



Research on Safety Management of Explosive Hazardous Chemicals in Laboratories from the Perspective of Laws and Regulations

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Abstract. With the rapid development of laboratory business, explosive hazardous chemicals are indispensable raw and auxiliary materials for laboratories. According to the development of international and domestic situations, the country has classified explosive hazardous chemicals as national controlled hazardous chemicals to prevent terrorists or individuals from using explosive hazardous chemicals for crime. Additionally, due to the inherent flammability and explosiveness, Improper operation or management can cause casualties and property damage, endanger social and public safety, and lead to laboratory safety accidents. This article takes the perspective of the user unit and compares the characteristics and management of explosive hazardous chemicals with ordinary hazardous chemicals by sorting out national regulations and standards. It clarifies the management requirements for the filing, procurement, storage, use, and public security prevention of explosive hazardous chemicals. Based on our own experience in the management of explosive hazardous chemicals, suggestions are proposed to strengthen the safety management of explosive hazardous chemicals.

Keywords: explosive hazardous chemicals; laws and regulations; safety management of laboratory

1 Introduction

Explosive hazardous chemicals can be used as raw materials or auxiliary materials to make explosives, including some strong oxidizing agents, strong reducing agents, and flammable substances, which themselves have flammability and explosiveness. In laboratory activities, it is inevitable to use of explosive hazardous chemicals. There are significant potential safety hazards in the procurement, storage, use, and other processes. Poor management in one aspect can lead to safety accidents such as fires and explosions. Furthermore, explosive hazardous chemicals are easily used by criminals to make explosives, posing a threat to social and public safety^[1]. In this situation, higher requirements have been put forward for explosive hazardous chemicals business units. Therefore, laboratories must strictly manage explosive hazardous chemicals, strictly control them from all aspects, implement measures that can effectively prevent public

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security risks and flammable and explosive the safety accidents of explosive hazardous chemicals, effectively ensure social security and stability.

2 Overview of laws and regulations

The safety supervision of explosive hazardous chemicals involves multiple links and departments. Emergency Management Department, the Ministry of Public Security, the Ministry of Transport and other departments strictly manage explosive hazardous chemicals within their scope of responsibility. Although China has not yet established a specific law for explosive hazardous chemicals, multiple existing regulations and standards have requirements for the safety management of explosive hazardous chemicals, the author has summarized the regulations and standards that should be followed when using explosive hazardous chemicals in laboratory.

On December 1, 2011, the State Council issued and implemented the "Regulations on the Safety Management of Hazardous Chemicals" (State Council Order No. 591) [2], which clearly stipulated the special management and control of explosive hazardous chemicals.

On May 11, 2017, in accordance with Article 23 of the "Regulations on the Safety Management of Hazardous Chemicals" (State Council Order No. 591), the Ministry of Public Security issued the "List of Explosive Hazardous Chemicals" (2017 Edition) [3]. There are 74 kinds of explosive hazardous chemicals in 9 categories in the list, including 3 acids, 11 nitrates, 3 chlorates, 4 perchlorates, 4 dichromates, 15 peroxides and superoxide, 16 flammable reducing agents, 11 nitro compounds and 7 others.

In 2018, the Ministry of Public Security issued and implemented the "Security and Prevention Requirements for Storage Places of Explosive Hazardous Chemicals" (GA1511-2018) [4], which stipulated the classification, protective areas and parts, manpower prevention requirements, physical prevention requirements, technical prevention requirements, and inspection, acceptance, operation and maintenance requirements of safety prevention systems for storage places of explosive hazardous chemicals.

In 2019, the Ministry of Public Security issued and implemented the "Measures for the Security Management of Explosive Hazardous Chemicals" (Order No. 154 of the Ministry of Public Security) [5], further clarifying the strengthening of security management of explosive hazardous chemicals and effectively preventing security risks of explosive hazardous chemicals.

