Laboratory Safety Manual

Edition: 2nd edition, June 2014
Telephone: 0571-88208993
Website: http://sbb.zju.edu.cn (Department of Laboratory and Equipment Management, Zhejiang University)

浙江大學
ZhejiangUniversity

Laboratory Safety Manual

Compiled by the Department of Laboratory and Equipment Management

Key Contacts

- Fire alarm: 119
- Police: 110
- Emergency Medical Aid: 120

Campus 110:

88206110 (Zijingang Campus)
87951110 (Yuquan Campus)
88273110 (Xixi Campus)
86971110 (Huajiachi Campus)
86592777 (Zhijiang Campus)

Department of Laboratory and Equipment Management:

88208993 (Laboratory Technical Safety Office, Zijingang Campus)
87951736 (Yuquan Campus)
88273305 (Xixi Campus)
86971174 (Huajiachi Campus)

Department of Logistics Management:

88981555 (Patriotic Sanitation Campaign Office, Zijingang Campus)
87951469 (Yuquan Campus)
88273378 (Xixi Campus)
86971332 (Huajiachi Campus)

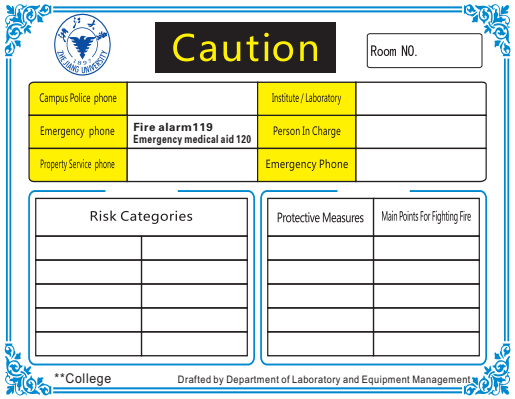
Hazardous Articles Warehouse:

88206906, 88206909 (Zijingang Campus)
87952023, 87952134 (Yuquan Campus)

Contents

I General safety guidelines

1. Learn and follow all established laboratory regulations before entering. Strictly carry out all operation procedures and keep records where relevant.
2. Ensure the visibility of the lab observation window. Post safety information placards at lab entrance and update them in time.



3. Keep the lab tidy and floors dry. Clean up waste material promptly. Keep evacuation routes free to enable easy access to power switches protective equipment and fire-fighting apparatus.
4. Never break away from the position in the process of experiment. There must be at least 2 people present during any dangerous experiments.
5. Before entering the lab, one should learn the underlying safety hazards and emergency measures, and adopt appropriate safety precautionary measures.
6. Lab personnel should choose the personal protective equipment appropriately according to compatibility and operational requirements. Ensure proper application, validity and integrity before using; learn about proper usage and maintenance.
7. Smoking, eating, sleeping and lighting mosquito-repellent incense are forbidden in lab. Heating equipments including electrical oil heaters and electric radiators are not permitted to use. Do not place irrelevant items in lab. Do not engage in horseplay in lab.
8. For special positions or assignments and operation of special apparatus, one should receive proper training and obtain the necessary licenses or permits before working.
9. Clean up immediately after all experiments. Lock door whenever leaving the lab, even temporarily. The last one to leave the lab should turn off the water, electricity and gas, close the windows and doors.
10. Apparatus should not be left on overnight. If it is necessary to do so, precautionary measures should be taken. Air conditioners, computers and water dispensers should not work overnight.
11. In non-experimental areas (like elevators, offices, lounges and meeting rooms, etc.), one should not wear protective articles such as lab coats or gloves.
12. Do not wear contact lenses in a chemistry lab or in a high temperature environment.
13. Familiarize yourself with the emergency equipment within lab or in the surrounding areas, and be able to use them correctly.
14. Stop experiments once hazardous conditions are detected. Take corresponding measures promptly to eliminate them. Do not take any risks.
15. When handling lab safety incidents, assess calmly, act timely, manage effectively, report it to supervisors and others, evacuate promptly when things get out of control, look after each other, and ensure everyone's safety.
16. If you catch on fire or are contaminated with chemicals, promptly use proper facilities like emergency shower right away.

Ⅱ Fire Safety Regulations

ⅰ Common Hazardous Conditions

1. Improper use and storage of flammable chemicals.
2. Evacuation route gets obstructed. Waste items are not disposed timely.
3. Improper use of electricity. The careless management of open flames.
4. Lab construction and modification do not comply with fire safety regulations.

ⅱ Fire-fighting

1. Principles of Fire-fighting and Usage of Equipment

1.1 Principles of fire-fighting: During the initial stage of fire-fighting, call for help, organize personnel to fight the fire with proper precautionary measures and notify the fire department. When fighting fire, control the fire before eventually putting it out. Rescue personnel before fighting the fire. Focusing on addressing the most serious conditions first when putting out fire.

1.2 Details and requirements when notifying the fire department

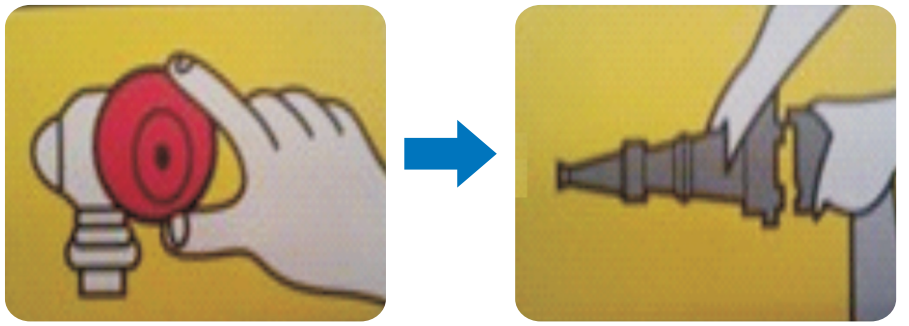
- Details: the location on fire (including block and room number), what is on fire, the intensity of fire, clarify if there's anything explosive, flammable or poisonous, and if there's anyone trapped. Please provide the information of the person who reports the fire (name, employer, department and phone number).
- Requirements: listen to the inquiries of fire personnel on duty carefully. Answer questions concisely and shortly. Don't hang up the phone until the fire personnel instruct that firefighters have been sent. After fire reporting, promptly send someone to the entrance to lead firefighters to the fire site.

