Xi'an Jiaotong-Liverpool University

西交利物浦大學

# Health and Safety Handbook

# Department of Biological Sciences
# Xi'an Jiaotong-Liverpool University
# (XJTLU)

## Preface

This handbook, which supplements Standard Operating Procedures (SOPs), outlines the responsibilities and arrangements for ensuring your safety. It is provided to help you work safely and avoid accidents by providing a framework within which a safe method of work can be established. It is therefore important that you read the information given here at the start of your work in the Department of Biological Sciences.

Accident prevention is mainly common sense, tidiness and specialist knowledge, but safety within laboratories does require constant vigilance and care. Remember that a little planning and thought can save a great deal of trouble and regret. Always seek expert advice when in doubt.

You are required to sign and return the declaration issued with this handbook stating that you have read the handbook and are satisfied as to your, and the Department's, responsibilities with respect to safety.

This handbook will be reviewed at least annually and supplementary information distributed to all members of the Department. Suggestions for inclusion, corrections and revisions for future editions of this handbook should be sent to the Lab Manager (Ms Jie Jiang; Email: Jie.Jiang@xjtlu.edu.cn; Tel.: 0512-8188 0482).

## Table of Contents

## 1. Useful Information

### 1.1. Emergency Telephone Number

**PMO office: 88161061 (campus phone: 1061)**

### 1.2. First Aiders

| Location | Name | Contact |
|---|---|---|
| Room SA431 | Dr. Rong Rong | Tel: 88161654<br>Email: rong.rong@xjtlu.edu.cn |
| Room SA429 | Ms. Jie Jiang | Tel: 81880482<br>Email: jie.jiang@xjtlu.edu.cn |
| Room SB461 | Ms. Sijing Meng | Tel: 81880485<br>Email: sijing.meng@xjtlu.edu.cn |

### 1.3. Contact information for Health and Safety

| Name | Position | Email | Extension |
|---|---|---|---|
| Professor Mu WANG | Head of Department | mu.wang@xjtlu.edu.cn | 81884673 |
| Sung Kay CHIU | Biological Safety Officer | David.chiu@xjtlu.edu.cn | 81883224 |
| Ms Sijing MENG | Experimental Officer | sijing.meng@xjtlu.edu.cn | 81880485 |
| Ms Jie JIANG | Lab Manager | jie.jiang@xjtlu.edu.cn | 81880482 |
| Ms Sixian CHENG | Health and Safety Officer | sixian.cheng@xjtlu.edu.cn | 88161005 |

### 1.4. Other useful telephone numbers

| Organization | Telephone number |
|---|---|
| Police station | 110 |
| Fire brigade | 119 |
| Suzhou Kowloon Hospital Shanghai Jiaotong University | 0512-62629999 |

| | |
|---|---|
| Medical School (http://www.sz9l.com/) | |
| The First Affiliated Hospital of Soochow University (http://fyy.sdfyy.cn/) | 0512-65223637 |
| Singhealth Medical Clinic (http://www.singhealth.asia/) | 0512-67671655<br>0512-67671611 |

## 1.5. Introduction

Biological safety in the laboratory requires the application of the precautionary principle including guidelines and regulations. The purpose of this handbook is to provide information on how to safely work with biological materials and what to do if there is an emergency while working in the laboratories. For additional information or clarification of the contents of this handbook please contact Biological Safety Officer.

## 1.6. Safety training

The Department is committed to meeting and identifying safety training needs for staff and students. The standard arrangement in place is:

*Health and Safety induction*: An induction by the Biological Safety Officer for all Year 2 and Year 4 students will be arranged every September prior to commencement of experimental classes or research projects. For new PhD students, Master's students, undergraduate students, and visiting researchers, safety induction will be provided on weekly basis upon request by Biological Safety Officer prior to commencement of research projects.

All members, including academic staff, technicians, students and other researchers in the department must take annual refresher Biological Safety training and pass the quiz in order to work in the laboratories.

## 1.7. General conducts and sanctions

The fundamental rules you should follow when you are in the laboratories are as follows:

- Obey all safety signs and warnings. i.e., Maximum Loading and Restricted Area

notices, Danger, No Entry, illuminated signs and alarms are installed.

- Only Authorized Personnel are allowed in the laboratories.
- Working in the lab alone is not allowed at any time for all members in the department.
- Do not use any lab equipment without proper training.
- Do not attempt to repair or modify any apparatus yourself unless you are authorized to do so. Faulty or damaged equipment must not be used.
- Keep your work area tidy and in a safe condition.
- Eating, drinking, smoking, storing food, applying cosmetics, and handling contact lenses are not permitted in the laboratories
- Doors marked 'FIRE DOOR - KEEP SHUT' must not be fastened in the open position. If they fail to close of their own accord, this must be reported to the Biological Safety Officer. Fire door should only be used during fire emergency.
- Keep corridors and staircases clear as they provide routes of escape in an emergency. Similarly, keep access to firefighting equipment clear.
- Running, throwing and similar acts of 'horseplay' are strictly forbidden. Even in an emergency, it is usually safer to walk quickly than to run.
- Turn off electrical equipment and lights when not in use.
- All liquid or solid materials containing potentially infectious material must be decontaminated before disposal.
- All research and teaching projects involving human blood, cell lines, body fluids, and/or unfixed human tissue, and other primate cells must be conducted in the Biosafety Level 2 lab. Research involving organisms in Risk Groups 3 and 4 is NOT permitted at XJTLU.
- Newly isolated or recognized infectious agents of unknown pathogenicity shall be treated as Biosafety Level 2 or greater infectious agents.
- All Visiting researchers and students working in the laboratory must be registered and must complete all applicable training prior to initiating laboratory work.

If you are aware of breaches, please report them immediately to your Principal Investigator or the Lab manager to ensure that we can correct the improper action and prevent accidents happening. Contravention of the Department's Health and

Safety Policy will not be tolerated and appropriate action will be taken to ensure that all required procedures are being upheld.

## 1.8 Responsibilities

1.8.1 Responsibilities for Department Biosafety Committee

The Department Biosafety Committee (DBC) approves or rejects all proposals and research conducted within the biohazard facility and also designates the biosafety level required. It is also responsible for: reviewing activities which raise health and safety issues, reviewing the activities of the Department of Biological Sciences as it pertains to infectious agents, assess containment levels, establishes a medical surveillance plan for all appropriate personnel and reviews any changes, challenges or grievances concerning research within the facility.

1.8.2 Responsibilities for Biosafety Officer

The Biosafety Officer (BSO) has the authority to: determine if an employee is unable to work within the facility, deactivate any malfunctioning containment equipment, and insure compliance with governmental health and safety regulations. The BSO is responsible for coordinating meetings of the DBC, provide technical guidance and training materials to personnel regarding laboratory safety, revise day-to-day procedures as experience dictates, insure that workers follow procedures and practices, advise Principal Investigators as to the proper functioning of their workers, initiate and supervise any needed emergency response, investigate and report to the DBC and Principal Investigator, any significant violations within the facility, accompany authorized visitors or maintenance workers around and into The Lab.

1.8.3 Responsibilities for PIs

The Principal Investigator (PI) of a research project or teaching laboratory is responsible for the following:

- Developing specific protocols to ensure the safe use of biological agents and recombinant DNA technology. The protocols must outline potential biohazards, necessary precautions and proper emergency procedures in the case of an accidental exposure of students and personnel.

- Informing the lab manager of the reasons and provision for any precautionary medical practices advised or requested (i.e. vaccinations or serum collection).
- Complying with the safety protocol, this handbook, campus policy and any applicable provincial and national laws and regulations.
- Training all personnel involved in the project so that they have a complete understanding of the hazards involved, are competent to undertake risk assessments, follow any safety procedures/practices/techniques that are required, as well as the emergency protocols in place for dealing with accidents.
- Registering visiting researchers and students working in the laboratory with lab manager.
- Verifying that any persons working on a Biosafety Level 2 research project and who are not employees at XJTLU, must have medical insurance. For clarification, students and postdoctoral fellows, who do not receive monetary compensation from the University payroll are usually not considered University employees and therefore must arrange their own medical insurance.
- Must taking full responsibilities for personnel working under his/her supervision.

1.8.4 Responsibilities for lab users

Laboratory staff, students and postdoctoral fellows who work in the laboratory are responsible for the following:

- Being familiar with all protocols used in the laboratory. Knowing all emergency procedures established by the Principal Investigator.
- Completing training and verifying documentation of required laboratory safety training.
- Following all appropriate laboratory practices as outlined in this manual, and all additional practices outlined in the laboratory safety protocol.

## 2. The paper work requirements

Before you begin working on anything, you are legally required to have as appropriate:

- Health and safety agreement form.

- Standard Operating Procedure (SOP).
- Risk Assessment (RA).
- Control of Substances Hazardous to Health (CoSHH).
- Signed Supervision Confirmation Letter from PI

## 2.1. Standard Operating Procedure (SOP)

A Standard Operating Procedure (SOP) defines the protocol you need to follow in order to use apparatus or equipment such as centrifuges or other complex, expensive and potentially dangerous pieces of equipment or handle any biohazards materials. Written laboratory safety procedures must be prepared by the PI or designee for each laboratory in which biological agents are used for teaching or research purposes. Research conducted at Biosafety Level 2 that has the potential for the production of aerosols must be conducted in a certified biosafety cabinet. The PI must ensure all laboratory personnel comply with laboratory standard operating procedures and safety plan. The individual laboratory safety plan must be based on actual laboratory safety practices.

## 2.2. Risk Assessment (RA)

A risk assessment is a careful examination of what could cause harm to people. The aim is to make sure no one gets hurt or becomes ill.

The steps to risk assessment are:

- Identify hazards and if possible remove them.
- Identify the people who will be affected.
- Evaluate procedure for risks and determine the appropriate precautions required.
- If appropriate, record the findings and review regularly.

Some items arising under risk assessments may need assessments under different regulations which may include:

- Control of Substances Hazardous to Health (CoSHH) regulations

Facilities, equipment use, relocations and processes must also be assessed.

Precautions will specify personal protective equipment (PPE) such as gloves and lab coats. Everyone must ask for, use and help improve the risk assessments for their tasks.

Risk assessments should be signed off by the Module leader or Head of the Research Group who should be confident that the person performing the work has read and understood the assessment. If control measures are required, then these should be made available to the person prior to the work commencing.

### 2.3. Control of Substances Hazardous to Health (CoSHH)

All chemicals and potentially hazardous substances should be treated as dangerous unless there is evidence to the contrary. Assessment of the risks associated with the use of any hazardous substances falls under the Control of Substances Hazardous to Health (CoSHH).

Each student or researcher must undertake a CoSHH assessment prior to the commencement of project which should be revised annually or whenever there is a change to procedures. This must take into account the risks posed by the use of any substance which may be hazardous, detailing appropriate precautions for use, minimising the risk, containment, any personal protective equipment requirements and the ultimate means of disposal of any product or residual material. A hard copy of the CoSHH form should be kept with your lab book.

In addition, the assessment must identify actions required for dealing with any issues arising from the procedure. If health surveillance or monitoring is appropriate, these must be specified and appropriate arrangements made. Relevant information may be found in reference books, databases or obtained from the manufacturers. However, manufacturer's data by itself does not normally constitute a suitable and sufficient assessment as the conditions, volumes and other preparations with which the substances may come into contact must be considered.

This assessment should be read and signed by the Principal Investigator involved in

work covered by the assessment.

### 2.4. Summary of controlling risk in the laboratory

When thinking about controlling risk associated with hazardous substances and experimental protocols, remember three things:

- Can you change the process or activity to eliminate the hazard?
- Can you substitute it?
- If not, can it be used in a safer form?

## 3. General laboratories guidelines

### 3.1. Working in a laboratory

With the appropriate paperwork in place, you can begin working in the laboratory. This is a potentially hazardous environment and it is your responsibility to ensure that you do not place yourself or others in danger. There are also rules that should always be followed when working in the laboratory.

3.1.1. Set requirements for access to the laboratory

- Only authorized personnel are permitted in laboratory areas. Under no circumstances should children or animals be allowed to enter laboratories.
- Undergraduate students can only be stay in the lab with the present of their supervisor or assigned academic staff in the lab.
- High risk work should only be performed during working hours when other members of staff are present. Working after hours should only be done if it is unavoidable and on SOPs where Risk Assessments deem the risk as low and manageable. The PI is responsible for assessing the risk of work being carried out and whether the person undertaking the work is competent. If working alone, make sure that someone knows where you are, your contact numbers and the duration of your work.
- All visitors to the laboratory should be registered on arrival. This is a requirement for insurance purposes and so they can be accounted for in case of an emergency. Prior to working in the laboratory, all safety documentation must be in place. For further information, see the Lab Manager.

- Ensure that you know your First Aiders, the location of eye irrigators, emergency exit routes and fire extinguishers. Make sure you understand the fire alarm procedures and what you should do in case of emergency evacuation.
- Always make sure that the works you are undertaking has authorized risk assessments and Control of Substances Hazardous to Health (CoSHH) forms are in place. All groups should have copies of their risk assessments and CoSHH forms in an easily found place.
- Keep laboratory door closed at all times.

3.1.2. Set standards for appropriate behaviour in the laboratory

- Always wear the appropriate personal protective equipment (e.g. lab coat, gloves and eye protection). Suitable footwear with closed toes and heels must be worn in all laboratory areas. Remove protective clothing before leaving for non-laboratory areas.
- All technical procedures must be performed in a manner that minimizes the creation of aerosols.
- Smoking is prohibited in the laboratory.
- Do not eat or drink in the lab. Use the canteen or offices. Do not store your food or drink in lab fridges or freezers.
- Undergraduates are not permitted to stay in laboratories unsupervised.
- All researchers/students with wounds that are weeping or purulent (pus-exuding) must not work in the laboratory areas whenever infectious agents might be present.
- All researchers/students are required to keep their hair at an appropriate length, covered, or tied in such a manner so that it cannot come into contact with hands, specimens, containers or equipment. Wearing jewellery is not permitted. Applying cosmetics and inserting or removing contact lenses is not permitted in the laboratory. Mouth pipetting is forbidden. Mechanical pipettes are provided instead.
- Use a biological safety cabinet or other physical containment devices for procedures involving the manipulation of infectious materials that may generate an aerosol. Fume hoods are not storage areas. Before using a piece of equipment

for the first time, study the instruction manual and seek training by an experienced operator. If a piece of equipment breaks down or needs maintenance, make sure it is decontaminated before asking someone to work on it. Do not keep using a piece of equipment that seems faulty nor try to repair it yourself; simply report it to the Lab Manager.

- Hypodermic needles should never be re-capped or removed from syringes. Simply place them in a sharps bin as soon as you have finished with the procedure.
- Decontaminate work surfaces and equipment routinely, after completion of work and immediately after a spill or splash.
- Accidents of exposures to infectious materials and losses of containment must be reported immediately to the Lab Manager.

3.1.3 Enforce procedures to minimize the risk of sharps injuries.

- Standard procedures for needle stick and other injuries, animal bites/scratches, and occupational illness must be incorporated into individual procedures, as needed.
- Hypodermic needles and syringes must be used only for parenteral injection and aspiration of fluids from patients, laboratory animals, and bottles sealed with a diaphragm.
- Hypodermic needles and syringes must not be used as a substitute for automatic pipetting devices in the manipulation of potentially infectious fluids.
- Needles used in collection of potentially infectious material must not be recapped after use.
- All syringes, needles, and other sharps must be placed into yellow plastic puncture resistant containers labelled as containing "sharps" and "infectious material."

3.1.4 Set procedures for routine decontamination, accidental spill cleanup, disposal of contaminated materials, and emergencies.

- All liquid or solid materials containing potentially infectious material must be decontaminated before disposal.