In addition to the above regulations and rules, National and local standards have further clarified the requirements for the construction and storage of explosive hazardous chemical warehouses, such as GB15603-1995 "General Rules for the Storage of Commonly Used Chemical Dangerous Goods", GB 17914-1999 "Technical Conditions for the Storage and Maintenance of Flammable and Explosive Goods"[6], DB11/T 1322.2-2017 "Technical Specifications for Safety Production Registration and Evaluation Part 2: General Requirements for Safety Production", DB11/T 1191.2-2018 "Safety Management Regulations for Hazardous Chemicals in Laboratories Part 2:

Ordinary Higher Education Institutions", which is an important basis for us to do a good job in daily safety management of explosive hazardous chemicals.

3 Comparative Study on Safety Management of Explosive Hazardous Chemicals and Ordinary Hazardous Chemicals

According to the "Regulations on the Safety Management of Hazardous Chemicals", hazardous chemicals refer to highly toxic chemicals and other chemicals with properties such as toxicity, corrosion, explosion, combustion, and combustion-supporting, which are harmful to human health, facilities, and the environment. Currently, there are 2828 hazardous chemicals specified in the "Catalogue of Hazardous Chemicals", among them, 74 belong to explosive hazardous chemicals.

Explosive hazardous chemicals refer to hazardous chemicals that can be used to manufacture explosives. Due to the higher risk and harm of explosive hazardous chemicals compared to ordinary hazardous chemicals, the country implements stricter control over explosive hazardous chemicals. Through the review of regulations and standards, it can be found that the various links and management requirements for explosive hazardous chemicals are far higher than those of ordinary hazardous chemicals. This section compares the management requirements for ordinary hazardous chemicals and explosive hazardous chemicals, as shown in Table 1.

Table 1. Comparison of Safety Management Requirements for Ordinary Hazardous Chemicals and Explosive Hazardous Chemicals in the Laboratory

Serial Number	Items	Ordinary Hazardous Chemicals	Explosive Hazardous Chemicals
1	Filing requirements	No need for filing	Filing by the Ministry of Public Security
2	Flowmanagement information system	not have	have
3	Purchase	Direct procurement	Relevantqualification certification materials need to be submitted
4	Storage	Storage requirements for its own characteristics	In addition to the storage requirements for its own characteristics, there are also requirements for human prevention, physical prevention, technical prevention, and security prevention systems for theft prevention and robbery
5	Safekeeping	Dedicated person responsible for distribution	The custodian should be composed of two personnel,

			implementing dual locking, dual receiving and sending, dual storage, and dedicated management
6	Emergency plan	Emergency Plan for Hazardous Chemicals	Emergency plans for hazardous chemicals, including anti-theft, robbery prevention, damage prevention, and technical prevention system failures
7	Abandonment	Dispose of according to hazardous waste management requirements	Dispose of according to hazardous waste management requirements

4 Management requirements for explosive hazardous chemicals

This section will provide a detailed explanation of the requirements for the filing, procurement, storage, use, and security precautions of explosive hazardous chemicals according to their usage stages.

4.1 Filing

Before using explosive hazardous chemicals, explosive hazardous chemicals business units should be necessary to first file a record. Generally, an application is made to the public security organ of the location (county-level) where the explosive hazardous chemicals business units belongs. The filing process is that the explosive hazardous chemicals business units first needs to submit the filing materials to the public security organ of the location (county-level) where the explosive hazardous chemicals business units belongs, and then, the corresponding information are submitted to the management information system for the flow of explosive hazardous chemicals. After being approved by the public security organ, explosive hazardous chemicals business units can purchase and use them. The filing materials include the basic information of the explosive hazardous chemicals business units, legal representative certificate, commitment letter, filing application, description of the types, quantities, and uses of explosive hazardous chemicals used, institutional and personnel settings, emergency plan, storage site safety assessment report, etc. In order to successfully complete the filing work, the laboratory should investigate the demand for the use of explosive hazardous chemicals in the laboratory before submitting the filing materials, and determine the relevant information such as the types and quantities of explosive hazardous chemicals used. Another important purpose of filing is to ensure that the management system, personnel, and storage facilities of explosive hazardous chemicals in the workplace comply with relevant regulatory requirements, ensuring the safety of the use of explosive hazardous chemicals.

