Safety Regulations for Equipment and Chemicals

The objective of this Safety Regulations for Equipment and Chemicals is to provide clear and precise guidance to laboratory personnel on how to properly utilize equipment and store chemicals. This set of regulations has been formulated with meticulous reference to International Laboratory Safety Regulations, Chemical Safety Data Sheets (MSDS), and WHO Laboratory Biosafety Manual. By drawing upon these reliable and well-established sources of information and standards, the aim is to establish a robust and effective safety framework within the laboratory environment, ensuring the highest levels of protection for both the staff and the surrounding environment.

Regulated Utilization of Equipment

1. General Safety Instructions for Equipment Usage

(1) Pre-Use Preparation:

Prior to operation, carefully review the relevant instruction manuals to understand the operational conditions and precautions of the instruments.

Only after completing training and passing the evaluation may personnel obtain permission from management to operate the instruments for experimental purposes.

(2) Instrument Placement and Ventilation:

Instruments should be placed in well-ventilated areas, ensuring that ventilation openings are not obstructed by other objects to prevent overheating.

Instruments should not be stacked to avoid surface damage and should not be placed on the edges of tables or carts to prevent accidental falls.

(3) Initial Use and Connection:

During the first use of an instrument, connections should be verified by experienced personnel to prevent damage due to incorrect setup.

Instrument cables must not be damaged and should avoid overlapping with each other or with the objects being measured to prevent short circuits. Cables should, whenever possible, avoid crossing laboratory walkways.

(4) Operational Precautions:

Parameter adjustments during instrument operation must strictly adhere to the manufacturer’s guidelines.

In the event of an alarm or anomaly during operation, immediately disconnect the power supply and report to management.

Avoid spilling water or other liquids on the instrument during operation.

(5) Maintenance and Disassembly:

Instruments and equipment must not be disassembled or modified without prior approval from authorized personnel.

After completing experiments or when leaving the laboratory, ensure that the instrument’s power is turned off to prevent damage. If the instrument must operate unattended, explicit consent from management is required.

2. Heating Instruments and Equipment

(1) Operational Procedures and Protective Measures:

Operational procedures and precautions must be prominently displayed near the equipment.
Protective measures must be employed during use, and operators must strictly adhere to regulations without leaving their posts.
(2) Power Supply and Wiring:
Use power cords that match the instrument's power requirements and avoid using aged or damaged wires.
The equipment must be placed on flame-retardant and stable surfaces, with no flammable or explosive materials stored nearby.
(3) Usage Restrictions:
Do not use electric heating equipment to dry flammable materials. Toxic gases must be handled within a fume hood.
Avoid setting electric heating equipment at maximum temperature for extended periods. Equipment with poor temperature control must be immediately deactivated.
Regularly replace outdated electric heating equipment.

3. Refrigerators and Freezers

(1) Placement and Ventilation:
Refrigerators should be placed in well-ventilated areas, away from heat sources and flammable or explosive materials.
Refrigerators used for storing hazardous chemicals must be labeled with warning signs, regularly cleaned, and maintained with proper inventory records.
(2) Reagent Storage:
Containers for volatile reagents must be tightly sealed.
Strong acids, strong alkalis, and corrosive materials must be stored in corrosion-resistant containers placed within trays.
Prevent reagent bottles from tipping over or cracking when opening or closing the refrigerator door.
(3) Prohibited Items:
Storing food and beverages in laboratory refrigerators is strictly prohibited.

4. Autoclaves and Other Pressure Equipment

(1) Regular Inspections:
Conduct regular inspections to ensure the safety and effectiveness of autoclaves and other pressure equipment.
(2) Operational Requirements:
Operators must be trained and certified, adhering strictly to operational regulations.
Personnel must not leave their posts during equipment operation.
(3) Abnormality Handling:
In the event of any abnormality, immediately deactivate the equipment and notify management.

5. High-Speed Centrifuges

(1) Placement and Balance:
Centrifuges must be placed on stable and sturdy surfaces, with lids securely fastened before activation.
Ensure that centrifuge tubes are balanced to prevent vibration.

(2) Operational Precautions:
Verify that the separation switch is functioning correctly. Do not cut off the power supply or open the lid during operation.
If abnormal noise is detected, immediately stop the machine for inspection and resume operation only after resolving the issue.

6. Biological Safety Cabinets

(1) Pre-Operational Preparation:
Move all required items into the safety cabinet before operation to avoid disrupting airflow.
(2) Operational Procedures:
Turn on the fan and begin operation only after the airflow stabilizes. Work from clean areas to contaminated areas during operation.
Open flames are strictly prohibited. Minimize movement behind the cabinet and avoid rapid opening and closing of doors.
(3) Post-Operational Procedures:
After completing operations, keep the fan running and activate the UV lamp for disinfection.