- Work surfaces which may have contact with potentially infectious material must be decontaminated with a disinfectant at the beginning and end of the day and after any spill of potentially dangerous material. Soak up the disinfectant and contaminated material with an absorbent material (such as paper towels) and dispose of these materials in a double plastic bag or sealed container. Gloves must be worn for clean-up.
- All spills and other accidents, with overt or potential exposure to infectious materials, must be reported immediately to the laboratory supervisor and Biological Safety Officer.

A written record of such incidents must be maintained in the laboratory or department.

### 3.2. Personal Protective Equipment (PPE)

- Laboratory coats must be worn for all work carried out in laboratories and when not in use, hung on the hooks provided (do not mix laboratory coats with outdoor wear). Laboratory coats and gloves must not be worn in the canteen, toilets or outside the laboratory area.
- Disposable gloves must be worn when handling any toxic, hazardous or infectious materials.
- Masks and eye protection shall be worn whenever splashes, spray, droplets, or aerosols of blood or other potentially infectious materials may be generated and there is a potential for eye, nose, or mouth contamination.
- When using an ultra-sonicator, ear protectors must be worn. Insulated gloves and a face visor must be worn when handling liquid nitrogen containers (e.g. inserting/removing samples, filling container with nitrogen).
- All PPE shall be removed immediately upon leaving the work area or as soon as possible if overtly contaminated and placed in an appropriately designated area for decontamination or disposal.

### 3.3. General laboratory tidiness

Whenever you have finished an experiment, are going to tea or lunch or going home, clean up after yourself:

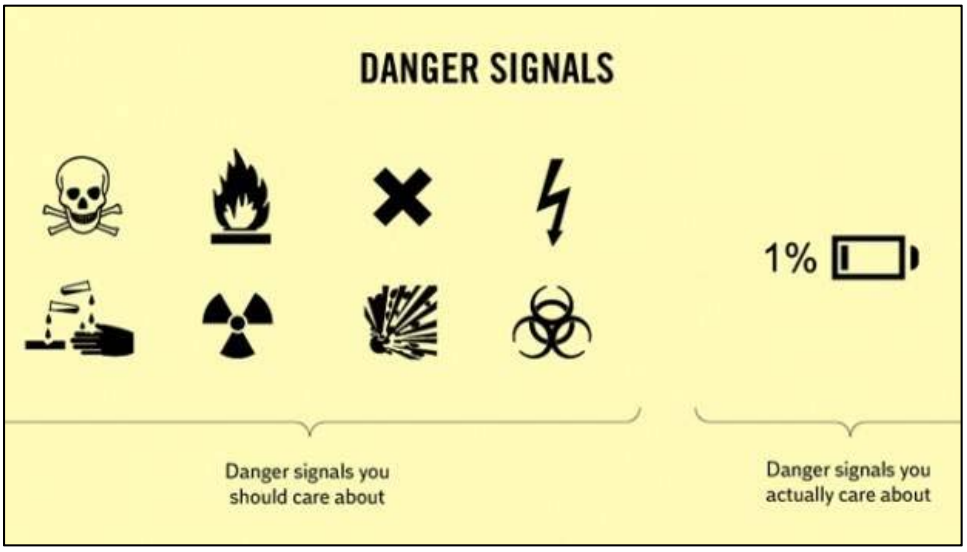
- Always clean up after yourself and work in a clean and tidy manner. Clean up spills immediately – a cleaner or work colleague may not know what the spill is. Return containers to appropriate places.
- Rinse and decontaminate all dirty glassware.
- Turn off equipment after use.
- Wipe down benches, close windows, doors and turn off lights.

## 4. Chemicals and hazardous substances

Understand the hazards and risks of the chemicals by reading your Control of Substances Hazardous to Health (CoSHH) forms and Material Safety Data Sheets (MSDS's) that come with every chemical. If in doubt, check first. There are some basic guidelines when using chemicals and these are identified below.

### 4.1. Labelling

All chemicals and reagents must be clearly labelled with the name of the contents, the date of preparation and your name. Be sure to use indelible ink and ensure the label is readily visible from a distance. Also make sure you are familiar with standard warning signs.



http://www.gizmodo.co.uk/2014/08/on-low-battery-and-other-dangers/

***Some standard warning signs – how many do you know?***

The symbols below indicate that the chemicals in question have extra hazards associated with them:

**Explosive**

**Flammable**

**Oxidizing**

**Corrosive**

**Toxic**

**Health Hazard**

**Environmental Damaging**

**Irritant**

### 4.2. Safe use, storage and disposal of chemicals

MSDS documents are provided with every chemical. These sheets will provide you with the information you need to use, store and dispose of your materials. Your MSDS and Risk Assessment will alert you to such specific dangers that may be associated with the storage of your chemical. For example, you may need to store it separately, apart from other chemicals, at a specific temperature or in a ventilated area. Flammables or corrosive chemicals should be locked up in special designed cabinet. Chemicals stored in work areas should only be those in frequent use and not in bulk quantities.

### 4.3. Handling chemicals

- Always wear appropriate gloves and a lab coat. Dispose of your gloves in the lab before leaving the lab and wash your hands.

- Dispose of hazardous materials safely as soon as possible after use.
- Never use a chemical without first undertaking a CoSHH assessment. You should know first how to deal with spills, or accidents such as ingestion, eye contact and exposure to the skin or wounds.
- Always use the appropriate bottle carrier provided when transporting Winchester bottles. Do not carry Winchester bottles by the neck.
- Return Winchesters of flammable solvents to the flammable solvent cabinets after use. Do not leave on floors, bench tops, open shelves, fume cupboards.

### 4.4. Carcinogens

Possible carcinogens are listed in two groups: Group 1 is regarded as known human carcinogens and Group 2 is probably/possibly human carcinogens. Whenever a member of staff introduces a new chemical to the laboratory, they must first check so that the necessary risk assessment can be made.

### 4.5. Disposal of chemicals

Use your MSDS and Control of Substances Hazardous to Health (CoSHH) form to identify how to dispose of the chemical you are using. If you are unsure, talk to your Lab Manager.

### 4.6. Spillages

Secure the area. If it is safe to do so, mop up the spillage with paper towels. Bag the towels for disposal. Ensure the area is completely safe before allowing the area to be accessible again. If in any doubt, contact the Lab Manager.

### 4.7. Controlled chemicals

There are three categories of chemicals which are controlled by Chinese Government: highly toxic chemicals, precursors to drugs and precursors to explosives. (List attached as Appendix H, I and J) No “highly toxic chemicals” are allowed on the campus of XJTLU. It is highly recommended to use substitute for these chemicals. If it is impossible to find substitute, please contact Lab manager for help. Purchasing of “Precursors to drugs” and “Precursors to explosives” need to be

centralized and get permit from government. You need to order them through the Lab Manager.

## 5. Biological safety

### 5.1 General information

Biological Safety refers to the use of things such as animal or human tissue, bloods, micro-organisms (viruses, fungi, parasites and bacteria), dangerous pathogens and genetic manipulation. All such work requires that you have Standard Operating Procedures (SOP) and Risk Assessments (RA) in place.

An infectious agent is considered to be a biological hazard if exposure may result in risk to the well-being of humans, animals, or plants. Infectious agents include, but are not limited to conventional pathogens, recombinant DNA research involving pathogenic vectors, agents carried in human tissue, and inherent and experimental infections of laboratory animals.

Molecular Biology and Microbiology laboratories are often unique work environments that may pose identifiable infectious disease risks to persons in or near them. Infections have been contracted in the laboratory throughout the history of research. To prevent infection, PIs must make an initial risk assessment based on the Risk Group (RG), followed by a thorough consideration of the agent itself and how it is to be manipulated.

Factors to be considered in determining the level of containment include agent factors such as:

- virulence
- pathogenicity
- infectious dose
- environmental stability
- potential routes of exposure
- communicability

□□laboratory procedures

□□quantity

□□availability of vaccine or treatment

□□gene product toxicity

□□physiological activity

□□allergenicity

Any strain that is known to be more hazardous than the parent (wild-type) strain should be considered for handling at a higher containment level. Certain attenuated strains or strains that have been demonstrated to have irreversibly lost known virulence factors may qualify for a reduction of the containment level compared to the Risk Group assigned to the parent strain. The containment level required may be equivalent to the Risk Group classification of the agent or it may be raised or lowered as a result of the above considerations.

### 5.2 Risk group classification

Laboratories in Biological department are designed for handling risk group 1 or risk group 2 materials. Research involving organisms in risk groups 3 and 4 are NOT permitted at XJTLU. Biosafety Level 3 or 4 facilities are NOT available on campus.

Table 1 WHO classification of infective microorganisms by risk group

*Table 1.* ***Classification of infective microorganisms by risk group***

**Risk Group 1** *(no or low individual and community risk)*
A microorganism that is unlikely to cause human or animal disease.

**Risk Group 2** *(moderate individual risk, low community risk)*
A pathogen that can cause human or animal disease but is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Laboratory exposures may cause serious infection, but effective treatment and preventive measures are available and the risk of spread of infection is limited.

**Risk Group 3** *(high individual risk, low community risk)*
A pathogen that usually causes serious human or animal disease but does not ordinarily spread from one infected individual to another. Effective treatment and preventive measures are available.

**Risk Group 4** *(high individual and community risk)*
A pathogen that usually causes serious human or animal disease and that can be readily transmitted from one individual to another, directly or indirectly. Effective treatment and preventive measures are not usually available.

## 5.3 Summary of Biological Safety Levels of Practices and Containment

There are four Biosafety Levels (BSL) that consist of combinations of laboratory safety practices and techniques, safety equipment and laboratory facilities. Each combination is specifically appropriate for the operations performed, for the documented or suspected routes of transmission of the infectious agents, and for the laboratory function or activity. The recommended Biosafety Level for an organism represents the conditions under which the agent can be ordinarily handled safely.

**Table** 2 Summary of Biological Safety Levels: describing the classification of agents, laboratory practices, safety equipment, and facilities

| BSL | Agents | Practices | Safety Equipment |
|---|---|---|---|
| 1 | Not known to consistently cause disease in healthy adults | GMT | None. Open bench work. |
| 2 | Associated with | GMT plus: | Open bench plus BSC for |

| | | | |
|---|---|---|---|
| | human disease, hazard = percutaneous injury, ingestion, mucous membrane exposure | Limited access<br>Biohazard warning signs<br>"Sharps" precautions<br>Biosafety manual defining any needed waste decontamination or medical surveillance policies | potential aerosols and autoclave.<br>PPEs: laboratory coats; gloves; face protection as needed |
| 3 | Indigenous or exotic agents with potential for aerosol transmission; disease may have serious or lethal consequences | BSL-2 practice plus:<br>Controlled access<br>Decontamination of all waste<br>Decontamination of lab clothing before laundering<br>Baseline serum | BCSs or other physical containment devices used for all open manipulations of agents; PPEs: protective lab clothing; gloves; respiratory protection as needed<br>Physical separation from access corridors<br>Self-closing, double-door access<br>Exhausted air not recirculated<br>Negative airflow into laboratory |
| 4 | Dangerous/exotic agents which pose high risk of life-threatening disease, aerosol- | BSL-3 practices plus:<br>Clothing change before entering<br>Shower on exit<br>All material | All procedures conducted in Class III BSCs or Class I or II BSCs in combination with full-body, air-supplied, |

| | | |
|---|---|---|
| transmitted lab infections; or related agents with unknown risk of transmission | decontaminated on exit from facility | positive pressure personnel suit<br>BSL-3 plus:<br>Separate building or isolated zone<br>Dedicated supply and exhaust, vacuum, and decon systems<br>Other requirements outlined in the text |

## 5.4 Warning Signs and Postings

The universally accepted biological hazard warning symbol must be used throughout the university to notify workers about the presence of infectious agents. The warning symbol must be removed when the hazardous agent is no longer in use or present.

**Biohazard**

- The location of the posting is determined by the access to the area where biological hazards are used.
- Doors to any laboratory containing a designated infectious agent must be posted.
- Postings must be displayed in other areas such as biosafety cabinets, freezers, or other specially designated work and storage areas or equipment where biological hazards are used.
- All individual containers of biological hazards must be labelled to identify the content and any special precautionary measures that must be taken.
- Universal biohazard labels must be affixed to containers of regulated waste, and refrigerators and freezers containing blood or other infectious materials.

- Labels must be affixed to other containers used to store, transport, or ship blood or other potentially infectious materials.
- Acceptable color-coded (red or orange) bags or containers may be substituted for labelling requirement.

## 5.5 Safety Equipment

Safety equipment includes biosafety cabinets, enclosed containers and other engineering controls designed to remove or minimize exposures to hazardous biological materials. The biosafety cabinet (BSC) is the principal engineering control used to provide containment of infectious splashes or aerosols generated by many microbiological procedures.

Safety equipment also may include items for personal protection such as personal protective clothing, respirators, face shields, safety glasses or goggles. Personal Protective Equipment (PPE) is often used in combination with other safety equipment when working with biohazards agents. In some situations, personal protective clothing may form the primary barrier between personnel and the biohazards agents.

a. Biosafety Cabinets

There are two types of BSCs in Biological department:

- □ The Class I BSC provides personnel and environmental protection but no product protection. It is similar in function to a chemical fume hood but has a HEPA filter in the exhaust system to protect the environment.
- □ Class II BSC (Types A1 and A2) are designed for work involving microorganisms assigned to Biosafety Levels 1, 2 and 3. These cabinets provide the microbe-free work environment necessary for cell culture propagation and other biohazards agent handling.

For specific instructions on how to properly operate your biosafety cabinet please contact the lab manager.

## 5.6 Personal Protective Equipment

Individuals will be encouraged to use appropriate personal protective equipment (PPE) as indicated by the PI and/or Biosafety Officer. Adequate PPE is provided at

no cost by the department to the students and researchers and must be readily accessible at the worksite. This includes, but is not limited to the following: gloves, gowns, laboratory coats, face shields or masks, head covers and eye protection.

- Gloves must be worn when it can be reasonably anticipated that the researchers or students may have hand contact with blood, other potentially infectious materials, mucous membranes, and non-intact skin and when handling or touching contaminated items or surfaces. Disposable single use gloves shall be replaced as soon as possible when visibly soiled, torn, punctured, or when their ability to function as a barrier is compromised. Hands must be washed each time gloves are removed. Disposable gloves shall never be washed or disinfected for reuse. Utility gloves may be disinfected for reuse if the integrity of the glove is not compromised. However, they must be discarded if they are cracked, peeling, discoloured, torn, punctured, or exhibiting any sign of deterioration.
- Cryo protective gloves must be worn when handling liquid nitrogen to prevent frostbite.
- Safety goggles must be worn when it can be reasonably anticipated that the researchers or students may perform tasks that could generate splashes or spatters and containment equipment is not required. Safety glasses must be worn when the anticipation of splashes and spatters have been eliminated by the use of containment equipment or tasks performed will not generate splashes or spatters.
- Masks and eye protection shall be worn whenever splashes, spray, droplets, or aerosols of blood or other potentially infectious materials may be generated and there is a potential for eye, nose, or mouth contamination.
- Laboratory coats, gowns, aprons, clinic jackets, or similar outer garment must be worn in situations where there is a potential for exposure to infectious agents.
- All PPE shall be removed immediately upon leaving the work area or as soon as possible if overtly contaminated and placed in an appropriately designated area for decontamination or disposal.
- The PI is responsible for arranging and enforcing laundering and disposal procedures for PPE. When PPE is removed, it must be placed in an appropriately

designated area or container for storage, washing, decontamination, or disposal.

## 5.7 Waste management

The following concepts and procedures can help to handle the biological waste generated by laboratories in a safe and efficient way. Methods of how to process biological waste on-site are particularly useful to minimize waste pickups and to handle small quantities of biological waste generated during research.

