J.(2016) Construction and practice of laboratory safety education system. *Laboratory research and exploration*, 35 (4): 281-292.

- [2] Li, Z.Y., Liu, G.G., Chi, Y.G. (2010) Analysis and Countermeasures on safety management of scientific research type open laboratory in Colleges and universities. *Journal of Luoyang Institute of Technology: Natural Science Edition*, 20 (4): 94-96.
- [3] Jia, X.L.(2011) Analysis and Countermeasures of laboratory safety in Colleges and universities . *Laboratory research and exploration*, 30 (12): 193-195.
- [4] Ma, Y.J.(2016) Humanized laboratory management with graduate students as the main body . *Laboratory research Research and exploration*, 35 (10): 253-256.
- [5] Feng, Y.Q., Shen, Y.Y., Qin,L.(2010) Investigation and analysis of graduate students' laboratory safety awareness. *Anhui agronomy bulletin*, 16 (7): 198-200.
- [6] Gu, C.D., Fang, D., Wang, Y.P., et al. (2010) Discussion on laboratory safety management in Colleges and universities. *Laboratory research and exploration*, 29 (10): 178-180.
- [7] Gu, S.B., He, M.R., Fan, G.H. (2013) Several important links in safety management of scientific research laboratories in Colleges and universities. *Laboratory science*, 16 (3): 193-195.
- [8] Zhao, N. (2016) Analysis of current situation of safety management in scientific research laboratories of colleges and universities and countermeasures. *Experimental technology and management*, 33 (8): 242-244.
- [9] Ye, B.L., Wang, J.Q., Li, W.Y., et al. (2011) Construction and practice of laboratory safety management system in Colleges and universities. *Laboratory research and exploration*, 30 (8): 419-422.
- [10] Han, Y.D. (2016) Exploration on safety management of graduate students' using laboratory. *Laboratory research Research and exploration*, 35 (4): 293-296.
- [11] Li X.F. (2018) Building a team of laboratory safety officers based on Hain's law. *Experimental technology and management*, 35 (11): 254-256 + 271.
- [12] Fan, G.H., Cheng, L., Ning, T.Y., Song, X.L. (2018) Strengthening graduate management to ensure the safe operation of scientific research laboratory. *China modern education equipment*, (07): 9-11.
- [13] Wu, Z.Y., Tan, G.F., Xie, H.J., Yao, L.Y. (2018) Reflections on graduate students' participation in the safety management of scientific research laboratories in Colleges and universities. *Laboratory research and exploration*, 37 (05): 299-301 + 306.
- [14] Li, C.Y., Wu, Y., Gan, Y.H., Li, T.J. (2018) Graduate assistant management is a good way for laboratory management and graduate quality training. *Beijing Stomatology*, 26 (03): 166-167.
- [15] Song, Z.J., Fang, J. (2015) Mode and practice of students' participation in laboratory safety management. *Laboratory research and exploration*, 32 (5): 253-256.