4.2 Purchase

According to the "Measures for Public Security Management of Explosive Hazardous Chemicals", the explosive hazardous chemicals business units shall establish an information system for explosive hazardous chemicals and achieve interconnection with the information system of public security organs. Public security organs and the explosive hazardous chemicals business units shall implement electronic tracking identification management of explosive hazardous chemicals, monitor and record the flow and direction of explosive hazardous chemicals. For purchasing explosive hazardous chemicals, the following materials should be provided to the sales unit: (1) copies of legal certificates such as the unit's "Industrial and Commercial Business License" and "Public Institution Legal Person Certificate", as well as copies of the identity certificate of the handling person; (2) The legal use description of explosive hazardous chemicals should include specific uses, varieties, quantities, etc. Individuals are not allowed to purchase explosive hazardous chemicals.

Sales and purchasing units of explosive hazardous chemicals shall, within five days after the sale or purchase, report the variety, quantity, and flow information of the explosive hazardous chemicals sold or purchased to the local county-level public security organ for record through the explosive hazardous chemical information system. The explosive hazardous chemicals business units shall truthfully register information on the sale, purchase, entry and exit, receipt, use, return, and disposal of explosive hazardous chemicals, and enter it into the explosive hazardous chemical information system.

4.3 Storage

Due to the flammable and explosive nature of explosive hazardous chemicals, it is crucial to strengthen standardized management in the storage process to ensure the safe use of explosive hazardous chemicals. The "Measures for Public Security Management of Explosive Hazardous Chemicals" stipulate that units using explosive hazardous chemicals such as teaching, scientific research, medical treatment, testing, etc. can use storage rooms or cabinets to store explosive hazardous chemicals. The storage capacity of a single storage room or cabinet should be less than 50 kilograms. The "Security and Prevention Requirements for Storage Places of Explosive Hazardous Chemicals (GA1511-2018)" classifies storage places of explosive hazardous chemicals according to their enclosed form and chemical weight. Among them, storage rooms or cabinets used by teaching, scientific research, medical, testing, and other units with a total amount of explosive and hazardous chemicals not exceeding 50kg are defined as low-dose storage places, and detailed regulations have been put forward for their human resources prevention requirements, physical prevention requirements, and technical prevention requirements to prevent the loss, theft, and robbery of explosive hazardous chemicals.

GB15603-1995 "General Rules for the Storage of Commonly Used Chemical Dangerous Goods", GB 17914-1999 "Technical Conditions for the Storage and Maintenance of Flammable and Explosive Goods", DB11/T 1322.2-2017 "Technical

Specifications for Safety Production Registration and Evaluation Part 2: General Requirements for Safety Production", DB11/T 1191.2-2018 "Safety Management Regulations for Hazardous Chemicals in Laboratories Part 2: Ordinary Higher Education Institutions" also provide more detailed requirements for the storage of explosive hazardous chemicals. This article summarizes the requirements in the above regulations and standards, as detailed in Table 2.