1.3 Usage of fire extinguishers

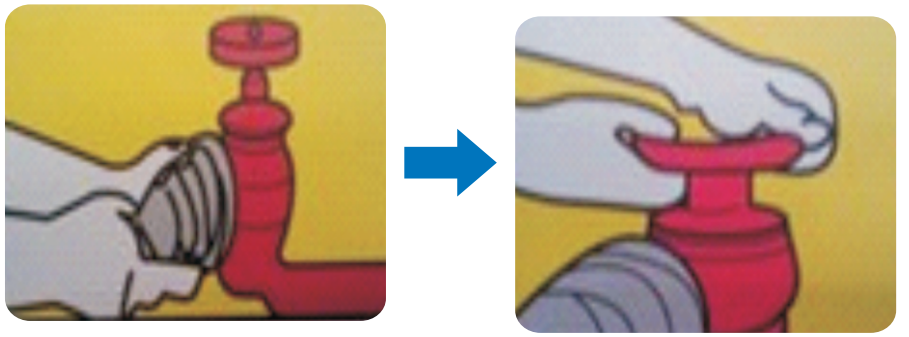
Pull out the locking pin | Hold the discharge hose and aim the nozzle at the base of the fire | Squeeze the trigger

Note: except for soda-acid extinguisher, other types of fire extinguishers can not be placed upside down or horizontally, or else the fire extinguish agent would not spray.

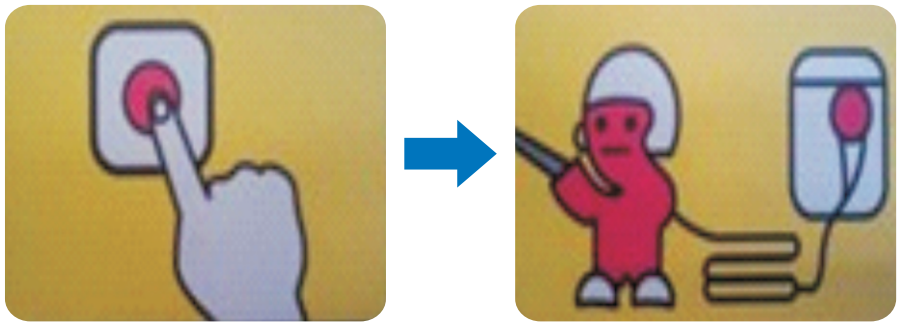
1.4 Usage of Fire Hydrant



1 Open the case | 2 Connect the fire-fighting lance



3 Connect the fire hose | 4 Open the valve



5 Press the water pump button (skip this step for most fire hydrant) | 6 Fight the fire

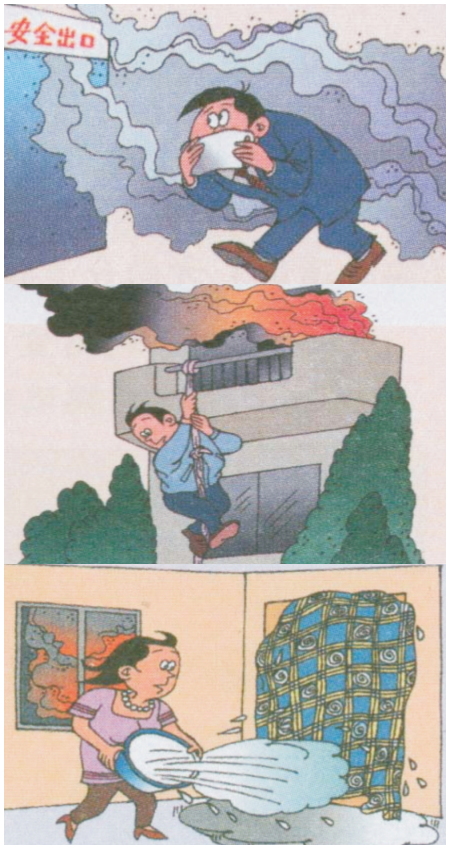
2. Self-rescue and Survival

Familiarize yourself with lab emergency exit, fire-fighting apparatus and the ways of self-rescue and survival

1.1 Stay calm and orientate before evacuating immediately. Move orderly and never push each other or ram around. Try to go downstairs. If the exit is filled with smoke, evacuate against the direction of smoke and escape through balcony, window or rooftop,if possible.

1.2 To avoid inhaling dense smoke, use wet towels or masks to cover nose and crawl along.

1.3 Escaping via elevators is strictly fo rbidden. If the stairs break down, or the passages are blocked, either escape through rooftop, balcony, downpipes, or tie ropes or connected sheet stripes on a fixed object (such as window frames or water pipes).



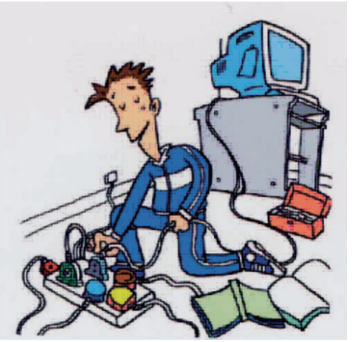
1.4 If it is impossible to evacuate, go back indoors, close all the windows and do-ors that connect areas on fire. Also, wet windows and doors to put off fire. Throw clothing or other objects out from the windows, signal for help, wait for rescue.

1.5 If you are on fire, do not stamp on or flap the flames. Instead, take off your clothes immediately, or use water, heavy clothes or roll on the ground to put out the fire.

1.6 Life safety comes first of all. Do not care about personal properties and leave immediately. Do not return to fire scenes.

Ⅲ Water & Electricity Safety

i Electricity Safety



Do not connect or extend electric wires arbitrarily; avoid using one power strip to connect multiple appliances

1. The capacity and plug of laboratory circuit should match the power output of all the equipment and device. Install air switch, leakage protector. For devices that requires high power, use a separate circuit.
2. Make sure all the electrical appliances are in good condition before power on.
3. Electrical appliances should be in good cooling condition, and kept away from heat or flammable items. Make sure the ground connection and zero connection of appliances are appropriate.
4. Do not take apart, change or fix electrical appliances on your own. Do not splice electric wires. Do not use knife switch, wooden switch panel or moldings.
5. When using electrical appliances, please keep hands dry. When hands, feet or other body parts touch wet floor, do not power on or touch electrical appliances charged with electricity.
6. For electrical appliances that have been working for a long time, necessary protective precautions should be taken.
7. For dangerous zones having high voltage and large currents, caution signage should be posted to warn people to stay away.
8. For the places storing flammable, explosive chemicals, avoid creating electric sparks or static electricity.
9. When any electrical appliances catch fire, switch off the power first before using water or fire extinguisher to put out fire. If it is impossible to cut off the power, quench the fire using non-conduction extinguishing agent like powder extinguishing agent or CO_2.