### 5.7.1 Housekeeping

- Areas where designated infectious agents are used should be cleaned on a regular basis by trained laboratory personnel with an appropriate disinfectant.
- Personal protective equipment such as gloves must be worn throughout the entire procedure.
- All equipment and working surfaces should be cleaned and decontaminated upon completion of procedures, spills, or after contact with potentially infectious materials.
- Decontamination must be performed using an appropriate disinfectant for the agent in use.
- If an area becomes contaminated with biohazards fluids, the fluid shall be absorbed with disposable absorbent material and placed in a biohazard container or bag. Protective coverings, such as absorbent paper, are to be removed and replaced when overtly contaminated or at completion of procedures.
- All receptacles intended for reuse, such as bins, pails, or cans that may be contaminated should be inspected and decontaminated on a regular basis.
- Broken glassware should be cleaned up using mechanical means, such as brush, broom, dust pans, tongs, forceps, etc and placed in a sharps container for later pickup.
- Equipment that may become contaminated with blood or other potentially infectious materials shall be checked routinely and prior to servicing or shipping and shall be decontaminated as necessary.

### 5.7.2 Sterilization and Disinfection

a. Sterilization

- Sterilization is a method or process to remove all viable microorganisms from an object or material.
- The process must consistently produce objects that are negative to chemical and biological indicators of contamination.
- Achieving sterility of the finished product depends on the number and type of organisms present, the temperature, and the length of contact time.
- Steam sterilization (autoclaving) will kill most microorganisms when steam under pressure is applied at 121°C for a minimum of 45 minutes.
- Sterilization will not be complete if steam does not reach all surfaces of the object, for example on items that have a high soil load and densely packed materials.
- Spore strips (B. stearothermophilus) can be placed at the centre of the autoclave pack as a biological indicator of sterility.
- Autoclave tape is not an indicator of sterility; it simply indicates that the proper temperature has been achieved on the surface.

b. Disinfection

- Disinfection must be utilized where sterilization is not practical, for instance, on tables, cabinets, and some equipment.
- Disinfection is the use of antimicrobial chemicals on inanimate objects with the purpose of destroying all non-spore forming organisms of pathogenic nature or which would compromise the integrity of the experiment.
- Disinfection does not mean the destruction of all organisms.
- Disinfectants destroy microorganisms by coagulating or denaturing proteins, injuring the cell membrane, and stopping normal enzymatic reactions.
- The range of susceptibility of microorganisms to disinfectants is relatively broad.
- The vegetative bacteria, fungi, and lipid containing viruses are highly susceptible to disinfecting agents.
- Non-lipid containing viruses are moderately resistant to these disinfecting agents.
- Spore forms are the most resistant to disinfectants.

- Use only disinfectants approved for use with a particular organism.
- There are many chemical disinfectants on the market, with the main constituent being one of the following: chlorine, quaternary ammonium compounds, alcohol, formaldehyde, iodine, phenolics, or glutaraldehyde. Choose proper chemical disinfectant according to the SOP provided by PIs.

5.7.3 Biological waste disposal

Biological or infectious waste is waste that has pathogens or biologically active material present in sufficient concentration or quantity so that exposure of a susceptible host could result in disease.

The two most common waste treatment methods utilized at XJTLU are steam sterilization and chemical disinfection. Each method requires strict adherence to the state rules and regulations in order to be an effective means of treating the waste.

- Steam Sterilization (Autoclave): Steam sterilization utilizes pressurized steam at 121 to 132 °C to kill pathogenic organisms that are present in the infectious waste. Steam sterilization process does not destroy the waste. Instead, it renders it non-infectious. Properly sterilized waste can be disposed of in the regular trash after placing the autoclaved bag containing the waste in a regular black household garbage bag. Standard operating procedures must include the following criteria:
    - o The proper bags must be utilized.
    - o The temperature of the autoclave must be at least 121°C.
    - o The pressure must be at least 15 psi.
    - o Waste must be treated for a minimum of 45 minutes.
    - o A sterilization indicator strip that changes color when operating parameters are achieved should be run with every cycle.
    - o Once the waste has been treated, it should be double bagged in thick black liners and placed in designated garbage containers.

- Chemical Disinfection: Aqueous or solid biohazard waste that does not contain hazardous materials can be disposed of through the sanitary sewer provided it is treated prior to doing so. In order for this waste to be disposed on in the proper

manner, the following criteria must be met:

o Disinfectants used must have been shown to be effective against the microorganisms present.

o The waste must be immersed for a minimum ten minutes in a freshly prepared solution of 10% bleach solution, 75% isopropanol solution or other acceptable disinfection methods.

The Department adheres to the policies outlined below. Contact your Lab Manager for further information.

| **Category of waste** | **Type of waste** | **Action by individual labs** |
|---|---|---|
| Solid Waste | • Plasticware for disposal (including plastic bijoux , universal caps plastic pipets, petri dishes, cell culture bottles, EP tubes etc.) | • Autoclave bag for autoclave<br>• Use autoclave tape<br>• Place in yellow medical waste bin |
| | • Hazardous chemicals | • Check with Lab Manager |
| | • Syringes needles,<br>• blades, | • Yellow sharps bin then autoclave when sharps bin 2/3 full<br>• Use autoclave tape<br>• To avoid potentially serious injuries, do not leave sharps unattended and never put them into ordinary waste bins |

| | | |
|---|---|---|
| | • Broken glass<br>• Other glassware for disposal | • Dispose in blue glassware collection bins<br>• New ones can be obtained from Lab Manager |
| Solid Waste | | |
| | • Waste paper (non-contaminated)<br>• other non-contaminated material (unless mentioned above) | • Place in refuse bags within laboratory bins |
| | • Batteries | • Recycle |
| | • Toner cartridges | • Recycle |
| | • Organic Solvents | • Do not mix organic and inorganic solvents<br>• Collect in 25L white bottle in the lab |
| | • Other hazardous chemicals | • Check with Lab Manager |
| Liquid Waste | | |
| | • Fluids (including cell cultures medium, unused culture media and other liquid bio-hazardous waste) | • Autoclave or mix with bleach for at least 2 hours (10% final concentration) then sluice.<br>• Use autoclave tape. |

Each working area should contain:

- An autoclave bag in waste bin
- A yellow sharps bin

- A yellow medical waste bin
- A large waste bin with disposable liner for waste paper and other non-contaminated waste as indicted in the table above.

Empty Winchester bottles should be recycled. Other non-contaminated, non-Pyrex large glass items should be disposed of in large glass bins.

5.7.4 Biological Spill Clean-Up Procedures

The following procedures are provided as a guideline to biological spill cleanup.

- Wear laboratory coat, eye protection and gloves during clean-up.
- Apply disinfectant and allow a minimum of 15-20 minutes contact time.
- Wipe up spillage with disposable disinfectant-soaked cloth or tissue.
- Wipe the walls, work surface and any contaminated equipment with a disinfectant-soaked cloth.
- Discard contaminated disposable materials in appropriate biohazard waste container(s) and autoclave before discarding as waste.
- Place contaminated reusable items in biohazard bags or in autoclave pans with lids before autoclaving and clean up.
- Expose non-autoclavable materials to disinfectant and allow 20 minutes contact time before removing from the biosafety cabinet.
- Remove protective clothing used during clean up and place in a biohazard bag for autoclaving. If disposable, treat as biohazards waste.
- Run cabinet 15 minutes after clean up before resuming work or turning cabinet off.

5.7.5 Emergency Procedures

The following items should be noted in the event of an accident, exposure, and/or spill:

- Attend to any injured personnel.
- Call lab manager 8188-0482 for emergency assistance.
- Notify EHS about a spill or exposure to a biohazards agent outside of

containment.

- Report exposures and injuries to lab manager.
- Report the Accident to the lab manager for a review of laboratory protocols and procedures.

## 6. General laboratory practices

There are some Standard Operating Procedures (SOP's) within the Department that all staff and students are likely to use and which have some specific hazards. The risks associated with these are outlined below.

### 6.1. Electrophoresis

Some electrophoresis systems employ lethally high voltages and almost all are potentially hazardous since they employ aqueous buffer solutions at voltages high enough to be dangerous to the operator if accidental contact occurs. It is very important to use an adequately shielded apparatus, an appropriately grounded and regulated power supply and, most importantly, common sense when carrying out electrophoresis experiments.

### 6.2. Chemicals

There are several hazardous chemicals commonly used in electrophoresis experiments:

- *Acrylamide* – is a neurotoxin and carcinogen. It is rapidly absorbed through the skin; therefore wear gloves, whether working with a solution or solid. Prepared solutions should be used wherever possible to avoid risk of dust inhalation/absorption. Gels should be poured over a tray so that any spilled acrylamide does not spread over the bench. Acrylamide solutions should be polymerized before disposal. It is strongly discouraged that you use the solid to weigh out and prepare solutions. If for some reason, it is necessary to do so, a mask must be worn when weighing it out to prevent inhalation.
- *Ethidium bromide* – is a powerful mutagen, therefore always wear gloves whilst handling gels or solutions containing dye and rinse apparatus thoroughly after use. Solutions of ethidium bromide should be passed through an ethidium

bromide extraction filter. You must record the volume passed through the filter. When the filter has reached full capacity, it should be disposed of as chemical waste. The filtrate should be flushed down the sink. Handling ethidium bromide:

- Ethidium bromide intercalates into DNA and forms an efficient energy transfer agent when stimulated with ultraviolet light
- Because it is so toxic, pre-prepared ethidium bromide stock solutions are highly recommended. Wear gloves and avoid splashes.
- Agarose gels contaminated with ethidium bromide should be disposed in designated bin.

**EB is not allowed to be used within the department.**

- *Formamide* – is a powerful mutagen/teratogen. Therefore wear gloves and avoid skin contact.
- *Coomassie blue* – is a carcinogen, therefore wear gloves and avoid skin contact.

### 6.3. Ultraviolet (UV) radiation

UV radiation is one of the best characterized causes of skin cancer. Exposure to longer wavelengths (>290 nm) can result in skin ageing, pigmentation abnormalities and cataracts of the eye. UV radiation presents a greater risk to "fair skinned" individuals.

As such, eye and skin protection must be used when handling UV light sources as it is extremely effective at causing tissue damage even for short exposures. Always cover any uncovered skin prior to UV exposure. Limit the exposure to other people working around you. A curtained-off area or contained room is advisable.

Gloves, a lab coat and full face visor labelled "Suitable for use with UV" must be worn when viewing ethidium bromide gels or when harvesting caesium chloride gradients containing ethidium bromide-stained DNA.

### 6.4. Light microscopy

To view things such as slides under light microscopy, the materials are typically fixed and stained. Fixatives such as formaldehyde and gluteraldehyde are toxic. Therefore, always wear a lab coat and gloves at all times. To avoid inhalation, wear a face mask when weighing out powders and dissolve in a fume hood. Dispose of waste solutions in a sink in a fume hood.

### 6.5. Phenol

Large volumes of phenol and phenol/chloroform (i.e. > 1mL) should be collected in Winchester bottles for disposal.

Contamination of skin with phenol and some of its derivatives may produce rapid collapse and death. Standard first aid treatment for chemical burns (washing the skin with water for 10-15 minutes) may increase systemic absorption and toxicity in the case of phenol burns. If spilt on skin (using gloves) remove contaminated clothing and then swab repeatedly with glycerol, glycerine, or polyethylene glycol (PEG) for 30 minutes.

**7. Work in BSL2 lab**All personnel assigned to The Lab shall read and comply with the procedures of this manual and meet with the BSO before starting work. In addition, they should be clearly instructed by their PI as to the procedures they must follow. The laboratory worker is responsible for proper labelling of all biological, chemical and radioactive materials within the facility. Any unsafe act or malfunctioning equipment should be brought to the immediate attention of the BSO and the PI. Employees should report to their PI and the BSO any instances which constitute an exposure to biological, chemical or radioactive materials. Individuals who are pregnant or immunocompromised should seek medical advice before working in a BSL-2 laboratory.

### 7.1 Physical containment features and zone classification

The term "containment" is used in describing safe methods for managing infectious

agents in the laboratory environment where they are being handled or maintained. The purpose of containment is to reduce or eliminate exposure potential or risk for laboratory personnel and others, and to prevent escape of potentially infectious agents to the outside environment. Primary containment, the protection of personnel and the immediate laboratory environment from exposure to infectious agents, is provided by good microbiological technique and the use of appropriate safety equipment. Secondary containment, the protection of the environment external to the laboratory from exposure to infectious materials, is provided by the combination of facility design and operational practices.

The biological safety cabinets (BSC) are among the most effective, as well as the most commonly used, primary containment devices in laboratories working with infectious agents. These cabinets when used in conjunction with good microbiological techniques provide an effective containment system for safe manipulation of moderate and some high-risk microorganisms.

The type of laminar flow biological safety cabinets utilized in The Lab is the Class II cabinets. This BSC is designed for work with low to moderate risk agents. The design features of this hood include: (1) an air barrier along the work opening prevents the escape of biological agents into the laboratory, (2) the air flow to the work surface is sterilized with a High Efficiency Particulate Air (HEPA) filter , and (3) the exhaust air is filtered by a HEPA-filtered to prevent contamination of the environment.
The air-handling system in the facility is designed in such a way that the air pressure in the facility is negative to that of the rest of the building, the air pressure in the laboratories are negative with respect to that of the corridor, and the air pressure in the biological safety cabinets are negative with respect to that of the laboratories. Thus, the direction of the air flow is always toward the area of increasing hazard. Exhaust air from the biological safety cabinet is HEPA-filtered before being released to the environment.

The facility is divided into two zones, a potentially contaminated zone and a non-

contaminated zone. The potentially contaminated zone is the primary containment zone, which includes the class II laminar flow biological safety cabinets. All work requiring BSL-2 containment must be conducted within these cabinets.

The open laboratory consists of the space exterior to the biological safety cabinet which is also considered potentially contaminated and constitutes the secondary containment zone. All work conducted in this space shall be in accordance with BSL-2 requirements. Other potentially contaminated zone also includes: the interior of the facility beyond the access door, the ventilation system up to and including the HEPA filters and the sewage system. The non-contaminated zone is associated with the area "external" to The Lab. Entry into The Lab is restricted to authorized personnel.

## 7.2 Facility assignment procedures

Any investigator desiring to use of the facility shall submit a written research proposal to the DBC and the BSO. This proposal must have the signature of the PI. Space in The Lab is allocated on a **temporary** basis and only to those persons who have completed the authorized user certification. This certification includes, but not limited to, an orientation to The Lab and a review of procedures while working in the facility. The DBC may approve the use of biohazard materials within The Lab. Biohazard material may not be used for any purpose, or in any other location, other than that originally approved by the DBC. Should a new project be initiated, a new written proposal should be submitted to the DBC and BSO. Personnel changes must be reported to the BSO as they occur. Once a year the BSO will generate a list of certified personnel and request that the PI verify that the list is current.
Upon completion of a project, the investigator is required to decontaminate and remove all materials and equipment in accordance with established procedures. The BSO will ensure that all materials and equipment have been decontaminated prior to removal from the laboratory.

## 7.3 Medical considerations

### A. MEDICAL RESTRICTIONS

Pregnant women, persons on steroid therapy or immunosuppressive drugs shall not work in the facility prior to a thorough evaluation of the risks involved. The decision to allow these persons to work in the facility is to be made by the University's EHS office and the responsible PI with notification to the BSO.

Persons with a fresh or healing laceration or skin lesions should not work with any infectious material unless the injury is completely protected. Personnel with injuries of this type must notify their PI and the BSO prior to working in the facility.

### B. REPORTING

Any illnesses or symptoms known to be associated with the infectious organisms, chemicals being used, or any change in the users' medical condition should be immediately reported to the PI and BSO.

An incident report is to be completed by the investigator and forwarded to the Biosafety Officer as soon as possible after the occurrence.

### C. MEDICAL PROTECTION

All authorized users should provide a record of Hepatitis B vaccination to the DBC before working in The Lab.