Table 2. Storage Requirements for Explosive Hazardous Chemicals

Standards	Main Content
<p>"The General Rules for the Storage of Commonly Used Hazardous Chemicals" (GB 15603-1995)</p>	<p>4.8 Divide, classify, and store hazardous materials according to their performance.</p> <p>All types of hazardous materials shall not be mixed with prohibited materials for storage. The configuration of prohibited materials is shown in Appendix A (reference).</p> <p>6.3 Hazardous chemicals that can cause combustion, explosion, or chemical reactions when exposed to fire, heat, or moisture, and produce toxic gases, shall not be stored outdoors or in damp or waterlogged buildings.</p> <p>6.4 Chemical hazardous materials that can undergo chemical reactions and cause combustion, explosion, decomposition, combination, or the production of toxic gases under sunlight exposure should be stored in first class buildings. The packaging should be protected from light.</p> <p>6.5 Explosive materials are not allowed to be stored together with other types of materials, and must be isolated and stored in limited quantities separately. Warehouses are not allowed to be built in towns, and a certain safe distance should be maintained from surrounding buildings, transportation arteries, and power transmission lines.</p> <p>6.6 Compressed gas and liquefied gas must be stored separately from explosive materials, oxidants, flammable materials, spontaneous combustion materials, and corrosive materials. Flammable gases shall not be stored together with combustion supporting gases or highly toxic gases; Oxygen must not be mixed with oil for storage. Containers containing liquefied gases are pressure vessels and must have pressure gauges, safety valves, emergency shut-off devices, and regular inspections to prevent overloading.</p>
<p>"Technical Conditions for Storage and Maintenance of Flammable and Explosive Goods" (GB</p>	<p>4.2 Warehouse</p> <p>4.2.1 It should be dry, easy to ventilate, enclosed, and protected from light, and lightning protection devices should be installed; Places in the warehouse that may emit (or leak) combustible gases or vapors should be equipped with combustible gas detection and alarm devices.</p> <p>4.2.2 Various types of goods should be strictly zoned, clas-</p>

17914-2013)	<p>sified, and stored in separate warehouses based on their nature and fire extinguishing methods.</p> <p>4.2.2.1 Explosive goods should be stored in the warehouse of a first-class light top fire-resistant building.</p> <p>4.2.2.2 Low and medium flash point liquids, Class I flammable solids, self igniting substances, compressed gases, and liquefied gases should be stored in the warehouse of Class I fire-resistant buildings.</p> <p>4.2.2.3 Flammable goods, oxidants, and organic peroxides that come into contact with moisture should be stored in warehouses of primary and secondary fire-resistant buildings.</p> <p>4.2.2.4 Class II flammable solids and high flash point liquids should be stored in warehouses with a fire resistance rating not lower than Class II.</p> <p>4.3 Safety requirements</p> <p>4.3.1 Goods should be kept away from direct sunlight, ignition sources, heat sources, power sources, and environments that generate sparks.</p> <p>4.3.2 In addition to classified storage according to Appendix A, the following varieties should be stored in a dedicated warehouse:</p> <ul style="list-style-type: none"> a) Explosives: Black gunpowder and explosive compounds should be stored in specialized warehouses; b) Compressed gases and liquefied gases: Flammable gases, combustion supporting gases, and toxic gases should be stored in dedicated warehouses; c) Flammable liquids can be stored in the same warehouse; However, goods with different fire extinguishing methods should be stored in separate warehouses; d) Flammable solids can be stored in the same warehouse; However, emulsifier H and acidic or acidic products should be stored separately in separate warehouses; e) Nitrocellulose esters, safety matches, red phosphorus, sulfurized phosphorus, aluminum powder and other metal powders should be stored in separate warehouses; f) Spontaneous combustion commodities: yellow phosphorus, hydrocarbon based metal compounds, and products soaked in animal and vegetable oil should be stored in separate warehouses; g) Flammable goods that come into contact with moisture should be stored in a dedicated warehouse; h) Oxidants and organic peroxides, primary and secondary inorganic oxidants, and primary and secondary organic oxidants should be stored in separate warehouses; Chlorate, permanganate, nitrite, sodium peroxide, hydrogen peroxide, etc. should be
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<p>"Technical Specifications for Safety Production Registration and Evaluation Part 2: General Requirements for Safety Production" (DB11/T 1322.2-2017)</p>	<p>stored separately in dedicated warehouses.</p> <p>3.8.1.7 Special warehouses should be set up in the following situations:</p> <ul style="list-style-type: none"> a) The total storage capacity of flammable liquid hazardous chemicals is more than 0.5t; b) The total storage amount of hazardous chemicals such as oxidizing substances and organic peroxides is more than 0.5t; c) Total flammable gas storage capacity 36Nm^3 (For example, when the working pressure is 15MPa, it is equivalent to 6 bottles of 40L) or above; d) The total storage amount of corrosive hazardous chemicals is over 1 ton; e) Toxic gases; f) Total storage capacity of non flammable and non-toxic gases 60Nm^3 (For example, when the working pressure is 15MPa, it is equivalent to 10 bottles of 40L) or above. <p>3.8.1.8 Special storage rooms should be set up in the following situations:</p> <ul style="list-style-type: none"> a) The total storage capacity of flammable liquid hazardous chemicals is less than 0.5t or does not exceed the usage capacity of one day and night; b) The total storage amount of hazardous chemicals such as oxidizing substances and organic peroxides is less than 0.5t or does not exceed the usage amount for one day and night; c) The total storage amount of corrosive hazardous chemicals is less than 1 ton or does not exceed the usage amount for one day and night.
<p>"Safety management standards for hazardous chemicals in laboratories Part 2: Ordinary higher education institutions"(DB11/T 1191.2-2018)</p>	<p>9.2 Hazardous chemicals should be stored in specialized warehouses, storage rooms, gas cylinder rooms, or cabinets, and should not be stored outdoors.</p> <p>9.3 Chemicals that are mutually prohibited should not be stored in a mixed manner. The commonly used list of prohibited substances for hazardous chemical storage can be found in Appendix A. Hazardous chemicals with different fire extinguishing methods should be isolated and stored.</p> <p>9.4 The storage of hazardous chemicals in the laboratory should meet the following requirements:</p> <ul style="list-style-type: none"> b) Flammable and explosive chemicals that need to be stored at low temperatures should be stored in a refrigerator with explosion-proof function; e) Corresponding management requirements should be established for explosives, explosive hazardous chemicals, and precursor chemicals; <p>9.5 The storage limit requirements for hazardous chemicals in the laboratory are as follows:</p>