Use dry bamboo pole, wooden stick or other insulator to remove the wire

ii Electric Shock First Aid

1. Remove the Person in Electric Shock From the Power Source as soon as Possible

Turn power off or unplug the power source. If it is impossible to identify or turn off the power source, use an insulator like a dry wooden stick or a bamboo pole to remove the wire. Do not touch the objects charged with electricity or the body of the person in shock.

2. Provide First Aid and Call for Ambulance

Once the person is removed from electricity, lay the person on the back somewhere dry and well ventilated. If the person shocked stops breathing and is in cardiac arrest, make sure the respiratory tract is clear before performing first aid measures including resuscitation and chest compression. Meanwhile, dial 120 for an ambulance so as to send the wounded to hospital as soon as possible. Keep performing Cardio Pulmonary Resuscitation (CPR).

3. Essentials of Resuscitation

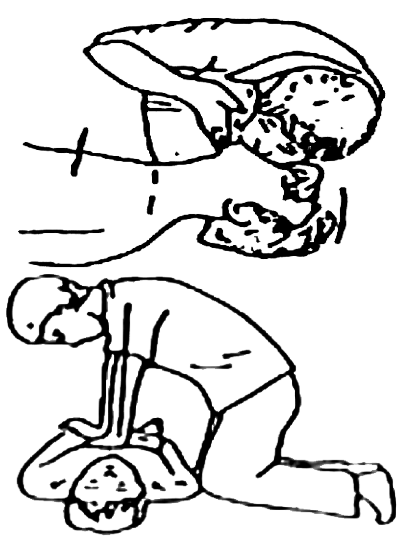
3.1 Lift the chin of the wounded, remove foreign matters in the mouth to keep the respiratory tract clear.

3.2 Pinch the nose of the wounded, blow air into the body via mouth to mouth at an interval of 1 to 1.5 second, 12-16 times per minute.

3.3 If the mouth is tightly shut, perform mouth to nose resuscitation procedures. Make sure no leakage of air through the mouth.

4. Initiatives of Chest Compression

4.1 Identify the spot or chest for administering chest compression. To press correctly, use the index and middle finger of right hand to locate the midpoint between the rib and breastb-ones; place the middle finger at this po-int, and the index finger under the breastbone. Place the other palm on the breastbone.



4.2 Press with the same gesture. Straighten both arms. Do not bend the elbows. Place one hand above the other. Press the breastbone vertically down 3-5cm before each release.

4.3 Press at a constant speed of 80 times per minute.

iii Water Safety

1. Learn about the location of water valves in lab buildings.
2. When the water tap or pipe is leaking or blocked, fix or dredge it in a timely manner.
3. The sink and sewage system should remain unobstructed.
4. Make sure that once the water tap is turned on, it will not be left unattended.
5. Check regularly if the hose connecting cooling water device is aging and change it promptly to prevent leaking.
6. For unattended water flow processes, make sure precautionary measures are in place.

Ⅳ Chemical Safety

i Purchase of Chemicals

1. A series of assessment has to be carried out by relevant departments including safety office, prior to the purchase of hazardous chemicals that are highly toxic or are ingredients for making toxins or explosives. Upon approval, the Hazardous Articles Warehouse of the University Resources Center should be responsible for the purchase.
2. The purchase of narcotic or psychiatric drugs has to be approved by relevant school authorities as well as governmental departments.
3. Common chemicals should be purchased from companies with chemical business licenses or permission.
4. Do not purchase illegally, obtain or sell unofficially hazardous chemicals, narcotic drugs or psychiatric drugs.

ii Preservation of Chemicals

1. General Guidelines

1.1 All chemicals and reagent have to be tagged with identifiable labels. Do not tag labels with partial information or next to an existing one. Include the information such as name, concentration or purity, person responsible, date of the reagent or reaction product.

1.2 The places storing the chemicals should be clean, well ventilated, safety with good insulation and away from heat or fire.

1.3 Do not store large quantity of reagent especially in barrels in the laboratory. Do not store large amount of flammable materials, explosives or strong oxidants in the laboratory. Chemicals should be stored in tightly sealedcontainers and categorized. Do not store together chemicals that are incompatible or can produce strong reaction.

1.4 Keep a day-to-day inventory of the chemicals. Dispose waste chemicals timely.

2. Requirements for Storing and Categorizing Dangerous Chemicals

2.1 Highly toxic chemicals, narcotic drugs and psychiatric drugs should be stored in a safe or fridge with double lock. The request, transport, usage and lock of those chemicals should be conducted by at least two persons simultaneously. Keep relevant records in time.

2.2 Explosives should be stored separately from flammables or oxidants under 20 centigrade. Better to be stored in an explosion-proof reagent cabinet or fridge.

2.3 Corrosive chemicals should be placed on the lower shelf of the anti-corrosion reagent cabinet or in an anti-corrosion tray in an ordinary reagent cabinet.

2.4 Reducing agent and organic substance should not be stored together with oxidants, sulfuric acid or nitric acid.

2.5 Strong acid, especially sulfuric acid, should not be stored together with strong oxidant salts like potassium permanganate and potassium chlorate. Do not mix salts like potassium cyanide, sodium sulphide, sodium nitrite, sodium chlorate and sodium sulfite with acids as they might create toxic gases.

2.6 Place chemicals that can create toxic gas or fume in a ventilated reagent cabinet.

2.7 Alkali metal like sodium or potassium should be stored in kerosene, whereas yellow phosphorus and mercury should be stored in water.

2.8 Do not mix medicines like acetic anhydride, acetyl chloride and thionyl chloride that are likely to hydrolyze with aqueous solution, acid or alkali.