The BSO shall provide to all authorized users of The Lab, the current information on the availability of any medical protection (i.e., vaccines) appropriate for the infectious agents used in the facility. This protection shall be offered to all "at-risk" personnel.

## 7.5 Biohazard spill outside a biological safety cabinet (BSC)

If biohazardous material is spilled in the BSL2 laboratory, one must avoid inhaling any airborne infectious material and getting the infectious agent onto your body and

clothing. A "spill kit" is available in The Lab. You should always have a freshly prepared solution of a disinfectant in the event of a sudden spill in the laboratory. The BSO should be notified once the contaminated laboratory has been evacuated. Other users in the area are to be warned against entry.

Immediate Spill Control:
1. Evacuate all personnel and close the door.
2. Remove contaminated clothing carefully, folding the contaminated area inward. Place clothing in a bag or directly into the autoclave. Thoroughly wash your hands and face and any exposed area of the body. Shower, if necessary.
3. Notify the BSO and PI.

POST SIGNS ON THE EXIT DOOR TO WARN OTHERS NOT TO ENTER THE CONTAMINATED AREA. NO ONE SHOULD ENTER THE ROOM PRIOR TO EMERGENCY RESPONDER'S ARRIVAL. Time should be taken to formulate a plan to decontaminate. Once all personnel have left the area, there is no need to rush into the contaminated area.

Assist the BSO as necessary. Decontamination will involve treatment of gross contamination by local application of disinfectant and possible gaseous decontamination of the entire working space.

Decontamination of a spill:

1. Dress in protective clothing and wear double gloves. Respiratory protection is strongly recommended and care should be taken during decontamination not to disperse droplets.
2. Place paper towels along the outside of the spill, working from the edges toward the center. Pour the germicidal solution (10% solution of sodium hypochlorite (household bleach) or Virkon® S Disinfectant or its equivalent , around the spill and allow to flow into the spill. To prevent aerosols, avoid pouring the germicidal solution directly onto the spill. Try covering the spill with an absorbent pad and apply the decontaminant to the absorbent pad.

3. Allow to stand for 30 minutes, this will provide enough contact time for adequate disinfection.
4. Carefully remove the soaked pads, placing them into an autoclave bag. Working toward the center of the spill, use paper towels to wipe up the spill. Discard the paper towels into an autoclave bag.
5. Using paper towels soaked in disinfectant to wipe beyond the area of visible or suspected splashing, including the floor and vertical surfaces. Discard the paper towels in an autoclave bag.
6. Decontamination is complete when the whole area of suspected liquid contamination has been washed with a disinfectant and all excess decontaminate has been mopped up.

### 7.6 Biohazard spill inside a biological safety cabinet (BSC)

A spill that is confined to the interior of a BSC should present minimal or no risk to personnel in the area. However, chemical disinfectant procedures should be initiated at once while the cabinet ventilation system continues to operate to prevent escape of contaminant from the cabinet.

Spray or wipe, wall, work surfaces and equipment with a disinfectant. A 10% solution of sodium hypochlorite (household bleach) or Virkon type product is recommended. The operator must be properly gloved and gowned during this procedure. Household bleach can penetrate latex gloves and can be corrosive to metal and so any alternative to bleach should be considered .

Flood the work surface of the BSC with sufficient disinfectant solution to ensure that the drain pans and catch basins below the work surface contain sufficient disinfectant. Allow the disinfectant to work for 30 minutes before it is cleaned up.

Make sure to wipe all surfaces including the front intake grill. Drain the disinfectant into a container.

Repeat the above process with distilled water or mild soap and water.

If the disinfectant is suitable for autoclaving, put the gloves, wiping cloth and sponges into an autoclave bag; these materials should be autoclaved and discarded in the red bag system as medical waste.

If not disinfectant is not compatible with autoclaving (like bleach), place all materials in a red biohazard bag and dispose of as biological waste. The above process will not disinfect the filters, blower, air ducts, or other interior parts of the cabinet. The BSO should be consulted to determine if gaseous decontamination of these items is necessary.

### 7.7 Malfunction of biological safety cabinet

A failure of a BSC exhausts system is indicated by a red warning light (insufficient flow) and an alarm. When the alarm sounds, laboratory workers should follow these procedures:

1. Terminate the work.
2. Cover and contain all vessels containing infectious agents and contaminated equipment. Turn off all electrical equipment and services, i.e., gas and vacuum.
3. Notify others in the laboratory and leave the room.
4. Post signs to warn others about the malfunction.
5. Call the Biosafety Officer.
6. Remain available to provide assistance to the Biosafety Officer and supporting personnel.

### 7.8 Operational procedures

Only supplies and equipment related to the experiment or studies shall be introduced into the facility.

Supplies, equipment, etc., shall not be removed from the facility unless they have been sterilized or decontaminated under the supervision of the BSO.

In order to maintain the established, negative airflow pattern within the facility, all doors shall be kept closed at all time.

Use of hypodermic needles and syringes should be limited to operations or procedures for which there are no alternatives. All sharps should be disposed of in a sharps container.

Safe transportation of infectious materials within the facility requires the use of a secured, labeled non-breakable secondary container.

All activities involving infectious materials are to be conducted in a BSC. Handling these agents on open bench is NOT permitted.

Mouth pipetting is not allowed. Appropriate pipettes and pipetting aids are to be provided by the investigator.

Work surfaces shall be decontaminated daily and immediately following spills of biohazardous agents with Virkon® S Disinfectant or its equivalent or a designated disinfectant followed by rinsing with distilled water.

In all procedures, care should be taken to minimize creation of aerosols. Any aerosol generating procedure must be performed in a BSC.
All flasks, test tubes, etc., in which biological agents are grown or stored shall be appropriately covered to contain any potential spills.

Primary suction flasks must contain an appropriate liquid disinfectant (i.e., 10% household bleach) before use.

A separate solvent trap is required to capture volatile (?) solvents/chemicals; these chemicals are then properly disposed of under the supervision of the BSO.

Sinks within this facility are primarily a water source and hand washing station; they are NOT a disposal area. Contaminated liquids should be kept in a container and are not to be poured into the sinks. All wastes including tissue culture media, cultures, buffers, etc., must be autoclaved prior to disposal.

Due to the communal nature of the facility, all materials have the potential of being a hazard and should be treated with appropriate caution.

### 7.9 Waste disposal procedures

Each authorized user is responsible for autoclaving of his/her own waste materials and their subsequent removal from the autoclave. Scheduling is arranged among users.

### General Procedures

Solid waste containers (that do not have sodium hypochlorite solutions) are to be clearly labeled "Infectious" and lined with two autoclave bags. Waste materials are placed in the autoclave. The user must log in **each** autoclave use. When autoclaving is complete, the user is responsible for removing the waste from the autoclave and discarding it in the red barrels provided. Our typical recommended autoclaving cycle is 1 hour at 120°C. (or 250°F)

Used pipettes and pipette tips are to be placed in containers with sufficient disinfectant, to allow the disinfectant to contact with the entire pipettes or tips. Liquid disinfectants are to be used only for interim decontamination of items. Under no condition does this constitute a final procedure. Sharps disposal containers must contain sufficient appropriate disinfectant to cover all the items.

Liquid Waste

Liquid waste should be mixed with disinfectant (e.g., 10% household bleach) in the biological safety cabinet, whenever possible. Liquid wastes may be disposed of using methods approved by the Biosafety Officer.

**Never autoclave liquids in non-autoclave containers.**
**Never autoclave household bleach or other chemicals.**
**Never autoclave radioactive waste.**

Consult the Biosafety Officer for disposal techniques concerning hybrid waste material (e.g., radioactive/biohazardous waste).

Solid Waste

Media bottles, culture flasks, culture tubes, and any other vessels that may have come in contact with potentially infectious material must be decontaminated in the biological safety cabinet with sufficient disinfectant before being placed in biohazard bags and autoclaved.

Contaminated pipettes may be soaked in sufficient disinfectant for at least 30 minutes before autoclaving.

A disinfectant may be used in sharps containers but note that all sharps containers will be autoclaved before disposal.

Ordinary Waste

Limit the amount of ordinary trash (e.g., paper, cardboard) brought into The Lab by removing supplies from their outer packaging prior to stocking the laboratory.

Ordinary trash (paper, wrappers, and cardboard) is placed in the hallway for removal by the Housekeeping Staff. All ordinary trash that may be contaminated shall be autoclaved prior to exiting the facility.

**7.10 Facility operations:**

The following basic principles underlie the procedures for movement of personnel and equipment when the containment facility is in use:

Medical Survey must be obtained from the BSO before working in The Lab.

Within The Lab, appropriate protective clothing is always worn.

Protective clothing is to be removed when leaving the containment facility.

Equipment and material is "autoclave out" except for items unsuitable for autoclaving.

Alternative methods of decontamination are determined by the BSO.

PERSONNEL ACCESS AND EGRESS

1. Regulations for work inside The Lab

Disposable lab wear is to be changed weekly or as needed.

Shoe covers and head covers should be used when necessary.

When required by the BSO, maintenance personnel are to use disposable suits over street clothes. These suits are placed in a biohazard bag when exiting the facility for appropriate autoclaving and disposal.

2. Personnel Entering

Store personal items in assigned lockers.

Non-disposable cloth lab coats, as well as other laboratory attire, must not enter The Lab, lab coats may be hung on hooks, provided in The Lab.

Proceed to your work area in street clothing.

Don personal protective equipment which may typically consist of: disposable lab coat or disposable suit, shoe covers, head covers and double latex gloves.

3. Personnel Exiting

Remove outer pair of gloves when work is completed in biosafety cabinet.

Remove disposable lab coat, place it in infectious waste container or hang it on a coat hook in the facility laboratory.

Remove second pair of gloves.

Wash hands thoroughly before exiting.

Proceed to the corridor in street clothing and exit facility.

NO LABORATORY ATTIRE IS TO EXIT THE LAB.

4. Emergency Exit

In an emergency, personnel in the laboratories may leave via the access corridor without changing clothes, if the situation is significantly dangerous.

## 8. Electricity

The electricity in China is generally 220V, 50Hz.

## 9. Compressed gasses

Cylinders of compressed gas must only be used by those who have been properly instructed in their use and are aware of the hazardous properties of the compressed gas, such as its flammability, toxicity, supercooling or chemical activity. Cylinders must be transported by means of a suitable hand trolley and not lifted by the cap or dragged along the ground. They must be supported and secured in the vertical position at all times, whether in use or not, though there are exceptional, specific circumstances when liquid gas cylinders may be used in a horizontal position.

## 10. Pregnancy at work

Women who are pregnant, planning to conceive, who have recently returned to work and/or breast-feeding, should immediately undertake a risk assessment to ensure the safety of the mother and developing foetus. If you are unsure about any aspect of your work, and whether it presents a hazard you should consult your Lab Manager.

## 11. Safety and personal security

### 11.1. Accidents

If there has been an accident, in order:

- Without putting yourself at risk, make the situation safe for yourself and the casualty before approaching, e.g. switch off electricity, clear away broken glass.
- Give first aid if you are qualified.
- Phone for help on 120, if an ambulance is required, give the accident's detailed location, report numbers of casualties and what happened, describe injuries if possible.
- Fill in the Report of an Injury form and submit to the Lab Manager.

### 11.2. Chemical emergencies

The possibility of chemical emergencies and how they are to be managed should be covered by Control of Substances Hazardous to Health (CoSHH) assessment. Any casualty must receive priority and go to hospital if required, accompanied by data

sheets which should be readily available on the substances being used. Spillages must be cleared up at the same time if possible or immediately afterward, by a safe procedure to prevent further casualties or harm. Priority is to be given to splashes to the body. Adequate suitable materials for soaking up any foreseeable spillages must be available on site. Spill kits must be replenished after use.

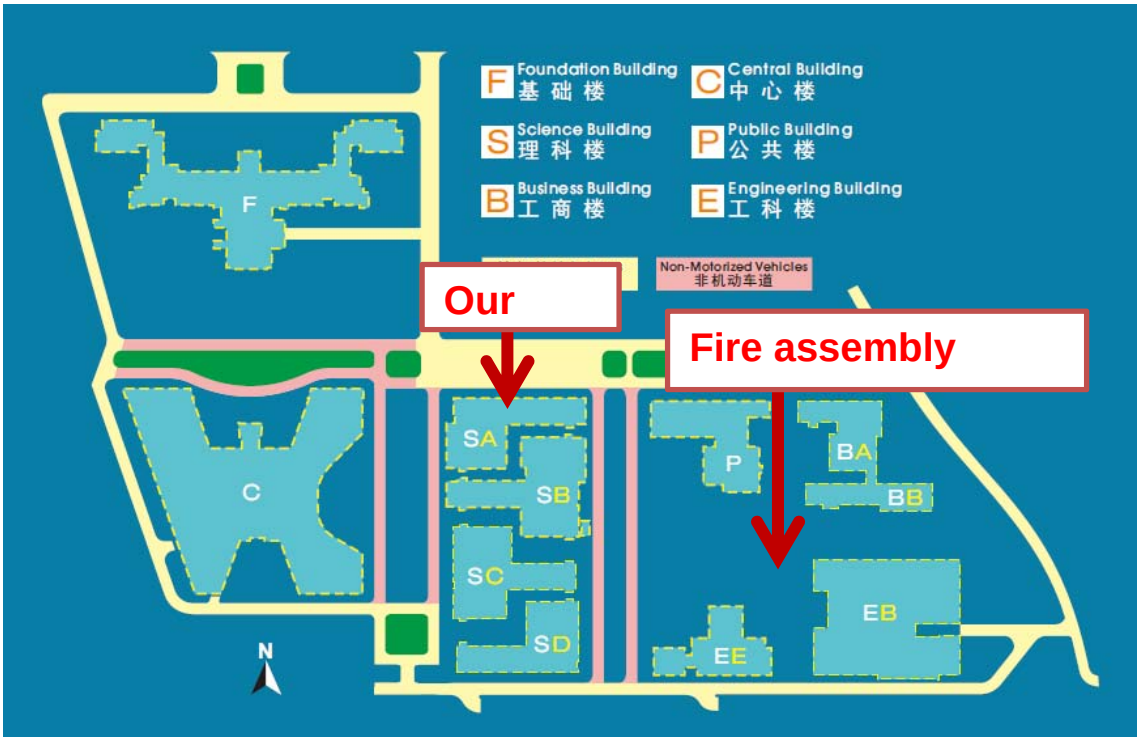
### 11.3. Evacuation drill

Evacuation drills occur infrequently but are important and must be undertaken promptly and responsibly. You should treat the drill as though a fire had been discovered and move to the assembly point without delay.

## 12. Fire

### 12.1. Fire alarms tests

If you hear the fire alarm, you must treat it as a genuine fire alarm and evacuate. Everyone should assemble at the assembly point showed in the map below:




### 12.2. Fire extinguishers

These should be used only if their use puts you at no risk; if the fire is small scale and readily manageable; and if you know which kind to use. Make sure you know the location and type of the fire extinguishers nearest to each place you work.

### 12.3. If you discover a fire

If you discover a fire in any building you should raise the alarm by breaking a red fire alarm call point or shouting "Fire", then, if you have exited to a safe location, call the Fire Service by telephoning **119** on an internal telephone to report:

- The exact location of the fire;
- Whether there are any special hazards;
- Whether there are any casualties

On hearing the Fire Alarm:

- Leave by the nearest exit without using any lift and proceed to the assembly point, without stopping to collect belongings or work items.
- Close doors and windows to limit any spread of fire as you pass by, as long as this does not delay your exit.
- Do not use the lift.
- If you were the person who detected the fire and raised the alarm, and have not already done so you must report it to Security by phoning **1061**.
- Return only after receiving authority from the Fire Brigade Officer or the Fire Safety Officer.
- It is important that you know your fire evacuation procedure.