	a) The total amount of hazardous chemicals stored in each laboratory, except for compressed and liquefied gases, should not exceed 100L (kg). The total amount of flammable and explosive chemicals stored should not exceed 50L (kg), and a single packaging container should not exceed 25L (kg)
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The storage of explosive hazardous chemicals should also comply with the storage instructions in the Chemical Safety Data Sheet (SDS) and the common storage taboos with other chemicals, that is to divide, classify, and store hazardous materials according to their performance. Explosive hazardous chemicals with conflicting chemical properties or different protection and fire extinguishing methods are stored in the same warehouse, explosive hazardous chemicals are prone to react with each other or cause fire or explosion accidents due to incorrect fire extinguishing methods, posing hazards to the laboratory.

4.4 Use

"Measures for Public Security Management of Explosive Hazardous Chemicals" clearly stipulate that units using explosive hazardous chemicals shall not lend or transfer their purchased explosive hazardous chemicals, if it is necessary to transfer due to changes in production, suspension of production, relocation, closure, etc., the transfer shall be made to a unit with relevant permits or supporting documents. Both parties shall report the relevant situation to the local county-level public security organs within five days after the transfer. Therefore, in the daily use of laboratories, it is prohibited to privately borrow and obtain explosive hazardous chemicals from units or universities with cooperative relationships. This behavior not only violates the regulations, but also easily leads to unclear flow of explosive hazardous chemicals, bringing difficulties and hidden dangers to laboratory safety management.

Personnel using hazardous chemicals must undergo training and understand necessary usage, protection, and emergency knowledge before taking up their positions. When using hazardous chemicals, relevant regulations such as SDS should be strictly followed, protection measures should be taken, special equipment should be used to prevent leakage, scattering, and diffusion, and excessive use and illegal operations should be prohibited. When hazardous chemicals need to be transferred or repackaged to other containers, the container must be inspected before use and labeled. When preparing the solution, it is necessary to strictly follow the corresponding regulations, wear a mask and acid and alkali resistant gloves to prevent evaporation and splashing, and should be carried out in a fume hood. The explosive hazardous chemicals that are discarded after use should be carefully classified and collected, and transferred and disposed according to hazardous waste disposal requirements. If explosive hazardous chemicals are lost, stolen, or robbed, it should be reported to the public security organs immediately.