2.9 Do not store halogen (fluorine, chlorine, bromine and iodine) with ammonia, acid and organics.

2.10 Do not mix ammonia with halogen, mercury, hypochlorous acid and acid.

iii Usage of chemicals

1. Read Material Safety Data Sheet (MSDS) before experiments. Learn about the properties of various chemicals and take proper protective measures.
2. Follow the lab instructions strictly for achieving the objective of experiments. Try to reduce the usage of dangerous substances or replace them with low-risk substances.
3. Maintain good ventilation in the workplace. When using chemicals, do not directly touch, taste or smell the chemicals.
4. Do not heat organic solvent in an open container or a close container using open flame. Do not store dry flammable organics in an oven.
5. Lab personnel should wear goggles, lab coats with long sleeves, trousers,

socks and other protective equipment. (**Comment:** Cotton lab coats are not recommended for handling flammable materials!)

6. When using alkali metal (potassium, sodium and so forth), do not mix it with water or aqueous solution.

iv Disposal of Chemical Waste

1. Clean up chemical waste after experiments. Store together those with the similar chemical properties. Use the original bottle or a narrow-mouth container with threaded cap to store the chemical waste in different categories, labeled with “For Chemical Waste Only”, except for those empty bottles. (All the labels can be purchased in the Hazardous Articles Warehouse of the University Resources Center) Make sure all the containers are sealed closely without leakage. Flasks storing waste fluids should be placed in a blue plastic container with compartments for separating items inside. 10 liters special barrel storing chemical waste fluids should not be overfilled (no more than the max line marked on the barrel)

Blue plastic container for waste collection

flexible grids inside

10 liters special barrel

2. Store organic waste fluids containing halogen, inorganic waste fluids containing mercury, arsenic or heavy metal separately. Do not mix them with others.
3. Chemicals that are radioactive, explosive (there are 8 types of explosives including detonating devices and detonating agent, nitro aromatic explosives, nitrate explosives, nitroglycerin composite explosives, chlorate composite explosives, perchlorate composite explosive, liquid oxygen explosive and black powder), contagious, polychlorinated biphenyl or dioxin

should be disposed first to change their chemical property before transported to the chemical waste pickup point in the campus.

4. The personnel responsible for storing and transporting hazardous wastes should take Zhejiang University Laboratory Chemical Waste Registration Form (with 3 copies; available on the website of the Department of Logistics Management). Transport chemical waste to the waste accumulation areas of the campuses according to the given schedule. Assist the staff on site with their work.

Zhejiang University Chemical Waste Label

Category of Waste	Category of Waste	
☐ Organic waste fluid containing halogen	☐ Highly toxic	☐ Corrosive
☐ Organic waste fluid without halogen	☐ Toxic	☐ Spontaneous combustion
☐ Inorganic waste fluid with mercury	☐ Flammable	☐ Combustion upon water
☐ Inorganic waste fluid with arsenic	☐ Explosive	☐ Organism
☐ Inorganic waste fluid with heavy metal	☐ Other _____	
☐ Other inorganic waste fluid		
☐ Solid chemical waste	_____	

Main composition: _____

Manufacturer: _____

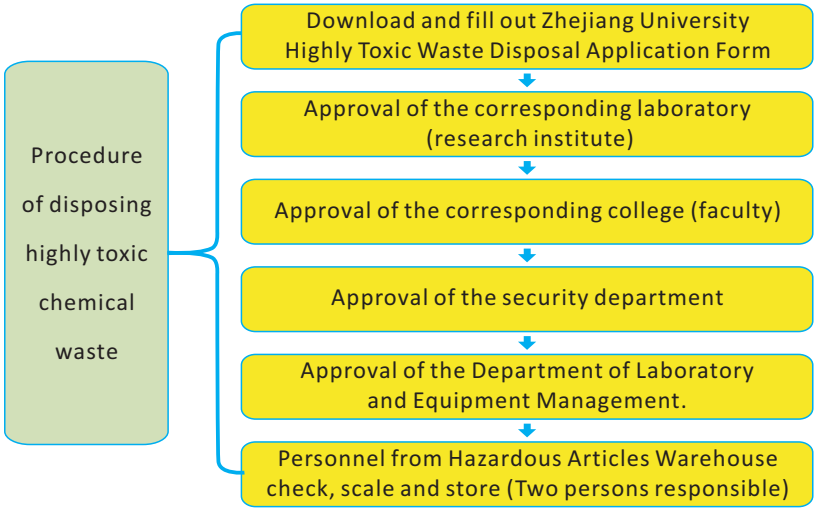
Name of the Laboratory _____

Carriers _____ Date _____

Campus	Address	Time
Zijingang	Field before the transfer station of non-dangerous chemical waste(southwest corner of School of Medicine)	Monday 1:30-2:00 p.m. Thursday 1:30-2:00 p.m.
Yuquan	Courtyard of Teaching Building No.8	Monday 10:00-10:20 a.m. Wednesday10:00-11:00 a.m. Friday 10:00-10:20 a.m.
	West Courtyard of Teaching Building No.10	Monday 10:30-11:00 a.m. Friday 10:30-11:00 a.m.
Xixi	Field on the south or the chemistry bvulding	Friday 1:30-2:00 p.m.
Huajiachi	Northeastern corner of Nami Hall (in front of the former warehouse for chemical waste)	First Thursday morning of each month 10:00-10:30

Note: The timeline is subject to the notification from the Department of Logistics Management.

5. Do not dispose highly toxic waste together with normal chemical waste. Fill out the Zhejiang University Highly Toxic Waste Disposal Application Form (available from the website of the department of laborary and equipment management). After approval from relevant departments, store them temporarily in the school dangerous chemical storage.

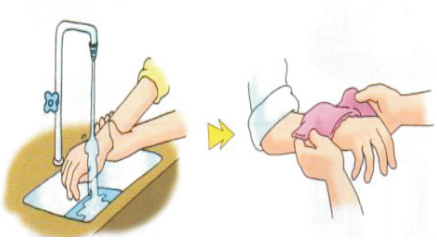


6. Collect or adsorb and decompose toxic gas before release.

v First Aid

Inform the supervisor once chemical incidents take place. Perform first aid procedures and then take the injured to hospital for medical treatment.

1. Chemicals Burns



Take off clothes conta minated with chemicals. Wash with a large amount of water for a long period to avoid enlarging the burned area. If the burned area is relatively small, wash with cold water for about 30 minutes and then apply ointment for burns. If the burned area is large, apply clean fabric (or gauze, towel, sheet) soaked with cold water onto the wound. Get medical attention immediately. When managing the wound, try to maintain the integrity of the skin with blister. Do not tear off the wounded skin. Do not apply colored medicine or other substances (like mercurochrome, gentian violet, soy sauce or toothpaste). Otherwise it will affect the judgment on the depth of the wound and treatment.