7. qPCR Instruments

(1) Pre-Use Preparation:
Before use, inspect the qPCR instrument's power supply, cooling system, and reaction module to ensure proper functionality.
Ensure that reaction plates or tubes are correctly placed to prevent liquid leakage.
(2) Operational Precautions:
Strictly follow the qPCR instrument's manual when setting up reaction programs to avoid temperature setting errors.
Do not open the instrument lid during operation to prevent temperature fluctuations that may affect results.
After use, promptly clean reaction plates or tubes to avoid residue contamination.
(3) Maintenance and Cleaning:
Regularly clean the reaction module and ventilation openings to ensure proper heat dissipation.
If the instrument exhibits abnormalities (e.g., temperature control failure, unusual noise), immediately deactivate it and notify maintenance personnel.

8. Western Blot Equipment

(1) Electrophoresis Apparatus Safety:
Place the electrophoresis apparatus on a stable surface and ensure the power cord is undamaged.
Avoid contact with the buffer solution during electrophoresis to prevent electric shock.
After electrophoresis, turn off the power and clean the electrophoresis tank and electrodes.
(2) Transfer Apparatus Safety:
Place the transfer apparatus in a well-ventilated area to prevent overheating.
Ensure that the transfer cassette is correctly placed to avoid liquid leakage during

transfer.
Clean the transfer cassette and instrument surface after use.
(3) Detection and Imaging Equipment:
Store developing and fixing solutions in well-ventilated areas and avoid direct skin contact.
When using imaging equipment, avoid direct exposure to strong light and ensure proper heat dissipation.

9. Microplate Readers

(1) Pre-Use Preparation:
Before use, inspect the microplate reader's power supply, filters, and detection module to ensure proper functionality.
Ensure that microplates are correctly placed to prevent liquid leakage.
(2) Operational Precautions:
Strictly follow the microplate reader's manual when setting up detection programs to avoid parameter setting errors.
Do not open the instrument lid during detection to prevent light interference.
After use, promptly clean microplates to avoid residue contamination.
(3) Maintenance and Cleaning:
Regularly clean the detection module and filters to ensure accurate readings.
If the instrument exhibits abnormalities (e.g., detection errors, unusual noise), immediately deactivate it and notify maintenance personnel.

Safe Storage of Chemicals

1. General Principles

(1) Categorized Storage: Chemicals should be meticulously sealed, precisely categorized, and stored in a manner that is not only appropriate but also adheres to strict safety standards. It is of utmost importance that incompatible chemicals, which have the potential to react explosively or violently, are never mixed under any circumstances. The chemical storage areas need to be maintained in a pristine condition, ensuring they are well-ventilated to prevent the accumulation of harmful vapors. Additionally, these areas should be properly insulated to safeguard against temperature extremes and must be located at a safe distance from heat sources and potential ignition points.
(2) Labeling and Protection: All chemicals, standards, and solutions should be accurately and clearly labeled with comprehensive information. It is strictly prohibited to fill containers with substances that do not correspond to the label. One must take every precaution to avoid direct physical contact with chemicals. Under no circumstances should one ever taste or directly inhale the fumes emitted by chemicals, as this can pose severe health risks.
(3) Experimental Protection: Laboratory personnel are obligated to don protective goggles that provide clear and unobstructed vision, as well as lab coats that fit snugly to offer maximum protection. Other essential protective gear must also be worn at all times. It is crucial to ensure that the working environment is equipped with an efficient ventilation system to maintain a constant supply of fresh air. Experiments

involving substances with strong odors, corrosive properties, or toxic gases must be carried out exclusively within a fume hood, which is designed to contain and safely remove these hazardous substances.

(4) Disposal of Unidentified or Degraded Chemicals: Any chemicals that remain unidentified or have undergone degradation must be dealt with promptly and disposed of through proper and safe destruction methods. This is to prevent any potential risks or harm that these substances might pose to the environment and human health.

2. Categorized Storage of Hazardous Materials

(1) Flammable Liquids: Flammable liquids should be stored in a cautious manner. They need to be placed away from any sources of heat and ignition in cool, dark, and well-ventilated areas. It is of utmost importance to ensure that containers are not overfilled, as this could pose a significant risk. The storage environment should be maintained at an appropriate temperature and humidity to prevent any potential hazards. Regular checks should be conducted to ensure that the storage conditions remain optimal.

(2) Corrosive Liquids: Corrosive liquids should be stored at the lower end of chemical cabinets using specially designed corrosion-resistant racks. These racks provide the necessary support and protection to prevent any damage or leakage. Chemicals that emit toxic gases or fumes must be stored separately in well-ventilated cabinets. The ventilation system should be efficient enough to remove the harmful gases and fumes promptly, ensuring a safe working environment. Special attention should be given to the sealing of the cabinets to prevent the escape of these substances.

(3) Highly Toxic Chemicals: Highly toxic chemicals need to be isolated from acids and stored in securely locked cabinets. This is to prevent any accidental exposure or unauthorized access. It is essential to avoid storing large quantities of flammable, explosive, or strong oxidizing agents in close proximity to highly toxic chemicals. A detailed inventory of these chemicals should be maintained, and regular audits should be carried out to ensure compliance with safety regulations.