4.5 Public security prevention

The storage units should establish a security system, establish a security organization, and equip full-time security personnel to be responsible for the security work of explosive hazardous chemicals. The security duty room should post alarm contact numbers in obvious areas. A system for inspecting and registering the entry and exit of explosive hazardous chemicals should be established, and the storage area keeper should be composed of two personnel, a system of dual locking, dual receiving and sending, dual storage, and dedicated management should be implemented, regularly verify the storage status of explosive hazardous chemicals, and take appropriate maintenance measures after storage. If any quality changes, packaging damage, leakage, or shortage of stabilizers are found, they should be dealt with in a timely manner. Security personnel and custodians should be trained before taking up their positions, and have records of participating in training and passing assessments. Employers should regularly provide training and education on security personnel and custodians, focusing on theft prevention and loss prevention. At least one safety meeting should be held every month with records kept. The laboratory should establish emergency response plans for the theft prevention, robbery prevention, destruction prevention, and technical prevention system failure of explosive hazardous chemicals, and conduct targeted emergency drills once a year. The storage area should conduct regular testing and maintenance of the safety protection system, and keep records of testing and maintenance to ensure the effective operation of the safety protection system. If the safety protection system malfunctions, an emergency plan should be initiated during the maintenance period. If the function cannot be restored after 24 hours, it should be reported to the local public security organ. The security prevention system should be tested every three years by a qualified unit, with a testing report issued and reported to the local public security organs^[7]. The explosive hazardous chemicals business unit should strengthen the inspection, assessment, rewards and punishments of public security prevention work, promptly identify and rectify public security hazards, and keep inspection and rectification records.

5 Strengthen the safety management of explosive hazardous chemicals

Explosive hazardous chemicals are dangerous, involve many management links, and are widely used, they are important hazard in laboratories. According to literature statistics, the number of laboratory accidents caused by human factors accounts for 58% of the total number, and the number of casualties accounts for 87.6% of the total number of accidents. The main reason include violations of operating procedures, careless or improper use, improper operation, non-standard storage of reagents, and improper disposal of waste materials^[8]. Therefore, avoiding unsafe human behavior plays an important role in improving the safety management level of explosive hazardous chemicals. As a responsible explosive hazardous chemicals business unit, strict requirements should be imposed, safety management systems should be fully imple-

mented, lessons should be learned from accidents that have occurred, safety hazards should be comprehensively identified, and the entire process safety of explosive hazardous chemicals should be ensured^[9-10]. It is suggested to further carry out work from the following aspects:

5.1 Establish a safety management responsibility system and clarify personnel responsibilities

The laboratory shall establish a strict management system for explosive hazardous chemicals, define the whole process management links, and assign the responsibilities of each link to individuals. Establish a procurement system for explosive hazardous chemicals, strictly approve procurement plans, and ensure that purchases are made within the scope of filing. During the acceptance process, the quantity and labels of purchased hazardous chemicals are carefully checked to ensure safe reception. Establish a registration system for entry and exit, and the custodian should truthfully register the flow information of explosive hazardous chemicals, ensuring clear accounts, account goods match case, and clear and verifiable records of the flow in and out of storage locations. Establish a warehouse safety inspection system, where the warehouse keeper should check the storage status of explosive hazardous chemicals on a daily basis, conduct regular inventory checks, promptly rectify problems found, and promptly search when discrepancies between accounts and goods. If the whereabouts cannot be found, it should immediately report to the industry regulatory department and the local public security organs. Establish a security duty system, and security personnel on duty should strengthen inspections of storage areas, promptly respond to suspicious situations, and prevent unsafe incidents from occurring.

5.2 Strengthen professional knowledge training and enhance personnel capabilities

Equip personnel with strong professional knowledge and rich work experience as safety management personnel, strictly manage every link from purchase, transportation, storage to use, conduct qualification review, hold a certificate to work, regularly and irregularly conduct special education, training and assessment, and improve the safety awareness and skills of full-time personnel. Familiarize and understand personnel with the properties, protective measures, and emergency response measures of explosive hazardous chemicals they come into contact with, strictly follow various operating procedures, and do not take education and training as mere formality to truly learn and understand. You can also develop a list of explosive hazardous chemicals and emergency plans for theft prevention, robbery prevention, destruction prevention, and technical prevention system failures into a book and send them to each relevant personnel for self-study, so that laboratory personnel know how to handle accidents correctly and reasonably. Targeted emergency drills are conducted once a year to effectively improve the emergency response ability of laboratory personnel.