2. Chemical Erosion

Remove contaminated clothing immediately. Wash the wound with a large amount of water or appropriate solvent or solution. Keep the wound clean for further medical treatment. If chemical contacts the eyes, immediately wash the eyes with thin strain of water. If only one eye is affected, protect the unaffected eye from water used to wash other eye.

3. Chemical Frostbite

Move the wounded away from the low temperature environment and freezing objects. Use warm water about 40 degrees centigrade to defrost the clothes, and then take them off or cut them off. Warm the affected area. Seek medical attention immediately. For people experiencing cardiac respiratory arrest, perform cardiac compression and resuscitation. Do not parch, apply an ice pack to the affected area, soak the affected area in cold water, or punch on the affected area.

4. Inhalation of Toxic Chemical

4.1 Cut off the source of poison immediately (e.g. turn off the valve of the pump,

plug the equipment leaking). Open windows and doors to reduce the concentration of poison.

4.2 Before entering the area having poisonous gases, please wear protective respirator and clothing.

4.3 Move the exposed person to fresh air soon. Perform first aid accordingly. Dial 120 for medical help.

5. Swallowing Chemicals by Mistake

5.1 Swallowing Ordinary Chemicals

To reduce the concentration of chemicals in the stomach, slow down the rate of absorption and protect gastric mucosa, immediately drink milk or water or eat egg, flour, starch or mashed potatoes. Otherwise drink water with activated carbon (normally every 10-15 grams can absorb about 1 gram of toxin) to provoke vomiting or excreting. Seek medical attention immediately.

5.2 Swallowing Strong Acid

Immediately drink 200ml 0.17% calcium hydroxide solution, 200ml magnesium oxide suspension, 60ml 3-4% aluminum hydroxide gel, milk, vegetable oil or water to dilute toxins. Eat 10 more dissolved eggs as alleviator. Seek medical attention immediately. Do not arbitrarily induce vomit or perform gastric lavage as first aid measures.

5.3 Swallowing Strong Alkali

Immediately drink 500ml diluted vinegar solution (1 portion of vinegar for 4 portions of water) or diluted fresh tangerine juice, then take olive oil, egg white, milk and etc. Seek medical attention immediately. Do not arbitrarily induce vomit or perform gastric lavage as first aid measures.

5.4 Swallowing Pesticide

For organic chloride poisoning, immediately induce vomit or perform gastric lavage. Use 1-5% sodium bicarbonate solution or warm water to pump the stomach, and then use 60ml 50% magnesium sulfate solution. Forbid using oil laxative. Seek medical attention immediately.

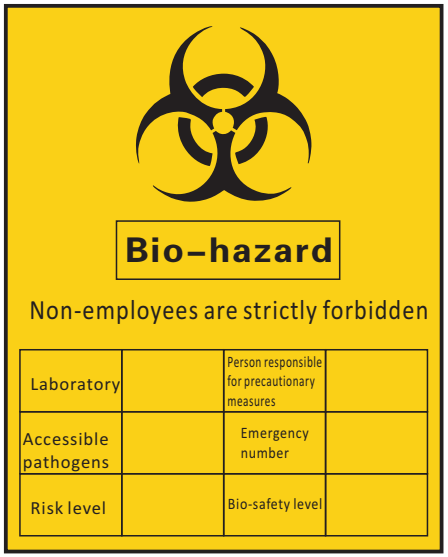
For organophosphate pesticide poisoning, use sodium bicarbonate solution to pump the stomach; for those swallow dip Terex, use saline or water to pump the stomach. Forbid using sodium bicarbonate solution. Meanwhile, Seek medical attention immediately.

6. Gas Explosion

Immediately cut off the power and gas. Evacuate personnel, move other explosive materials away. Notify the fire department.

V Biological Safety

1. Experiments using pathogenic microorganism have to be carried out in a biosafety laboratory approved by the Ministry of Public Health or the Ministry of Agriculture. Biologically safe laboratory include BSL-1, BSL-2, BSL-3 and BSL-4.Experiments involving highly pathogenic microorganisms are not allowed in BSL-1 and BSL-2, but can be carried out in BSL-3 or BSL-4 laboratory once authorization is obtained from the public health or agriculture department of the state council.
2. Workers should receive bio-safety training provided by the provincial public health or agriculture department and obtain Laboratory Bio-safety Training Certificate. Strictly follow laboratory procedure guidelines.
3. Bio-safety laboratories of different levels should be equipped with bio-safety cbinet accordingly. On the door of the laboratory, there should be placards indentifying bio-hazard. Always keep the doors closed. People are not allowed to enter without permission of the person in charge.
4. Strains of Viruses and bacteria as well as biological samples containing pathogenic organisms should be enlisted and kept by specific persons. There should be two people for lockup and acquisiton. Keep record of the purchase, storage, experimenting and disposal of strains of virus or biological sample.



5. Sterilize regularly laboratory, objects and equipments with autoclave or disinfectants that might have been contaminated with pathogenic microorganisms.
6. Breed laboratory animals and carry out experiments on animals in a laboratory with a permit for Laboratory Animal Experimentation.
7. Animals should be purchased from a company with a permit for Raising Laboratory Animals. The Animal Quality Certificate is required. Follow the rule of “3R” (reduction, refinement, replacement). Try to use other methods or

replace higher order animals with lower order animals.

8. Bio-chemical solid waste should be placed in specific yellow plastic bags for sorting and then labeled with Bio-chemical Waste Solid (labels are available from the Hazardous Articles Warehouse of the university resources center). Waste equipment with sharp tips should be packaged securely in cardboard boxes. Wastes contaminated by pathogenic microorganisms have to be sterilized in the laboratory before being transportation.

Zhejiang University Bio –chemical Waste Solid Label

Name: _____

Department: _____

Carrier: _____

Date: _____

Note: _____

9. If emergency occurs, take the most effective measures to control the affected area. Report to the supervisor, Department of Laboratory and Equipment Management and Department of Security.