(4) Explosive Solids: Explosive solids must be isolated from flammable materials and oxidizers. They should be stored at temperatures below 20°C using explosion-proof materials and containers. The storage area should be equipped with appropriate fire suppression systems and warning signs. Regular inspections of the storage facilities are necessary to detect any signs of deterioration or potential risks.

(5) Carcinogenic Chemicals: Carcinogenic chemicals should be clearly labeled with appropriate warning signs and stored in locked cabinets. The cabinets should be located in a restricted access area, and only authorized personnel should have access to them. Detailed records of the storage and usage of these chemicals should be maintained for future reference and to comply with regulatory requirements.

(6) Reactive Chemicals: Reactive chemicals should be stored separately to prevent any unwanted interactions. This requires careful planning and organization of the storage space. Each type of reactive chemical should have its designated area, and compatibility charts should be consulted to ensure safe storage. Regular monitoring of the storage conditions is necessary to detect any changes that could lead to a reactive event.

(7) Chemicals Producing Toxic Gases: Chemicals that produce toxic gases should be stored in reagent cabinets equipped with efficient ventilation and absorption systems. The ventilation system should be capable of removing the toxic gases quickly and effectively, while the absorption system should be able to neutralize or capture any harmful substances. Regular maintenance and testing of these systems are crucial to ensure their proper functioning.

3. Chemicals Requiring Isolated Storage

(1) Oxidizers and Reducers: Oxidizers and reducers must be stored with extreme caution and should never be placed together with organic materials. This is to prevent any chemical reactions that could lead to dangerous situations. Special storage containers and compartments should be used to keep these substances separate and clearly labeled.

(2) Strong Acids and Strong Oxidizers: Strong acids, especially sulfuric acid, should never be stored with strong oxidizer salts such as potassium permanganate or potassium chlorate. The combination of these substances can result in violent reactions and pose a significant threat to safety. Separate storage areas with proper insulation and protection should be provided for each of these chemicals.

(3) Hydrolysis-Prone Chemicals: Chemicals that are prone to hydrolysis, such as acetic anhydride and acetyl chloride, need to be kept away from water, acids, and bases. They should be stored in dry and sealed containers in a controlled environment. Special precautions should be taken during handling and storage to avoid any contact with substances that could trigger hydrolysis.

(4) Halogens and Ammonia, Acids, or Organic Materials: Halogens like fluorine, chlorine, bromine, and iodine should be stored separately from ammonia, acids, or organic materials. The interaction between these substances can lead to the formation of toxic or explosive compounds. Appropriate storage containers and safety measures should be implemented to ensure the safe storage of these chemicals.

4. Hazard Prevention Measures

(1) Pre-Use Preparation: Before using any chemicals, it is of utmost importance to conduct a comprehensive and meticulous review of the chemical safety data sheets (MSDS). This review should encompass a detailed examination of all aspects related to the physical and chemical properties of the chemicals. By doing so, one can gain a profound understanding of factors such as their stability, reactivity, flammability, toxicity, and potential interactions with other substances. This knowledge serves as a solid foundation for making informed decisions and taking appropriate precautions during the handling and usage of the chemicals.

(2) Operational Compliance: One must strictly and unwaveringly adhere to the established operational procedures and methods. This involves following each step precisely as prescribed, without any shortcuts or deviations. By doing so, not only can one ensure personal safety but also prevent any potential harm or risks to colleagues and the surrounding environment. Any negligence or non-compliance in following the operational guidelines could lead to serious consequences and should be avoided at all costs.

(3) Personal Protective Equipment (PPE): When preparing and using volatile reagents,

it is essential to don the appropriate personal protective equipment without fail. This may include items such as safety goggles, protective gloves, lab coats, and masks. Moreover, conducting experiments within a well-functioning fume hood is of critical importance. The fume hood helps to effectively remove and ventilate any harmful vapors or fumes, minimizing the exposure of the individual to potentially hazardous substances and creating a safer working environment.

(4) Operational Vigilance: During experiments, it is strictly prohibited to leave the workstation unattended under any circumstances. Maintaining constant vigilance and attention is crucial to promptly detect and address any unexpected developments or issues that may arise. Even a momentary absence could potentially lead to accidents, equipment malfunctions, or incorrect experimental results, thereby posing significant risks and complications.

(5) Chemical Handling and Disposal: It is imperative to have a clear and thorough understanding of the entire process related to chemical use, storage, safe disposal, and efficient waste management. This includes being familiar with the correct storage conditions, such as temperature, humidity, and light exposure, to maintain the integrity and stability of the chemicals. Additionally, knowing the proper methods for safe disposal and waste management helps prevent environmental pollution and ensures compliance with relevant regulations and safety standards.

(6) Hazard Awareness: It is essential to be constantly and acutely aware of the hazardous substances present in the workplace. This awareness should extend to a detailed understanding of their potential health risks, both in the short and long term. Based on this understanding, appropriate and effective preventive measures should be implemented without delay. This may involve implementing engineering controls, administrative procedures, or using additional protective equipment to minimize the exposure and potential harm associated with these hazardous substances.