## 13. Security at work

### 13.1. Personal security

The Department expects all members of staff to treat each other with respect, courtesy and consideration at all times. All members have the right to expect

professional behaviour from others, and a corresponding responsibility to behave professionally towards others.

Any person who makes any malicious accusations of bullying or harassment or threatens another person or their personal property will be subject to the University's Disciplinary Procedures.

If any member of staff has been subject to any personal threats by another member of staff they should report the matter to either their supervisor or central administration office. Personal items should be kept locked and out of sight. All incidents of theft or damage whether malicious or not should be reported.

**Appendix A**

**HEALTH AND SAFETY AGREEMENT FORM**

It is the policy of the Department of Biological Sciences to take all reasonably practical steps to ensure the safety, health and welfare of all employees and students in the Biological Sciences laboratories. To achieve this, everyone has a duty to co-operate by following the Standard Operating Procedures and Safety Rules laid down by the University and this Department as set out in the Department Health and Safety Manual.

Suggestions regarding the improvement of health and safety practices within the department are welcome. If any unanticipated hazard is identified, the Safety Officer MUST be consulted prior to commencing an activity. All accidents and incidents MUST be reported to the Departmental Health and Safety Officer and recorded in the Accident and Incident book. Students involved in experimental classes in the laboratories of the Department of Biological Sciences have to attend a Health and Safety Induction BEFORE starting any laboratory work.

Students must NOT work in labs without supervision and must NOT use equipment without proper training from staff (not other students). Faulty or damaged equipment must NOT be used.

---

**Part 1: Student information**

| | | | |
|---|---|---|---|
| Student name (English): | | Student ID no.: | |
| Student name (Chinese): | | Gender: | Male ☐ Female ☐ |

**Part 2: Medical information**

| |
|---|
| Do you have any known medical condition which might affect your participation in the laboratory work?<br>Yes ☐ No ☐ |
| If yes, please indicate:<br>eczema<br>epilepsy<br>antibiotic sensitivity<br>hyperallergic reactions<br>others:_____ (Please indicate) |

**Part 3: Declaration**

I, ……. (PRINT ENGLISH NAME) with ID number ……. (PRINT STUDENT ID NUMBER), have attended the Health and Safety Induction conducted by the Department of Biological Sciences, have read the Department Health and Safety handbook, understand my obligations, agree to carry out my work in accordance with them and agree to keep up to date regarding safe operating procedures. I declare that the information given within this Health and Safety Agreement Form is true and complete to the best of my knowledge.

…….. (SIGNATURE) …….. (DATE)

*Please return one signed copy of this document to the Department Health and Safety Officer and keep the*

*other for your reference.*

**Appendix B COSHH: SPECIFIC ASSESSMENT OF PROPOSED EXPERIMENT**

**Part I. Basic Information**

| |
|---|
| **Department:**<br>**Principal investigator / Responsible person:**<br>**Date of assessment:**<br>**Location of work** (Buildings and room numbers): |
| Briefly describe the activity/project |

**Part II. Substance Hazard Identification**

| |
|---|
| **Substances:** |
| **Quantity:** |
| **Maximum amount or concentration used**<br>Negligible ☐ Low ☐ Medium High ☐ |
| **Potential for exposure to hazardous substances**<br>Negligible ☐ Low ☐ Medium ☐ High ☐ |
| **Who might be at risk**<br>Staff ☐ Students ☐ Visitors ☐ Public ☐ Young people (<18yrs) ☐ New and expectant mothers ☐ Other ☐ |
| **Known Health Effects *(if necessary, refer to appropriate online database)*** |

**Part III. Control Measures**

| **Personal protective equipment (PPE)** *Specify which PPE(s) should be used* |
|---|
| Lab coat ☐ Overalls ☐ Chemical suit ☐ Disposable clothing ☐<br>Apron ☐ Spectacles ☐ Goggles ☐ Face shield ☐ Gloves ☐<br>Special headwear ☐ Special footwear ☐ Disposable mask ☐<br>Filter mask ☐ Half face respirator ☐ Full face respirator ☐ Other ☐ |
| **Storage of hazardous substances** |
| **Transport of hazardous substances** |

| | |
|---|---|
| | |
| **Waste management and disposal** *Specify the anticipated type of waste*<br>Liquid ☐ Solid Gas ☐ Inorganic ☐ Organic ☐<br>Aqueous ☐ Mixed ☐ Other ☐ | |
| **Instruction, training and supervision** | |
| Special instructions are required to safely carry out the work (If yes enter details below) | Yes ☐ |
| Special training is required to safely carry out the work (If yes enter details below) | Yes ☐ |

**Part IV. Emergency procedures**

| **Emergency procedures** | | |
|---|---|---|
| | | |
| **Minor spillage or release** | | |
| Specify procedure | | |
| Other actions | Evacuate and secure laboratory / area | Yes ☐ |
| | Inform competent person (eg principal investigator / school safety officer etc) | Yes ☐ |
| **Major spillage or release** | | |
| Specify procedure | | |
| Other actions | Evacuate building by fire alarm | Yes ☐ |
| | Call security and fire brigade | Yes ☐ |
| | Inform competent person (eg principal investigator / school safety officer etc) | Yes ☐ |
| **Fire Precautions** *Specify which fire extinguishing method(s) to use* | | |
| Carbon dioxide ☐ Water ☐ Powder ☐ Foam ☐ Blanket ☐ Automatic fire suppression ☐ Other ☐ | | |
| **First aid procedure** | | |
| **Waste Disposal procedure** | | |
| **Additional risks: (**for example circumstances where work will involve exposure to more than one substance hazardous to health, consider the risk presented by exposure to such substances in combination. Also, non-routine maintenance may present additional risk of exposure.) | | |

| **Emergency contacts (***PI or responsible person contact information should be provided***)** | | |
|---|---|---|
| Name | Position | Telephone |
| | | |
| **Sung Kay Chiu** | **Biosafety officer** | **81883224** |
| **Jie Jiang** | **Lab manager** | **81880482** |

| |
|---|
| **DECLARATION. The above is to the best of my knowledge an accurate statement of hazards and foreseeable risks. The procedures and precautions described will adequately control exposure to substances hazardous to health.** |
| Signature of student: Date: |
| Signature of assessor: Date: |
| Signature of Supervisor(if different from assessor): Date: |
| A copy of this assessment should be given to the research worker for insertion in his/her notebook, one should be retained by the assessor and one sent to the Departmental Safety Coordinator. |

**Appendix C**

**Department of Biological Sciences**

**APPLICATION FORM TO USE BSL2 LAB**

## Part 1: User information

| | | | |
|---|---|---|---|
| Name: | | Contact number: | |
| Principal investigator: | | HBV vaccine status: | Yes☐ No ☐ |

## Part 2: Project information

| |
|---|
| **Date of application:**<br>**Duration of the project:** |
| Briefly describe the activity/project including potential biohazardous involved: |

## Part 3: Declaration

I have attended the Health and Safety Induction conducted by the Department of Biological Sciences, have read the Department Health and Safety handbook especially Section 7 on the regulation regarding working in the BSL2 laboratory, understand my obligations, agree to carry out my work in accordance with them and agree to keep up to date regarding safe operating procedures.

I declare that the information given within this form is true and complete to the best of my knowledge.

(SIGNATURE) .....…….. (DATE) .....……..

PI's SIGNATURE .....…….. (DATE) .....……..

*Please return one signed copy of this document to the Department Health and Safety Officer and keep the other for your reference.*

**Appendix D**

**Department of Biological Sciences**

**STUDENT LAB WORK SUPERVISION CONFIRMATION LETTER**

**Student information**

| | | | |
|---|---|---|---|
| Student name (English): | | Student ID no.: | |
| Student name (Chinese): | | Gender:<br>Male ☐ Female ☐ | |

I hereby confirm that:

- the above-named student will work with me in lab ……..…… from …… (DATE) to …… (DATE).
- the student has attended safety training and past the safety test
- risk assessment has been done for the project
- health and safety form, CoSHH form have been done by the student
- I will ensure that the student will be trained before using any lab equipment
- I will arrange surveillance for students to work in the lab and take full responsibility for supervision.

**Signatures and date:**

Supervisor: …… Date: ……

Student: …… Date: ……

**Appendix E**

**Department of Biological Sciences**

**ACCIDENT AND INDIDENT REPORT FORM**

This form must be filled in by an employer or other responsible person.

**Part A: About you and your department**

| | |
|---|---|
| Name | |
| Position/Job title | |
| Department | |
| Office | |
| Telephone | |
| Email | |

**Part B: About the incident**

| | |
|---|---|
| On what date did the incident happen? | |
| At what time did the incident happen? | |
| Where did the incident happen? | |

**Part C: About the injured person**

(If you are reporting a dangerous occurrence, go to Part F)

| | |
|---|---|
| Name | Job title |
| Age | Gender Male ☐ Female ☐ |
| Home address and postcode | |
| Home phone number | |

**Part D: About the injury**

| | |
|---|---|
| What was the injury? | |
| Which part of the body was injured? | |
| Was the injury | a minor injury? ☐<br>a major injury or condition? ☐<br>a fatality? ☐<br><br>*(Note: please tick one box)* |
| Did the injured person | become unconscious? ☐<br>need resuscitation? ☐<br>remain in hospital for more than 24 hours? ☐<br>none of the above ☐<br><br>*(Note: please tick one box)* |

## Part E: About the kind of accident

| Please tick <u>one</u> box that best describes what happened, then go to Part F. | |
|---|---|
| Exposed to, or in contact with, a harmful substance | ☐ |
| Exposed to fire | ☐ |
| Exposed to explosion | ☐ |
| Contact with electricity or an electrical discharge | ☐ |
| Slipped, tripped or fell on the same level | ☐ |
| Injured while handling, lifting or carrying | ☐ |
| Hit something fixed or stationary | ☐ |
| Physically assaulted by a person | ☐ |
| Accidental ingestion of biological material | ☐ |
| Another kind of accident (describe it in Part F) | ☐ |

## Part F: Describing what happened

Give as much detail as you can (continue on a separate sheet, if necessary). For instance:

- The name of any substance involved
- The name of any kind of equipment involved
- The events that led to the incident
- The part played by any people

If it was a personal injury, give details of what the person was doing. Describe any action that has since been taken to prevent a similar incident.

**Part G: Signature**

Signature: ……

Chinese Name (print): ……

English Name (print): ……

Date: ……

**Appendix F**
**Department of Biological Sciences**
**CODE OF PRACTICE FOR WORK WITH ACRYLAMIDE SOLUTIONS**
(adapted from the UoL Code)

## 1. Introduction

Work with carcinogens is normally subject to the XJTLU Code of Practice for Work with Carcinogens, Mutagens and Teratogens (adapted from the UoL Code). However, because of the widespread use of acrylamide solution in electrophoresis, that Code makes provision for this shorter version. This present Code applies to the use of acrylamide solution; any use of solid acrylamide (which should be avoided if possible) must comply with all the provisions of the full Carcinogens/Mutagens/Teratogens Code.

## 2. Toxicity of Acrylamide

### 2.1 Cancer

Under the COSHH (Control of Substances Hazardous to Health) Regulations, acrylamide is a carcinogen, i.e. an agent which increases the incidence of malignant tumours, and consequently it needs special control. Containers of acrylamide now state "May cause cancer". Acrylamide is a carcinogen in Category 2, which covers:

> *"Substances which should be regarded as if they are carcinogenic to man. here is sufficient evidence to provide a strong presumption that human exposure to a substance may result in cancer, generally on the basis of appropriate long-term animal studies and other relevant information".*

Unlike many harmful effects of chemicals there is usually no early indication that a person has been dangerously exposed to a chemical carcinogen - it may take up to 30 years before symptoms appear. It is therefore of great importance that all staff and students observe the correct working principles in order that they do not place at risk their own or others' health and safety.

Smokers should bear in mind that exposure to some carcinogens, together with smoking, is known to have a synergistic effect, i.e. the combined risk is greater than the sum of the separate risks.

### 2.2. Other Toxicity

Acrylamide causes chromosome damage in vitro and in bone marrow in vivo. It should be regarded as mutagenic to humans, capable of producing heritable damage to germ cells. It is also a neurotoxin, causing disorders of the nervous system including fatigue, muscle weakness, tremors, numbness of the extremities and other sensory defects. There is evidence that this effect is reversible, but recovery is very slow. Acrylamide can also cause blistering and peeling in contact with the skin.

Clearly it is crucial to avoid any contact with acrylamide solution. The most likely mode of absorption is via the skin, and precautions against this must be rigorously observed, including precautions against contaminating the environment.

### 3. Precautions

The following precautions apply in addition to the **standard precautions** detailed in Circular SCR18 (from the UoL) "CoSHH: Control of substances hazardous to health," which should be studied together with this document.

### 3.1 Assessment and Notification

Acrylamide should only be used where no safer alternative exists, and where justified by the importance of the experiment.

Increasingly precast gels are being used. Where a precast gel is available, its use should be considered and if suitable for the work it should be used in preference to working with acrylamide monomer.

Acrylamide should be purchased in solution. There should normally be no reason (other than a small reduction in cost) for obtaining it in solid form. However, if there is no alternative, then the full carcinogens/mutagens/teratogens code, rather than this code, applies to use of solid acrylamide.

Use of acrylamide solution requires a **specific assessment** using the form attached. A separate form is needed for each worker, but one form may cover successive experiments of the same type. The precautions required by the assessment should include those set out in this code and any others which are considered to be necessary. The assessment must be approved by the Departmental Safety Officer as well as the supervisor.

All work involving use of carcinogens must be notified to the Head of Department, who is responsible to Senior Management Team under the University Safety Policy for ensuring, so far as reasonably practicable, that safe systems of work are used and that substances are stored and handled in a safe manner. Notification must include the quantity of the compound involved (or approximate rate of use for regular work), the name of the worker involved, and the nature of the work as well as the **specific assessment** covering the work to be done. The smoking status of workers should be noted. All this information must be kept on file for at least forty years.

A **specific assessment** form which incorporates these details is attached at the end of the Code. This should be completed and sent to the Head of Department, Departmental Safety Officer, and Safety Adviser before work starts. The form requires consideration to be given to foreseeable contingencies such as spillage, leakage or emergency. Further guidance on these is included in **standard precautions** (see SCR18 from the UoL).

Acrylamide should be used as little as possible in undergraduate experiments and only in circumstances where an adequate degree of supervision can be exercised. If so used, the experimental protocol must warn that it is carcinogenic, mutagenic and neurotoxic and must specify appropriate precautions, but **specific assessments** and notification to Occupational Health are not required.

### 3.2 Storage and Issue

The minimum possible quantities should be ordered and kept. Acrylamide solution must only be issued to or obtained by individuals who have read a copy of this Code of Practice and signed a statement to that effect (included in the **specific assessment** form). Before acrylamide solution is ordered, **specific assessments** must be completed for each user. Any issue from stores should be documented with the name of the person to whom it was supplied.

Acrylamide solution must be kept in strong tightly-stoppered containers, clearly labelled and carrying a clearly visible label stating "May cause cancer" together with the toxic hazard sign (skull and crossbones). It is advisable that this container should be placed inside an unbreakable outer container carrying an identification of the substance and the same warnings. Storage should be in a cool place.

### 3.3 Working Areas

Work with acrylamide solution must be carried out in a suitable laboratory. There must be sufficient working space that working areas do not need to become cluttered. The University Carcinogens/Mutagens/Teratogens Code normally requires a warning notice on the door of every laboratory where carcinogens are used. However an acceptable alternative in departments where extensive use is made of acrylamide is to place permanent notices at all entrances so that maintenance staff visiting the building can easily see them. These should state:


**WARNING! Experiments with cancer-causing substances are in progress in several laboratories in this building.**

**Do not start work in any laboratory without authorisation from a senior member of Departmental staff.**

Rooms must have hand-washing facilities including soap and disposable towels. Hands must be washed after the completion of any procedure in which acrylamide solution has been used, using cold water first, before any soap is used. This will normally be after the removal of gloves (see 3.4 below), but accidental contamination of gloves or skin must be washed off immediately.