Campus	Address	Time	Note
Zijingang	Between the research building B and C of the School of Medicine	Monday 1:30-4:00 p.m. Wednesday 1:30-4:00 p.m. Friday 8:30-11:30 a.m.	No lab animal carcasses
	Laboratory animal center	Every day 8:30-16:30	Lab animal carcasses only
Yuquan	To the West of Teaching Building No.10	Tuesday 1:30-4:00 p.m. Thursday 1:30-4:00 p.m.	
Xixi	Under the west wing staircase of 1st floor of Chemistry Building West No.7	Tuesday 1:30-4:00 p.m. Thursday 1:30-4:00 p.m.	
Huajiachi	West Building Inner Circle	Monday 9:00-11:30 a.m. Wednesday 9:00-11:30 a.m.	

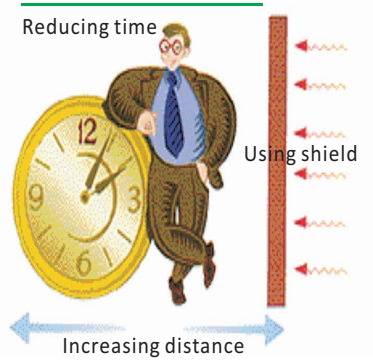
Note: The timeline is subject to the notification from the Department of Laboratory and Equipment Management.

Ⅵ Radioactive Safety

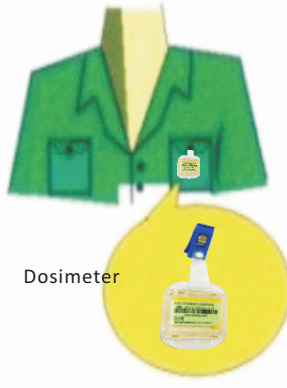
1. The use of radioisotope and radiation-generation devices has to be approved by government environmental agency applied through university. Acquire Radiation Safety Permit. Affected areas should be identified with radioactive signs and placards. Records of radioactive sources should be kept by specific personnel. Check on a regular basis to ensure items match the account book.

Beware of Ionizing Radiation

Three Basic Principles of Radiation Precautionary Measures



2. Concerned personnel should receive training provided by environmental agency and acquire a Radiation Safety and Protection Training Certificate. Upon certificate expiration, retraining is necessary.
3. Personnel involved in experiments with radiation should take the necessary protective measures, operate according to guidelines, avoid air contamination, surface contamination and external radiation accidents. Wear dosimeters correctly.Participate in monitoring.
4. Concerned personnel have to attend the physical check-ups arranged by university.
5. Students should attend lectures on radiation protection and safety provided by advisors.Advisors are responsible for monitoring of st-udents' behavior.
6. The purchase of radioactive substances has to be approved by the laboratory and equipment management department as well as the district, civic and provincial environmental agency. For importing radioactive substance, it also has to be approved by the state environmental agency.



7. If radioactive source spills or the package is broken, close all doors and windows as well as shut down the ventilation system. Report to the supervisors and the related departments immediately. Launch the emergency response and notify the neighboring staff to evacuate. Strictly control the affected area. Forbid irrelevant personnel to enter. Reduce and control the level of effect.

Flow chart of general purchase procedure

Prepare relevant documents Wait for approval of corresponding college or faculty

↓

First review by the Laboratory Technical Safety Office

↓

The approval of district, civic and provincial environmental agency. (Importing radioactive substance has to be approved by the state environmental agency.)

↓

Report to the Laboratory Technical Safety Office within one week after purchase

8. Radioactive Waste Disposal

8.1 Sign disposal agreement with qualified companies to dispose the sealed isotopes with long half-life. Send the agreement to the laboratory and equipment management department as back-up document.

8.2 Isotope with short half-life should be separated and then collected according to the half-life and the date of production. Store them for 10 half-lives in specific radioactive waste containers. Once the residue radiation reaches the background level, dispose the isotope according to guidelines for average laboratory waste.

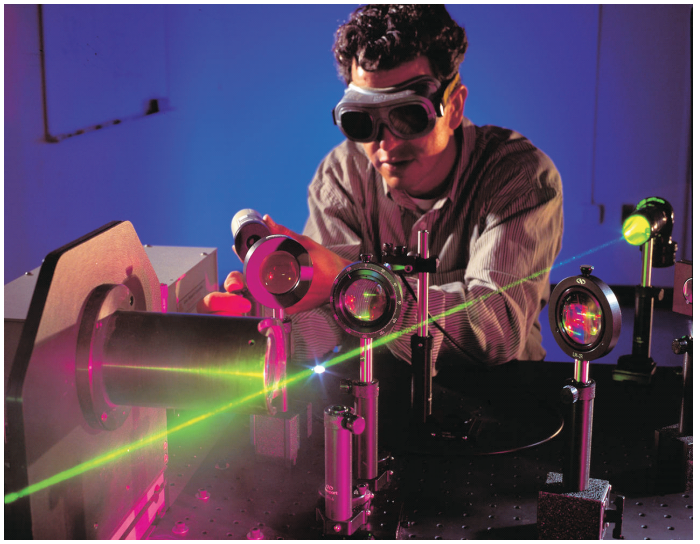
8.3 After finishing all the procedures applying to discard radiation-emitting devices like X-ray diffractometer, the crush of pressure vessel should be supervised by the staff from environmental agency and the university laboratory and equipment management department.

8.4 Radioactive chemical waste should be disposed by the qualified companies.

8.5 Radioactive waste that has decayed to background level of radiation should be disposed according to guidelines for average laboratory waste.

Ⅶ Laser Safety

1. Laser box and control panel should be labeled with warning signs for anyone entering the lab.
2. The person conducting laser-related experiments should have received relevant training. Operate according to the established laboratory procedures. During experiments, there should be supervising personnel present.
3. Before laser-related experiments,remove all items that may reflectlaser light (like watch, ring and bracelet) to avoid laser beam being reflected.
4. Conduct laser experiments under ample light. Meanwhile, take necessary precautionary measures. Do not stare directed into laser beam or refracted light. Avoid exposing the body to laser beam without proper protection.
5. The person conducting laser-related experiments should receive optical examination and recheck regularly (once a year).
6. Forbid harming other people when conducting laser experiments.