5.3 Intensify safety inspections and eliminate non-standard behavior

Carry out special inspections on explosive hazardous chemicals to ensure that the equipment and facilities in the relevant use and storage laboratories are in good condition, and the technical prevention system is effective. For discovered safety hazards, the laboratory is required to rectify them in a timely manner, strictly implement rectification measures and time limits, and prevent safety accidents. For illegal and irregular behaviors discovered, comprehensive measures such as economic penalties and production suspension and rectification should be applied to strictly punish them, promote the laboratory to firmly establish a safety concept, comprehensively improve safety management capabilities, and effectively improve the level of safety production.

5.4 Improve the level of informatization and track the flow of explosive and hazardous chemicals throughout the entire process

Apply Internet of Things technology to establish a management platform for explosive hazardous chemicals in the laboratory, input information such as the name, quantity, purpose, and flow direction of explosive hazardous chemicals into the management system, and effectively count and clarify the situation and flow direction. Through the synchronous implementation of online and on-site inspections, violations of operations and non-standard management behaviors are discovered, and rectified in a timely manner, safety hazards are eliminated, and precise management and control of explosive hazardous chemicals are achieved to avoid accidents.

6 Conclusion

Through combing the national laws and regulations, this paper systematically discusses the security prevention requirements and use requirements of explosive hazardous chemicals in laboratories, in the daily management of the laboratory, various laws, regulations, standards and safety management systems should be implemented in place to effectively regulate the purchase, storage and use of explosive hazardous chemicals in the laboratory, build a safety training system for explosive hazardous chemicals, attach importance to risk identification and control, and ensure the safety of the whole process management of explosive hazardous chemicals.

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Reference

1. Hui Peng. Discussion on Strengthening the Safety Supervision of Explosive Chemicals[C]. Nanjing, Jiangsu, China: Engineering Branch of the China Railway Society,2018:305-308.
2. State Council of the People's Republic of China. Regulations on the Safety Management of Hazardous Chemicals [EB/OL]. (2011-03-02) [2022-03-21]. http://www.gov.cn/flfg/2011-03/11/content_1822902.htm.
3. Ministry of Public Security of the People's Republic of China. List of Explosive Hazardous Chemicals [EB/OL]. (2017-05-11) [2022-03-20]. http://www.gov.cn/xinwen/2017-06/01/content_5198726.htm.
4. Ministry of Public Security of the People's Republic of China. Security and Prevention Requirements for Storage Places of Explosive Hazardous Chemicals[S]. Beijing: China Quality Inspection Press, 2018.
5. Ministry of Public Security of the People's Republic of China. Measures for Public Security Management of Explosive Hazardous Chemicals [EB/OL]. (2019-07-06) [2022-03-27]. http://www.gov.cn/zhengce/zhengceku/2019-07/06/content_5454271.htm.
6. General Administration of Quality Supervision. Technical Conditions for the Storage and Maintenance of Flammable and Explosive Goods: GB 17914-2013 [S].2013
7. Beijing Municipal Bureau of Quality and Technical Supervision. DB11/T 1427-2017, Safety precautions for storage sites of explosive hazardous chemicals[S]. Beijing, 2017
8. Zhihong Li. Statistical Analysis and Countermeasure Research on 100 Laboratory Safety Accidents [J]. experimental technology and management, 2014, 31(4):210-213.
9. Lili Jiang. Reflections on the Control and Emergency Response of Explosive Hazardous Chemical Accidents [J]. China Chemical Trade, 2017 (1): 22.
10. Jian Zhou, Hongxue Yuan. Analysis on Safety Management of Explosive Hazardous Chemicals Stored in Laboratories [J]. Laboratory Research and Exploration, 2020, 39(8): 313-316.

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