Precautions must be taken against spillage or breakage of apparatus. This should normally be done by working inside a spillage tray (stainless or stove-enamelled steel). For small quantities it may be an adequate alternative to cover the working space with clean dry plastic - or foil-backed absorbent paper (Whatman 'Benchkote' or equivalent), which should be rolled up from the edge to the middle when the work is completed, and consigned for incineration.

**3.4 Protective Clothing**

Protective clothing, although necessary, should be thought of as the last line of defence; normally the substance should be contained and there should be no contamination of protective clothing. Any manipulation or procedure that causes contamination of protective clothing is unsatisfactory and should be improved.

Suitable clothing is a high-necked, side-or-back-fastening laboratory coat with elasticated cuffs, a disposable polyethylene apron and gloves. Gloves should be known to be resistant to acrylamide (e.g. nitrile, butyl rubber, or polythene; not PVC or latex). *N-Dex* disposable nitrile gloves are one type that has been found acceptable. At the end of each work period or if splashed, disposable gloves must be removed inside out and consigned for incineration; reusable gloves must be decontaminated by rinsing.

Laboratory coats should either be disposable or sent for laundry at least weekly. However, if such coats are known or believed to be contaminated with acrylamide, they must not be sent to the laundry, but decontaminated or incinerated. Small spills (no more than 5 mls) on to a laboratory coat may be polymerized in situ by soaking the affected area in freshly made 1 mg/ml ammonium persulphate. Do not rinse monomeric acrylamide into the sink of drains.

Experimental techniques should minimise splashing, but visors should be available for use when appropriate.

**3.5 Cleanliness and Tidiness**

Good housekeeping practices are necessary with all chemicals, but it is particularly important that rooms where carcinogens are used are kept clean and tidy. Immediately a procedure has finished, the spillage tray and apparatus and work surfaces must be cleaned. Cleaning procedures should minimise the generation of aerosols and dispersal of dust. Cleaning materials known or suspected to be contaminated must be consigned for incineration. No part of the laboratory, including the inside of fume cupboards, and no piece of equipment, even if it is used only for the handling of these materials should be allowed to remain contaminated. Care should be taken to avoid the contamination of drawer and door handles; gloves should be removed before these are touched.

**3.6 Experimental Technique**

Technique should be of the highest order to minimise splashes, spills or the generation of aerosols. There should be no licking of labels. All necessary equipment should be assembled before the work is begun (this procedure will help to avoid the contamination of door and drawer handles).

### 3.7 Disposal

Disposal of acrylamide requires precautions in addition to those required by **standard precautions** (see SCR18 from the UoL). Materials consigned to the University Waste Chemical Services which are known or suspected to be contaminated with acrylamide must be doubly wrapped in suitable plastic bags. Each bag must be sealed and clearly labelled to indicate that it contains carcinogenic material.

Most acrylamide solution used in laboratories is converted to polyacrylamide gel, containing very low levels of free acrylamide. If standard methods are used and polymerisation proceeds normally, then the resultant gel should not be regarded as carcinogenic, and the carcinogens code does not apply to it, although it is still prudent to wear gloves where there is any chance of contact with the skin.

If polymerisation does not proceed as expected then it must be assumed that significant free acrylamide is present. See SC48 (from the UoL) for more information on waste disposal in general.

### 3.8 Monitoring

The Supervisor and Departmental Safety Coordinator should monitor that the working environment and systems of work are in accordance with this code of practice.

Enquires about the application of this Code of Practice should be to your Departmental Safety Officer in the first place, or to the University Safety Adviser.

**Appendix G**

**CODE OF PRACTICE FOR WORK WITH CHEMICAL CARCINOGENS, MUTAGENS AND TERATOGENS**

**(Adapted from the UoL Code)**

## 1. Introduction

The Control of Substances Hazardous to Health (CoSHH) Regulations require that assessments are made of every use of a substance hazardous to health.

This Code of Practice has to be read in conjunction with the separate document "CoSHH: Control of Substances Hazardous to Health" (Safety Circular SCR18 from the UoL). That document, which has been widely distributed, constitutes a generic assessment setting out **standard precautions** for use of substances hazardous to health and the conditions where they apply, and provides a proforma for preparing **specific assessments** where necessary.

Because of the special nature of carcinogenic, mutagenic and teratogenic hazards, extra precautions, in addition to **standard precautions**, are required in nearly every case where such hazards are present.

The Head, Chairman or Manager of each Department or other unit is responsible to the Senior Management Team for ensuring, so far as reasonably practicable, that this Code of Practice is observed.

## 2. Carcinogens

A carcinogen is an agent which increases the incidence of malignant tumours. There is evidence that, in the past, chemical laboratory workers have had an increased risk of contracting cancer and this may well be due to past exposure to carcinogens in the laboratory. Unlike many harmful effects of chemicals there is usually no early indication that a person has been dangerously exposed to a chemical carcinogen – it may take up to 30 years before symptoms appear. It is therefore of great importance that all staff and students observe the correct working principles in order that they do not place at risk their own or others' health and safety. Some biological agents can also cause cancer, but these are not covered by this code, which is about chemical agents. For the purpose of this code, "carcinogens" are regarded as substances officially classified as Category 1 or 2 carcinogens (see section 6, below).

## 3. Mutagens

Mutagens are substances that cause heritable genetic changes (mutations). Most mutations are harmful. However, some mutagens cause mutations in bacteria with no evidence of mutagenic effect on humans.

For the purposes of this code, mutagens requiring extra controls beyond CoSHH **standard precautions** are those recognised as having mutagenic effect on humans, of which relatively few have been identified (see section 6.2).

**4. Teratogens and Embryotoxins**

About three per cent of all babies suffer from some form of congenital malformation or disability. Exposure of the mother to certain substances (e.g. thalidomide or large amounts of alcohol) is known to increase the risk of malformation. These substances are known as teratogens.

There is some evidence that, in the past, children of laboratory workers have had an increased risk of suffering congenital malformation. Although there is little conclusive evidence about the teratogenic risk to humans of specific chemicals commonly encountered at work, it is clearly appropriate to take special care when there is evidence that a substance is teratogenic.

Risk to offspring may occur either through alteration of parental germ cells before conception or through toxic effects during pregnancy. Regarding the second effect, if a quantity of chemical is absorbed which is high enough to cause a toxic effect in the mother then it is likely also to affect the foetus; therefore, a chemical is normally only regarded as a teratogen or embryotoxin when it causes an effect at a dose which is not toxic to the mother.

Effects of the first kind may affect male sperm as well as female ova. In adults, male sperm are more susceptible to mutation but effects are likely to diminish after exposure to the agent is removed, whereas damage to female ova is more likely to be permanent. There can be damage to developing foetal gonads, so that exposure of a pregnant woman could put her children's children at risk.

Damage to the embryo, or fertilisation following damage to ovum or sperm, often leads to spontaneous abortion. In many cases the same chemical appears to cause higher rates of birth defects and of spontaneous abortion (it is thought that in many cases where a large dose causes a spontaneous abortion, a smaller one may cause abnormality) and the two effects are covered in this Code under the heading of teratogens and embryotoxins (see section 6.3).

**5. Pregnant Laboratory Workers**

Strict controls must be observed by all who work (including students) with teratogens or embryotoxins, but particular attention is required by pregnant women or women hoping to become pregnant. Precautions in relation to pregnancy are set out more fully in safety circular SC66: “New and expectant mothers – risk assessment”[available from the UoL], which applies not only to chemical teratogens and embryotoxins, but other hazards also.

Every Department must ensure that women working with, or likely to come into contact with, suspect or known teratogens are warned of the risk of the particular substance(s) and advised that they should notify the Head of Department in writing if they become pregnant, so that risks during pregnancy can be carefully

considered.

**Advice to Pregnant Workers**

You should notify your Head of Department in writing once pregnancy is confirmed, so that checks can be made that your working conditions are safe for you and your baby. It is your Head of Department's responsibility to see that a proper risk assessment is made of the work you do. If you need advice about the risk assessment or about hazards in relation to your work, contact your Departmental Safety Officer or the University Safety Adviser. If advice about fitness to work is required, members of staff should contact their Section HR manager who may refer them to the Occupational Health Service.

Once an employee tells the employer that she is pregnant, a more specific risk assessment is carried out, as set out in safety circular SC66 (from the UoL), covering all hazards. If she is working with teratogens/embryotoxins, the risk assessment will include a check that there is a CoSHH **specific assessment** and that strict precautions are being observed. Even though hazards should already be well controlled, further consideration should be given at this stage to the possibility of accidents. For example, accidental spillage in spite of precautions should be considered if a significant quantity of teratogen/embryotoxin is used.

In the unlikely event that the risk assessment shows that there is a significant risk at work to the health and safety of the expectant mother, working conditions must be adjusted.

## 6. Application of the Code

### 6.1. Definition of "Carcinogen"

**"Carcinogen"** is defined in the COSHH (Control of Substances Hazardous to Health) Regulations as any substance or preparation which, if classified in accordance with the Chemicals (Hazard Information and Packaging) (CHIP) Regulations, would be classified as carcinogenic (Category 1) or carcinogenic (Category 2). In addition a small number of other substances are classified by COSHH as carcinogens.

The CHIP Regulations recognise three groups of carcinogens:

**Category 1 -** Substances known to be carcinogenic to man.

**Category 2 -** Substances which should be regarded as if they are carcinogenic to man. There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in developmental toxicity, generally on the basis of appropriate long-term animal studies and other relevant information

**Category 3 -** Substances which cause concern for man owing to possible carcinogenic effect but in respect of which the available information is not adequate for making a satisfactory assessment. There is some evidence from appropriate animal studies, but this is insufficient to place the substance in Category 2.

Under the CHIP Regulations, substances in Categories 1 and 2 are marked ***"May cause cancer".*** This Code of Practice applies to these substances and to any other substances not classified under CHIP, where there is strong evidence which could justify inclusion in Category 1 or 2.

This Code does not apply to substances in Category 3, i.e. those marked ***"Possible risk of irreversible effects",*** or to substances described as "suspect carcinogens" in earlier versions of this Code, or in suppliers' literature, unless there is strong evidence which would justify inclusion in Category 1 or 2. Category 3 substances are covered by the general requirements of the COSHH Regulations, like other toxic substances. They should be dealt with according to the principles of Safety Circular SCR18 (from the UoL), "CoSHH: Control of Substances Hazardous to Health". This includes a duty to inform users about the risks of substances hazardous to health.

**6.2. Definition of "Mutagen"**

**"Mutagen"** in this Code of Practice means a substance classified under CHIP as a mutagenic risk to humans, and marked ***"May cause heritable genetic damage***". At the time this revised code was produced there was only one substance officially classified as a **mutagen** which is not already on the list as a **carcinogen** or **teratogen**.

**6.3. Definition of "Teratogen"**

**"Teratogen"** in this Code of Practice means a substance which is a recognised human teratogen/embryotoxin or which should be regarded as a human teratogen/embryotoxin, i.e. classifiable as a Category 1 or Category 2 developmental toxin under the CHIP Regulations.

The CHIP Regulations have three categories:

**Category 1 -** Substances known to cause developmental toxicity in humans.

**Category 2 -** Substances that should be regarded as if they cause developmental toxicity in humans. There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in developmental toxicity, generally on the basis of appropriate long-term animal studies and other relevant information

**Category 3 -** Substances that cause concern for humans owing to possible developmental toxic effects, generally on the basis of animal studies which provide evidence to cause strong suspicion, but where the evidence is insufficient to place the substance in Category 2.

Under the CHIP Regulations, substances in Categories 1 and 2 are marked ***"May cause harm to the unborn child".*** This Code of Practice applies to these substances and to any other substances, not classified under CHIP, which meet the criteria for Categories 1 and 2.

This code does not apply to substances in Category 3, i.e. those marked ***"Possible risk of harm to the***

***unborn child",*** or to substances described as "suspect teratogens" in earlier versions of this code, or in suppliers' literature, unless there is strong evidence which would justify inclusion in Category 1 or 2. Category 3 substances are covered by the general requirements of the COSHH Regulations (see SCR18). This includes a duty to inform all users about the risks, including suspect developmental toxicity.

A list of **carcinogens, mutagens** and **teratogens** appears in the Appendix. It is intended for guidance and does not claim to represent an exhaustive list of the substances in these categories. It is the responsibility of the individual to secure the latest information on any material he or she proposes to handle. Substances imported from outside the EU (notably the USA) may be labelled according to a different system. Nevertheless users should classify substances in accordance with the Appendix to this Code or the CHIP Regulations. If necessary the Safety Adviser should be consulted.

Some research indicates that exposure to solvents may be a teratogenic risk factor. The Appendix does not contain common solvents unless there is sufficient evidence against a specific solvent, but workers should take care to minimise their exposure to solvents in general.

The precautions for working with **teratogens** apply to men just as much as to women. Of course, it is especially important that the precautions in this Code are observed by women when pregnancy is a possibility because of the extra risk of damage to the embryo before pregnancy is confirmed. Observance of section 5, above, should minimise this risk. However, the possibility of damage mediated by the father cannot be ruled out; neither can the risk of environmental contamination caused by unsafe methods of work. The special precautions required for **teratogens** are designed to ensure that material is well contained and accounted for; consequently this Code should be observed by all who work with these materials, male and female.

There may be situations where the quantity of material to be used is so tiny that, even after allowing an appropriate safety margin, no realistic carcinogenic or teratogenic risk appears to exist. In such circumstances, if the precautions in section 7 present difficulty, the University Safety Adviser should be consulted.

### 6.4. Acrylamide

The Category 2 carcinogen acrylamide presents special difficulties because it is widely used in electrophoresis, and there appears to be no practical alternative. Acrylamide should normally be obtained in solution, to avoid the need for weighing out the solid. If it is essential to use solid acrylamide, the full precautions in this code are required, but when using solutions, some modifications are possible. XJTLU's "Code of practice for work with acrylamide solutions" sets out the relevant precautions.

### 6.5. Sodium azide

Sodium azide may be fatal if inhaled, absorbed through the skin or swallowed. It reacts with many heavy metals to form explosive compounds. Heating may cause an explosion. Causes eye, skin, and respiratory tract irritation. Contact with acids liberates toxic gas. Readily absorbed through the skin. Toxic to aquatic

organisms, may cause long-term adverse effects in the aquatic environment. Store and use of sodium azide requires full precautions.

Departments regularly using any other **carcinogen, mutagen** or **teratogen** may also, if they wish, prepare a document which includes all relevant extracts from this code, to be given to users. It should be authorised by the Safety Officer before use.

## 7. Precautions for Carcinogens, Mutagens and Teratogens

The following precautions are in addition to standard precautions (see SCR18 from the UoL)

### 7.1. Assessment and Notification

**Carcinogens, mutagens and teratogens** should only be used where no safer alternative exists, and where justified by the importance of the experiments.

A CoSHH **specific assessment** (see SCR18 from the UoL) must be prepared before the work is started. The precautions required by the assessment should include those set out in this code and any others which may be considered to be necessary. The assessment must be approved by the Departmental Safety Coordinator as well as the supervisor.

All work involving use of **carcinogens, mutagens and teratogens** must be notified to the DSC and to the Head of Department, who is responsible to the Senior Management Team under the University Safety Policy for ensuring, so far as reasonably practicable, that safe systems of work are used and that substances are stored and handled in a safe manner.

Notification must include the quantity of the compound involved (or approximate rate of use for regular work), the name of the worker involved, and the nature of the work as well as the **specific assessment** covering the work to be done. The smoking status of workers should also be noted and they should be warned of the possibility of a synergistic effect.