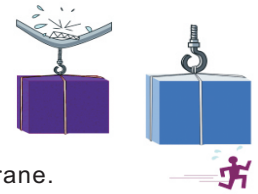
Ⅷ Special Equipment Safety

i Pressure Equipment

1. Check pressure equipment on a regular basis to ensure that it is safe. For pressure vessels that have been idle for a long-time, they have to pass the inspection conducted by special equipment department before use.
2. Personnel operating pressure equipment have to receive training offered by relevant departments and be certified. Operate according to the established operating guidelines.
3. When operating, the operator should not leave the site.
4. Stop operating once there is abnormality. Inform the person charging the equipment.

ii Lifting Equipment

1. Check lifting equipment on a regular basis to ensure its safety.
2. Personnel operating lifting equipment have to receive training offered by relevant departments and be certified. Operate according to established operating guidelines.
3. Check the equipment thoroughly and carefully before using.
4. Lifting equipment must not lift objects exceeding the allowed limitation.
5. Any people should not stay within the range of the crane.



iii Gas Cylinder

1. In principle, gas used in the lab should be purchased from an appointed supplier qualified through a bidding process held by university. For details, go to

Color of cylinder	Name of the gas
Black	Air, Nitrogen
Silver grey	Argon, Neon, Helium, Sulfur Dioxide, Carbon Monoxide, nitrogen monoxide(laughing gas), Sulfur Hexafluoride, Hydrogen Fluoride
White	Ethane, Nitric Oxide, Nitrogen Dioxide
Aluminum white	Carbon dioxide, Tetrafluoromethane
Light yellow	Ammonia
Brown	Ethylene, Propylene, Methane, Propane, Cyclopropane
Light blue	Oxygen
Light green	Hydrogen
Dark green	Chloride

the website of the Department of Laboratory and Equipment Management.
2. The department using gas should reject gas cylinders without appropriate label of the gas name, safety cap or bump protection ring, color signs and labels that certify its safety. Inform corresponding department and the Department of Laboratory and Equipment Management soon.
3. The department using gas should check information like the technical inspection tag, steel seal and other labels. Do not change the gas cylinder's steel seal and color-coded tag.

5. Do not pile flammable, explosive or corrosive substances near the gas cylinders. Keep them away from heat source. Keep the environment well ventilated and dry. Avoid direct sunlight or strong striking. Categorize gases before storage. Do not have mix storage (flammable gas and combustion-supporting gas). Do not store them in the hallway or public places. Room or cabinet to store gas cylinders only should be locked and managed by a specific person.
6. Gas cylinders should be properly fixed and secured from falling. Label the gas cylinder and the gas pipes. Hang signs to indica-te the status of gas cylinders.
7. Choose appropriate pipes to deliver gas. Use metal pipe for flammable, explosive, poisonous gas. Do not use copper pipe for ethane, ammonia or hydrogen.
8. Install bump protection ring for unfixed gas cylinders. Screw the safety cap tightly. Do not move while holding the main valve. Do not drag, roll or slide the gas cylinder.

9. Categorize the pressure reducer for the gas. Check for leakage after installation. Be cautious about leakage. Be aware of the pressure gauge reading to avoid leakage or over-pressurization.
10. When turning on the gas cylinder, switch the main valve before turning on pressure reducer. Once after using, turn off the main valve and release all the remaining gas. Then turn off the pressure reducer. Slowly turn on and off the pressure reducer, main valve and stop valve to avoid generating static electricity.
11. If leaking, shut the gas source value, open windows and evacuate people around. Do not turn on or off electrical power during the leakage of flammable or explosive gas.
12. Do not use up the gas in the cylinder. Retain some residue pressure.
13. In cases where reflux might take place, install equipment like one-way valve, nonreturn valve and buffer tank connecting the system pipes or equipment to prevent reflux.

Ⅸ Common Facility and Apparatus Safety

General Guidelines

1. Before use, get to know the operating procedures. Operate accordingly. Take necessary protective measures.
2. For the valuable equipment, establish operating rules. Connect it to stable voltage, UPS non-stop power. Use redundant supply if necessary.
3. After use, clean the equipment promptly. Keep record and maintenance. Stop using when there is mal-function. Report and repair it in a timely manner.

i Processing Machinery and Equipment

When running processing machinery and equipment, accidents might take place.

1. For equipment like shearing machine, planer, circular saw, forklifts, grinder and air compressor, there should be protectivemeasures like covers or guards.
2. For equipment like lathe or gear-hobbing equipment that is higher than the operator, place work platform with an appropriate height.
3. Wear necessary protective clothing (work clothes and gloves). Tighten loose clothing and hair. Do not wear the following items like long necklace, tie or scarf that could easily be drawn into the machine. Strictly follow the operating guidelines.

ii Fridge

1. Put the fridge in locations with good ventilated and free from heat source, flammable, explosive substances and gas cylinders. Leave out space for heat dissipation.
2. Label fridge containing hazardous chemicals with warning signs. Label all the reagents in the fridge and clean up on a regular basis.
3. Hazardous chemicals should be stored in an explosion proof fridge or an ordinary fridge altered to be explosion proof. Cap and seal the containers with

volatile organic reagent to avoid vapor accumulation in the fridge.

4. Choose anti-corrosion containers to store strong acid, strong alkali or corrosive substances. Place the container on a tray.
5. Stablize the test tubes (with plug) and those containers with high center of gravity like flasks. Otherwise, they might fall and break because of the open and shut of the door of the fridge.
6. Do not store drink or food in the fridge.
7. If the fridge shut down, transfer chemicals instantly and store them properly.

iii High-speed Centrifuge

1. High-speed centrifuge should be placed on stable and flat table. Tighten the cap before running.
2. Centrifuge tubes should be spaced out evenly to ensure the balance.
3. Ensure that the centrifuge safety switch functions. Do not open the cap of centrifuge before cutting off the power.

iv Heating Equipment

Heating equipment include open flame furnace, electric resistance furnace, incubator, drying oven, water bath, electric heat gun and hairdryer.

1. When using heating equipment, take necessary protective measures. Strictly follow the operating guidelines. During operation, operator must not leave the place (at least 10-15 minutes between every observation). After use, turn off the power.
2. Heating or thermal equipment should be placed on stable, flame-retarding experimenting table or on the ground. Do not pile flammable, explosive substances or other items near it.
3. Forbid using heating device to bake volatile flammable substances like solvent, oil products and plastic crate. If the heating creates toxic gases, operate in fume hood.
4. Store the heated substances safely in a powered-off environment.
5. Do not use open flame furnace in the laboratory. If one has to use it for a special occasion, apply for Open Flame Furnace Permit from the Department of Laboratory and Equipment Management.