A **specific assessment** form which incorporates these details is attached at the end of the Code. This should be completed and sent to the Head of Department, Departmental Safety Coordinator, and Safety Adviser before work starts. The form requires consideration to be given

to foreseeable contingencies such as spillage, leakage or emergency. Further guidance on these is included in **standard precautions** (see SCR18 from the UoL).

**Carcinogens**, **mutagens and teratogens** should not be used in undergraduate experiments other than in exceptional circumstances and when an adequate degree of supervision can be exercised. See section 5 for extra precautions with **teratogens.**

### 7.2. Storage and Issue

The minimum possible quantities should be ordered and kept. **Carcinogens, mutagens and teratogens** must only be issued to or obtained by individuals who have read a copy of this Code of Practice and signed a statement to that effect (included in the **specific assessment** form). Before a **carcinogen, mutagen or teratogen** is ordered, **specific assessments** must be completed for each user. Any issue from stores should be documented with the name of the person to whom it was supplied.

Materials must be kept in strong tightly-stoppered containers, clearly labelled and carrying a clearly visible label stating "May cause cancer," "May cause heritable genetic damage," or "May cause harm to the unborn child," together with the toxic hazard sign (skull and crossbones). In many cases it is advisable that this container should be placed inside an unbreakable outer container carrying an identification of the substance and the same warnings. Storage should be in a cool place. Containers must only be opened in an efficient fume cupboard or local exhaust hood or glove box, taking precautions against a build-up of internal pressure.

### 7.3. Working Areas

Work on significant quantities of **carcinogens, mutagens** or **teratogens** must be carried out in a suitable laboratory. It must have mechanical ventilation during the hours it is occupied. There must be sufficient working space that working areas do not need to become cluttered. Where there may be risk to maintenance personnel, the door should be identified with a notice saying:"Danger! Experiment with carcinogens (or mutagens, or teratogens) in progress. Do not start work in this laboratory without authorisation from.... [name]"

The name of a responsible person or persons should be indicated. These notices should be used sparingly and removed when no longer required. Cleaning should be carried out when the room is occupied, and cleaners should be reminded not to handle bottles or anything which is likely to be contaminated. The room must have hand-washing facilities including soap and disposable towels. Hands must be washed after the completion of any procedure in which a carcinogen or teratogen has been used, using cold water first, before any soap is used. This will normally be after the removal of gloves (see 7.4 below), but accidental contamination of gloves or skin must be washed off immediately.

All materials, except those of negligible volatility, must be used either inside a fume cupboard or exhaust hood with a face velocity of at least 0.5 m/sec at 0.5 m aperture or, for significant quantities of the most potent materials, inside a sealed glove box kept at negative pressure relative to the atmosphere.

When weighing out **carcinogens, mutagens or teratogens,** weigh a sealed container. Then, inside the fume cupboard or glove box transfer the material into the pre-weighed container

inside a spillage tray. Reseal and weigh again. Repeat until you have the amount of material needed. Do not handle **carcinogens, mutagens** or **teratogens** over the balance. It is easier to adjust the amount of solvent rather than to weigh a fixed amount when preparing solutions.

Precautions must be taken against spillage or breakage of apparatus. This should normally be done by

working inside a chemically resistant spillage tray (stainless or stove-enamelled steel). For small quantities it may be an adequate alternative to cover the working space with clean dry plastic - or foil-backed absorbent paper (Whatman 'Benchkote' or equivalent), which should be rolled up from the edge to the middle when the work is completed, and consigned for incineration.

### 7.4. Protective Clothing

Protective clothing, although necessary, should be thought of as the last line of defence; normally the **carcinogen, mutagen or teratogen** should be contained and there should be no contamination of protective clothing. Any manipulation or procedure that causes contamination of protective clothing is unsatisfactory and should be improved. Suitable clothing is a high-necked, side-or-back-fastening laboratory coat with elasticated cuffs, a disposable polyethylene apron and gloves. Gloves should be selected so that the "breakthrough time" (details available from suppliers) is at least 12 minutes, and preferably at least 2 hours. The material selected should be stated on the **specific assessment**. Unless disposable, gloves should be decontaminated at the end of every procedure, or whenever contaminated. They should be checked carefully for pinhole leaks before use. Protective clothing must be removed before leaving the laboratory.

Users must never touch drawer or door handles light switches or telephones wearing protective gloves, nor wear such gloves outside the laboratory.

Laboratory coats should either be disposable or sent for laundry at least weekly. However, if such coats are known or believed to be contaminated with **carcinogens, mutagens or teratogens,** they must not be sent to the laundry, but decontaminated or incinerated. Experimental techniques should minimise splashing, but visors should be available for use when appropriate.

### 7.5. Cleanliness and Tidiness

Good housekeeping practices are necessary with all chemicals, but it is particularly important that rooms where **carcinogens, mutagens or teratogens** are used are kept clean and tidy. Immediately a procedure has been completed, the spillage tray and apparatus and work surfaces must be cleaned. Cleaning procedures should minimise the generation of aerosols and dispersal of dust. Cleaning materials known or suspected to be contaminated must be consigned for incineration. No part of the laboratory, including the inside of fume cupboards, and no piece of equipment, even if it is used only for the handling of these materials, should be allowed to remain contaminated.

### 7.6. Experimental Technique

Technique should be of the highest order to minimise splashes, spills or the generation of aerosols. As far as possible, chemicals should be handled as suspensions or solutions rather than as finely divided powders. There should be no licking of labels. All necessary equipment should

be assembled before the work is begun (this procedure will help to avoid the contamination of door and drawer handles). Care must be taken to avoid contaminating the exterior of containers. Any such contamination must be cleaned off within the fume cupboard before returning to store, and the cleaning

material disposed as contaminated waste.

### 7.7. Health Surveillance

Health surveillance is not required where the COSHH assessment is that exposure is so adequately controlled that there is no reasonable likelihood of an identifiable disease or adverse health effect. This should always be the case for work with **carcinogens, mutagens and teratogens** in accordance with this code.

### 7.8. Accidents and Incidents

Any accidental release of **carcinogens, mutagens or teratogens** under circumstances where individuals may have been exposed must be reported without delay to the Safety Adviser by telephone.

### 7.9. Work with Animals

The precautions specified in this Code of Practice should be used wherever applicable in animal experimentation. For this type of work there is an extra hazard of unpredictable behaviour by animals when substances are being administered, and special care is required in their handling and restraint.

The XJTLU Code of Practice on Animal Hazards should also be followed.

Where **carcinogens, mutagens or teratogens** are administered to animals, the animals should be kept in a flexible film isolator or other sealed controlled environment under negative pressure relative to the atmosphere. The method of containment should be approved by the Laboratory Animal Health Officer.

Materials for administration to animals should be diluted in a fume cupboard to the minimum practicable strengths before being taken into the animal unit.

Staff should wear protective gowns, caps and disposable gloves in addition to the respiratory protection required by the University's Code on Allergy to Laboratory Animals. Techniques should minimise the possibility of splashing or squirting, but full face visors should be available for use when appropriate. Showering/washing facilities should be available.

All specimens, hair, paper, polythene, protective sheets, litter, faeces, corpses, animal tissues etc, should be placed in labelled yellow polythene bags and incinerated. Cages and trays should go directly to washing machines and should not be mixed with other dirty trays.

There may be cases where the dose rate is so tiny or the material is metabolised so fast to something less toxic that no realistic carcinogenic/teratogenic risk exists. However, before dosing animals with **carcinogens, mutagens or teratogens** the Safety Adviser should be consulted.

### 7.10. Disposal

Disposal of **carcinogens, mutagens and teratogens** requires precautions in addition to those required by **standard precautions** (see SCR18). Materials consigned to the University Waste Chemical Services which are known or suspected to be contaminated with **carcinogens, mutagens or teratogens** must be doubly wrapped in suitable plastic bags. Each bag must be sealed and clearly labelled to indicate that it contains carcinogenic, mutagenic or teratogenic material. Disposal of dilute substances should not normally be necessary; the solvent should if possible be removed by evaporation. If it is necessary to put carcinogenic/teratogenic solvents, or solvents contaminated with **carcinogens, mutagens** or **teratogens**, into the solvent waste system, containers must be clearly identified to indicate what **carcinogens, mutagens** or **teratogens** are present.

See SC48 (available from the UoL) for more information on waste disposal in general.

### 7.11. Monitoring

The Supervisor and Departmental Safety Officer should monitor that the working environment and systems of work are in accordance with this code of practice. Where environmental checks for contamination are appropriate, e.g. by wipe tests, they should be carried out.

## CARCINOGENS, TERATOGENS, EMBRYOTOXINS AND MUTAGENS

The following list is for guidance and does not claim to be exhaustive.

C = carcinogen
M = mutagen
T = teratogen/embryotoxin

For the definitions of these terms see the full Code. Substances in this list can also be expected to be toxic in other ways.

*The list includes some groups of compounds marked with an asterisk. Individual compounds in such a group should be treated as indicated unless the user has specific evidence on the compound indicating that it can be treated differently.

2-acetamidofluorene and its derivatives C
acrylamide - special generic assessment applies C,M
acrylonitrile C
actinomycin D C,T
adriamcin C,T
*aflatoxins C
*alkylating agents C
alkyl mercury compounds T
amethopterin C,T

4-aminoazobenzene C
o-aminoazotoluene C
4-amino-2', 3-dimethylazobenzene C
aminoethylene C, M
6-aminonicotinamide T
4-aminodiphenyl (4-aminobiphenyl) and its salts C
4-amino-3-chorophenol C
aminopterin (4-aminobiphenyl) T
aromatic petroleum distillate extracts C
arsenic and *arsenic compounds C
asbestos (all types) C
azacytidine C,T
azaserine (serine diazoacetate) C
azathioprine C
azoxybenzene C
azoxyethane C
azoxymethane C

benzo(a)anthracene C
benzo(a)pyrene C,T, M
benzo(b)fluoranthrene C
benzo(j)fluoranthrene C
benzo(k)fluoranthrene C
benzotrichloride C

benzene C
benzidine and its salts C
beryllium and its compounds, with the exception of aluminium beryllium silicates C
binapacryl (ISO) T
bis (chloroemethyl)ether C
bis (2-ethylhexyl)phthalate T
bis (2-methoxyethyl)ether T
bis (2-methoxyethyl)phthalate T
2,2'-bioxirane C, M
bis(2-chloroethyl)sulphide (sulphur mustard) C
1,3-butadiene C
1,4-butanediol dimethylsulphonate (busulfan, Myleran) T

cadmium and *cadmium compounds C
cadmium chloride T
cadmium fluoride T

calcium chromate C
captafol (ISO) C
carbadox (INN) C
carbon monoxide T
chlorambucil C, T
2-chloroallyl diethyldithiocarbamate (sulfallate ISO) C
4-chloroaniline C
chlorodimethylether C
C.I. direct black 38 C
C.I. direct blue 6 C
C.I. direct brown 95 C
C.I. direct red 28 C
C.I. disperse blue 1 C
C.I. pigment yellow 34 T
C.I. pigment red 104 T
1-chloro-2,3-epoxypropane (epichlorohydrin) C
chloromethyl methyl ether C
chromates of calcium, chromium, potassium, sodium, strontium and zinc C
chromium (VI)compounds C
coal soots, coal tar, pitch and coal tar fumes C
colchicine T
cycasin C
cyclohoximide T
cyclophosphamide C,T
cytochalasin B T
cytosine arabinoside (Ara-C) T

daunomycin C
demecoline T
dialkylinitrosamines C
4,4'-diaminodiphenylmethane C
1,3-diamino-4-methylbenzene C
o-dianisidine and its salts C
diazomethane C
dibenz(a,h)anthracene C
dibenzo(a,i)pyrene C
1,2-dibromo-3-chloropropane C, M
1,2-dibromoethane C
dibutylphthalate T
1,2-dichloroethane C
B,B'-dichlorodiethyl sulphide (mustard gas) C

2,2'-dichloro-B-methyldiethylamine (nitrogen mustard) C, T
3,3-dichlorobenzidine and its salts C
1,4-dichlorobut-2-ene C
2,2'-dichloro-4-4'-methylenedianiline (MbOCA) and its salts C
1,3-dichloro-2-propanol C
diepoxybutane C, M
1,2-diethylhydrazine C
diethylstilboestrol C,T
diethyl sulphate C, M
dihydrotestosterone T
N,N-dimethylacetamide T
3-3'-dimethylbenzidine and its salts C
dimethylcarbamoyl chloride C
3-3'-dimethoxybenzidine and its salts C
N,N-dimethylformamide T
1,1-dimethylhydrazine C
1,2-dimethylhydrazine C
dimethylnitrosamine C
dimethyl sulphamoyl chloride C
dimethyl sulphate C
dinickel trioxide C
2,4-dinitro-6-sec-butylphenol T
dinitrotoluene (all isomers) C
dinoseb and its salts and esters T
dinoterb and its salts and esters T

engine oil - see used engine oil
epichlorohydrin C
epoxyethane C
1,2-epoxy-3-phenoxypropoane C
1,2-epoxypropane (propyleneoxide) C
epoxypropan-1-ol C
erionite C
etacelasil T
ethoxyethanol T
ethoxyethyl acetate T
ethyl carbamate (urethane) C
ethyleneimine (azirine,aziridine) C, M
ethylene oxide C, M
ethylene thiourea T
ethyl methanesulphonate C

N-ethyl-N-nitrosourea C

finazifop butyl T
5-fluoro-2-dexycytidine (cancer therapy) T
flumioxazin (iso) T
flusilazol T
formamide T
furan C

hardwood dusts C
heptachlor C
hexachlorobenzene C
hexamethylphosphoramide (hexamamethylphosphoric triamide) C, M
hydrazine and its salts C
hydrazine bis (3-carboxy-4-hydroxybenzene sulphonate) C
hydrazobenzene C
hydrocarbons C26-55, aromatic rich C
4-hydroxyaminoquinoline-1-oxide C
hypoglycin-A T

ifosfamide (mitoxana) T
iodoacetic acid T
indomethacine T

kepone C

lead and lead compounds T - Control of Lead at Work Regulations apply.
lubricating mineral oils: unrefined and mildly refined vacuum distillates C

melphalan C
mercury, organic compounds of T
2-methoxyethanol T
2-methoxyethyl acetate T
2-methoxyaniline (*o*-anisidine) C
methoxyacetic acid T
2-methoxy-1-propanol acetate T
2-methoxypropanol T
2-methoxypropyl acetate T
methylacrylomidomethoxyacetate (containing at least 0.1% acrylamide) C, M
methylaminopterin (4-amino-10-methylfolic acid) T
2-methylaziridine C

methylazoxymethanol C
methyl-ONN-azoxymethyl acetate C, T
7-methylbenz(a)anthracene C
methylbis(2-chloroethyl)amine hydrochloride ('HB2') C
4,4'-methylenebis(2-chloroaniline) C
4,4'-methylenedi-o-toluidine C
3-methylcholanthrene C
N-methylformamide T
methylhydrazine C
N-methyl-N'-nitro-N''-nitrosoguanidine C,T
N-methyl-N-nitrosourea C,T
4-methyl-m-phenylenediamine C
methyl-ONN-azoxymethyl acetate (methylazoxy methyl acetate) C

2-naphthylamine and its salts C
nickel dioxide C
nickel monoxide C
nickel subsulphide C
nickel tetracarbonyl T
nickel sulphide C
5-nitroacenaphthene C
2-nitroanisole C
4-nitrodiphenyl C
nitrofen (ISO) C,T
2-nitronaphthalene C
*N-nitroso compounds C
2-nitropropane C
4-nitroquinoline-1-oxide C

*oestradiol and related steroids T
oil - see used engine oil and lubricating mineral oil

petroleum extracts - may be carcinogenic. Obtain details from supplier
phenacetin SC
phenylhydrazine and its salts C
pitch - see coal
*phorbol esters C
*polycyclic aromatic hydrocarbons C
potassium bromate C
potassium chromate C
prednisolone T

1,3-propanesultone C
3-propanolide (propiolactone) C
propylene oxide C
6-propyl-2-thiouracil T

reserpine C

safrole C
sodium arsenate, sodium arsenite C
sodium chromate C
sterigmatocystin C
streptonigrin T
strontium chromate C
styrene oxide C
sulfallate (iso) C

tamoxifen T
testosterone T
2,3,7,8-tetrachlorodibenzo-p-dioxin C,T
tetracycline T
tetranitromethane C
thalidomide T
thioacetamide C
tobacco smoke C,T - Code of Practice on Smoking applies
*o*-tolidine (3,3'-dimethylbenzidine) C
o-toluidine (1-amino-2-methylbenzene) and its salts C
triamcinolone T
trichloroethylene C
α,α,α-trichlorotoluene C
tridemorph T
triglycidyl isocyanurate M
tris (1-aziridinyl)phosphine sulphide C

uracil mustard (5-(bis(2-chloroethyl)amino)uracil) C
urethane (INN) C
used engine oil C

vinclozolin (iso) T
vinyl chloride (chloroethylene) C
vinyl bromide (bromoethylene) C

warfarin T

zinc chromates (including zinc potassium chromate) C

## Appendix H HIGHLY TOXIC CHEMICALS

Introduction:

1. This list is from "The Hazardous Chemical" (2015 V)
2. The definition of Highly Toxic Chemical is that the chemicals with acute toxicity, including synthetic chemicals and their mixtures and natural toxins, as well as those with acute toxicity that are likely to cause public safety hazards.
3. The standards of identifying whether the chemicals are toxic or not (Big Mouse Experiment, one of the following conditions needs to be satisfied):
    - Through the month, LD50 $\leq$ 5 mg/kg;
    - Through the skin, LD50 $\leq$ 50 mg/kg;
    - Inhale for four hours, LC50 $\leq$ 100ml/$m^3$ (Gas), 0.5 mg/L (Steam), 0.05 mg/L (Dust, Fog). The data of the experiment through the skin can also use rabbits as samples.