Zhejiang University Laboratory Open Flame Furnace

Permit of Use

Serial no. 2012001

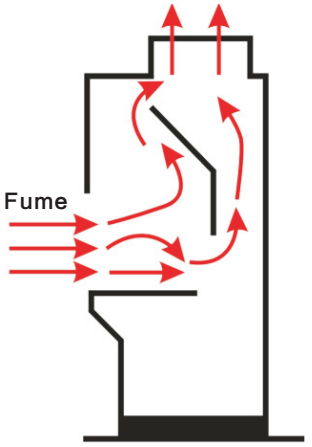
College	**college	Laboratory (institute)	**institute
Premise of use	**campus**building**room		
Number of open flame furnaces	4	Power	1000W/each
Person in charge	***	telephone	12345678
Note	1.This permit must be posted at the place of using open flame furnace. Any department or individual shall not alter the place of use. 2.Use the open flame furnace only when there is someone present. 3.Maintain the place clean and tidy. Do not store flammables or explosives around.		

Department of Laboratory and Equipment Management
2012 March

6. When using hot wire furnace, make sure that the wire is in good contact with the heating rod. Humid gas has to be dried before entering the furnace.
7. Avoid the water bath to run dry. Make sure that water does not spill into electricity junction box.
8. When using electric heat gun, do not aim at any body part.
9. When using hairdryer or electric heat gun, do not jam or cover the air inlet or outlet. Unplug after use.

v Fume Hood

1. Do not store chemicals in or under the fume hood.
2. Before use, check to see if the ventilation system and other parts are in good conditions.
3. When operating, stay away from it at least 15cm, and try to reduce abrupt movement inside the hood or in front of the hood face. Minimize the movement of people in the lab.
4. Do not store items that would stick out of the cabinet or jam the closure of the glass window.
5. Do not block the exit of the fume hood or the opening beneath the deflector. If one has to store items in the hood, elevate and place them on the sides. Elevate them from the fume hood work surface so that air will pass underneath them, and place them away from any contamination sources.
6. Check the exhaust performance on a regular basis. Maintain the ventilating effect. Do not jam the air outlet with paper or light objects.
7. During experiments, do not extend the head and upper body into the fume hood. Operator should



Ventilation principles of fume hood

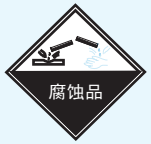
adjust the glass window to elbow height so that chest and above are protected by it. When not operating, lower the glass window to 10-15cm from bottom.

8. If there is mal-function, do not conduct any experiments Immediately close the hood window and contact maintenance personnel for repair.
9. After each use, clean the work platform and equipment thoroughly. Close the glass window. For fume hoods that are contaminated, hang some clear warning signs and notify other people to avoid unnecessary damage.

vi Emergency shower and eyewash station

1. Use emergency shower and eyewash station carefully. Maintain the access corridors clear. Do not use them unless there is alaboratory accident (except for repair).
2. Conduct maintenance on the emergency shower and eyewash station on a regular basis to ensure proper function. Keep records immediately.
3. In case of emergency, pull the hook handle of the emergency shower to wash.
4. After use, clean up the surroundings.

Appendix 1 Common Safety Signs and Symbols

 Biology safety	 Caution for infection	 Flammable fluid	 Flammable gas
 Flammable solid	 Pyrophoric substance	 Combustion upon contact with water	 Oxidant
 Organic peroxide	 Highly toxic	 Toxins	 Poisonous gas
 Explosives	 Carcinogen	 Corrosive	 Beware of radiation
 Laser	 Microwave	 High pressure device	 Beware of ultra-violet damage

 Wear protective clothes	 Wear protective gloves	 Wear protective goggles	 Wear protective hat
 Wear protective mask	 Wear gas mask	 Keep ventilation	 Wear protective face mask
 Forbid open flame	 Forbid eating	 Forbid storage	 No trespassing
 Caution	 Beware of electric shock	 Beware of cold	 Beware of heat
 Beware of fire	 Beware of hand injury	 Beware of magnetic field	 Beware of machinery

Appendix 2 Laboratory Safety Commitment

Laboratory Safety Commitment

I have read the Laboratory Safety Manual of Zhejiang University. I am familiar with various laboratory guidelines and requirements. I promise that, from now on, I will strictly follow all safety rules and operating procedures and keep acquiring knowledge on safety measures which are not mentioned in this manual. I will learn about the emergency equipment surrounding the laboratory and its correct usage. I will learn about the potential hazards of the projects in the laboratory. I will learn about relevant protective and first aid measures. I will carry out my duty of warning and notifying. If accidents take place because of my violation against safety guidelines and consequently causing physical or financial damage, I will take responsibility accordingly.

To Sign:

Date:

Department: _____

Student/Job Number: _____

ID Number: _____

Note: This signed commitment is in two copies. This copy is kept by the department of the person signed in archives for future check (first copy).

Appendix 2 Laboratory Safety Commitment

Laboratory Safety Commitment

I have read the Laboratory Safety Manual of Zhejiang University. I am familiar with various laboratory guidelines and requirements. I promise that, from now on, I will strictly follow all safety rules and operating procedures and keep acquiring knowledge on safety measures which are not mentioned in this manual. I will learn about the emergency equipment surrounding the laboratory and its correct usage. I will learn about the potential hazards of the projects in the laboratory. I will learn about relevant protective and first aid measures. I will carry out my duty of warning and notifying. If accidents take place because of my violation against safety guidelines and consequently causing physical or financial damage, I will take responsibility accordingly.

To Sign:

Date:

Department: _____

Student/Job Number: _____

ID Number: _____

Note: This signed commitment is in two copies. This copy is kept by the person signed (second copy).

References

1. Hong Kong University of Science and Technology Safety& Environmental Protection Manual
2. Hong Kong Baptist University Safety Manual
3. Tsinghua University Laboratory Safety Manual
4. Wuhan University Laboratory Safety Manual
5. Ningbo University Laboratory Safety Manual
6. University Laboratory Safety Overview (Chief Editor Li Wuyi, Zhejiang Photography Press, 2006)
7. University Chemistry Laboratory Safety and Precautions (Chief Editor Feng Jianyue, Zhejiang University Press, 2013)