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 1 | 4 | 5-氨基-3-苯基-1-[双(N,N-二甲基氨基氧膦基)]-1,2,4-三唑[含量 > 20%] | 威菌磷 | p(5-Amino-3-phenyl-1H-1,2,4-triazol-1-yl)-N.N,N',N'-tetra-methyl phosphonicdiamide | Triamiphos; Wepsin | $C_{12}H_{19}N_6OP$ | 1031-47-6 | 30182783 |
| 2 | 20 | 3-氨基丙烯 | 烯丙胺 | 3-Aminopropene | allylamine | $C_3H_7N$ | 107-11-9 | 2334 |
| 3 | 40 | 八氟异丁烯 | 全氟异丁烯；1,1,3,3,3-五氟-2-(三氟甲基)-1-丙烯 | Octafluoroisobutylene | Perfluoroisobutylene | $C_4F_8$ | 382-21-8 | 3162 |
| 4 | 41 | 八甲基焦磷酰胺 | 八甲磷 | Octamethyl diphosphoramide | Schradan; Octamethyl | $C_8H_{24}N_4O_3P_2$ | 152-16-9 | 3018 |
| 5 | 42 | 1,3,4,5,6,7,8,8-八氯-1,3,3a,4,7,7a-六氢-4,7-甲撑异苯并呋喃[含量 > 1%] | 八氯六氢亚甲基苯并呋喃；碳氯灵 | 1,3,4,5,6,8,8-Octachloro-1,3,3a,4,7,7a-hexahydro-4,7-methanoisobenzofuran | Isobenzan;Octachloro-hexahydro-methanoisobenzofuran | $C_9H_4Cl_8O$ | 297-78-9 | 2761 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 6 | 71 | 苯基硫醇 | 苯硫酚；巯基苯；硫代苯酚 | Phenyl mercaptan | Benzenethiol;Mercaptobenzene; Thiophenol | $C_6H_6S$ | 108-98-5 | 2337 |
| 7 | 88 | 苯胂化二氯 | 二氯化苯胂；二氯苯胂 | Phenylarsine dichloride | Dichlorophenylarsine; FDA | $C_6H_5AsCl_2$ | 696-28-6 | 1556 |
| 8 | 99 | 1-(3-吡啶甲基)-3-(4-硝基苯基)脲 | 1-(4-硝基苯基)-3-(3-吡啶基甲基)脲；灭鼠优 | 1-(3-Pyridinylmethyl)-3-(4-nitrophenyl)urea | Pyrinuron; Pyriminl; Vacor | $C_{13}H_{12}N_4O_3$ | 53558-25-1 | 2588 |
| 9 | 121 | 丙腈 | 乙基氰 | Propionitrile | Ethyl cyanide | $C_3H_5N$ | 107-12-0 | 2404 |
| 10 | 123 | 2-丙炔-1-醇 | 丙炔醇；炔丙醇 | Propargyl alcohol | 2-Propynyl alcohol; Acetylene carbinol | $C_3H_4O$ | 107-19-7 | 2929 |
| 11 | 138 | 丙酮氰醇 | 丙酮合氰化氢；2-羟基异丁腈；氰丙醇 | Acetone cyanohydrin | 2-Hydroxyisobutyronitrile; 2-Methyllactonitrile | $C_4H_7NO$ | 75-86-5 | 1541 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 12 | 141 | 2-丙烯-1-醇 | 烯丙醇；蒜醇；乙烯甲醇 | 2-propen-l-ol | Allyl alcohol; Vinylcarbinol | $C_3H_6O$ | 107-18-6 | 1098 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 13 | 155 | 丙烯亚胺 | 2-甲基氮丙啶；2-甲基乙撑亚胺；丙撑亚胺 | Propyene imine | 2-Methylaziridine | $C_3H_7N$ | 75-55-8 | 1921 |
| 14 | 217 | 叠氮化钠 | 三氮化钠 | Sodium azide | | $NaN_3$ | 26628-22-8 | 1687 |
| 15 | 241 | 3-丁烯-2-酮 | 甲基乙烯基酮；丁烯酮 | 3-Buten-2-one | Methyl vinyl ketone; Butenone | $C_4H_6O$ | 78-94-4 | 1251 |
| 16 | 258 | 1-(对氯苯基)-2,8,9-三氧-5-氮-1-硅双环(3,3,3)十二烷 | 毒鼠硅；氯硅宁；硅灭鼠 | 5-(4-Chlorophenyl)silatrane | 1-(4-Chlorophenyl)silatrane | $C_{12}H_1ClNO_3S$ | 29025-67-0 | |
| 17 | 321 | 2-(二苯基乙酰基)-2,3-二氢-1,3-茚二酮 | 2-(2,2-二苯基乙酰基)-1,3-茚满二酮；敌鼠 | 2-(2,2-Diphenylacetyl)-1,3-indandione | Diphacinone; Diphacin | $C_{23}H_{16}O_3$ | 82-66-6 | 2588 |
| 18 | 339 | 1,3-二氟丙-2-醇(Ⅰ)与1-氯-3-氟丙-2-醇(Ⅱ)的混 | 鼠甘伏；甘氟 | 1-Chloro-3-fluoro-2-propanol mixt. with 1,3-dirfluoro-2-propanol | Gliftor | $C_3H_6ClFO·C_3H_6F_2O$ | 8065-71-2 | 2588 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 合物 | | | | | | |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 19 | 340 | 二氟化氧 | 一氧化二氟 | Oxygen difluoride | Fluorine monoxide | $OF_2$ | 7783-41-7 | 2190 |
| 20 | 367 | O-O-二甲基-O-(2-甲氧甲酰基-1-甲基)乙烯基磷酸酯[含量 > 5%] | 甲基-3-[(二甲氧基磷酰基)氧代]-2-丁烯酸酯；速灭磷 | Methyl-3-[(dimethoxyphosphinyl)oxy]-2-crotonate | Mevinphos; Phosdrin | $C_7H_{13}O_6P$ | 7786-34-7 | 3018 |
| 21 | 385 | 二甲基-4-(甲基硫代)苯基磷酸酯 | 甲硫磷 | Dimethyl-4-(methylthio)phenyl phosphate | Dimethyl-p-(methylthiofenyl)fosfat ; GC 6506 | $C_9H_{13}O_4PS$ | 3254-63-5 | 3018 |
| 22 | 393 | (E)-O,O-二甲基-O-[1-甲基-2-(二甲基氨基甲酰)乙烯基]磷酸酯[含量 > 25%] | 3-二甲氧基磷氧基-N,N-二甲基异丁烯酰胺；百治磷 | 3-Dimethoxy phosphinyloxy-N,N-dimethylisocrotonamide | Dicrotophos; Bidrin | $C_8H_{16}NO_5P$ | 141-66-2 | 3018 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 23 | 394 | O,O-二甲基-O-[1-甲基-2-(甲基氨基甲酰)乙烯基]磷酸酯[含量 > 0.5%] | 久效磷 | O,O-Dimethyl-O-1-methyl-2-N-methylcarbamoyl) vinyl phosphate | Monocrotophos; Azodrin; Nuvacron | $C_7H_{14}NO_5P$ | 6923-22-4 | 2783 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 24 | 410 | N,N-二甲基氨基乙腈 | 2-(二甲氨基)乙腈 | N,N-Dimethylaminoacetonitrile | 2-Dimethylaminoacetonitrile | $C_4H_8N_2$ | 926-64-7 | 2378 |
| 25 | 434 | O,O-二甲基-对硝基苯基磷酸酯 | 甲基对氧磷 | O,O-Dimetyl-O-p-nitrphenylphosphate | Methyl paraoxon | $C_8H_{10}NO_6P$ | 950-35-6 | 3018 |
| 26 | 461 | 1,1-二甲基肼 | 二甲基肼[不对称]；N,N-二甲基肼 | 1,1-Dimethylhydrazine | Dimethylhydrazine, Unsymmetrical | $C_2H_8N_2$ | 57-14-7 | 1163 |
| 27 | 462 | 1,2-二甲基肼 | 二甲基肼[对称] | 1,2-Dimethylhydrazine | sym-Dimethylhydrazine; Hydrazomethane | $C_2H_8N_2$ | 540-73-8 | 2382 |
| 28 | 463 | O,O'-二甲基硫 | 二甲基 | O,O'-Dimethylthioph | Dimethyl thiophosph | $C_2H_6ClO_2PS$ | 2524-03-0 | 2267 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 代磷酰氯 | 硫代磷酰氯 | osphoryl chloride | oryl chloride | | | |
| 29 | 481 | 二甲双胍 | 双甲胍；马钱子碱 | Strychnine | Strychnidin-10-one; Certox | $C_{21}H_{22}N_2O_2$ | 57-24-9 | 1692 |
| 30 | 486 | 二甲氧基马钱子碱 | 番木鳖碱 | Brucine | 2,3-Dimethoxystrychnidin-10-one; Brucine alkaloid | $C_{23}H_{26}N_2O_4$ | 357-57-3 | 1570 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 31 | 568 | 2,3-二氢-2,2-二甲基苯并呋喃-7-基-N-甲基氨基甲酸酯 | 克百威 | 2,3-Dihydro-2,2-dimethyl-7-benzofuranyl-N-methyl carbamate | Carbofuran; Furadan; Diafuran | $C_{12}H_{15}NO_3$ | 1563-66-2 | 2757 |
| 32 | 572 | 2,6-二噻-1,3,5,7-四氮三环-[3,3,1,1,3,7]癸烷-2,2,6,6-四氧化物 | 毒鼠强 | 2,6-Dithia-1,3,5,7-tetrazatricyclo-[3,3,1,1,3,7]decane-2,2,6,6-tetraoxide | Tetramethylenedisulphotetramine; NSC172824 | $C_4H_8N_4O_4S_2$ | 80-12-6 | 2588 |
| 33 | 648 | S-[2-(二乙氨基)乙基]-O,O-二乙基硫赶磷酸酯 | 胺吸磷 | S-[2-(diethylamino)ethyl]O,O-diethylphosphorothioate | Amiton; Metramac | $C_{10}H_{24}NO_3PS$ | 78-53-5 | 3018 |
| 34 | 649 | N-二乙氨基乙基氯 | 2-氯乙基二乙胺 | N-Diethylaminoethyl chloride | N-(2-Chloroethyl) diethylamine | $C_6H_{14}ClN$ | 100-35-6 | 2810 |
| 35 | 654 | O,O-二乙基-N-(1,3-二硫戊环-2-亚基)磷酰胺[含量 > 15%] | 2-(二乙氧基磷酰亚氨基)-1,3-二硫戊环；硫 | Diethyl-1,3-dithiolan-2-ylidene phosphoroamidate | Phosfolan; Cyolane | $C_7H_{14}NO_3PS_2$ | 947-02-4 | 3018 2783 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 环磷 | | | | | |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 36 | 655 | O,O-二乙基-N-(4-甲基-1,3-二硫戊环-2-亚基)磷酰胺[含量 > 5%] | 二乙基(4-甲基-1,3-二硫戊环-2-叉氨基)磷酸酯；地胺磷 | Diethyl (4-methyl-1,3-dithiolan-2-ylidene) phosphoroamidate | Mephosfolan; Cytrolane | $C_8H_{16}NO_3PS_2$ | 950-10-7 | 3018 |
| 37 | 656 | O,O-二乙基-N-1,3-二噻丁环-2-亚基磷酰胺 | 丁硫环磷 | O,O-diethyl 1,3-dithietan-2-ylidene phosphoramidate | Fosthietan; Geofos | $C_6H_{12}NO_3PS_2$ | 21548-32-3 | 3018 |
| 38 | 658 | O,O-二乙基-O-(2-乙硫基乙基)硫代磷酸酯与O,O-二乙基-S-(2-乙硫基乙基)硫代磷酸酯的混合物[含量 > 3%] | 内吸磷 | O,O-Diethyl O(and S)-2-(ethylthio)ethyl phosphorothioate mixture | Demeton; Systok; Demox; E 1059 | $C_8H_{19}O_3PS_2$ | 8065-48-3 | 3018 |
| 39 | 660 | O,O-二乙基-O-(4-甲基香豆素基-7)硫代磷酸酯 | 扑杀磷 | O,O-Diethyl O-(4-methylumbelliferone) phosphorothioate | Potasan | $C_{14}H_{17}O_5PS$ | 299-45-6 | 2811 |
| 40 | 661 | O,O-二乙基-O-(4-硝基苯基)磷 | 对氧磷 | O,O-Diethyl O-(4-nitrophenyl) | Paraoxon | $C_{10}H_{14}NO_6P$ | 311-45-5 | 3018 2783 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 酸酯 | | phosphate | | | | |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 41 | 662 | O,O-二乙基-O-(4-硝基苯基)硫代磷酸酯[含量 > 4%] | 对硫磷 | O,O-Diethyl-O-(4-nitrophenyl) phosphorothioate | Parathion; Ethylparathion; Thiophos; Corothion | $C_{10}H_{14}NO_5PS$ | 56-38-2 | 3018 |
| 42 | 665 | O,O-二乙基-O-[2-氯-1-(2,4-二氯苯基)乙烯基]磷酸酯[含量 > 20%] | 2-氯-1-(2,4-二氯苯基)乙烯基二乙基磷酸酯；毒虫畏 | 2-Chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate | Vinyphate; Chlorfenvinfos | $C_{12}H_{14}Cl_3O_4P$ | 470-90-6 | 3018 |
| 43 | 667 | O,O-二乙基-O-2-吡嗪基硫代磷酸酯[含量 > 5%] | 虫线磷 | O,O-Diethyl-O-pyrazinylphosphorothioate | Thionazin; Zinophos; Nemafos | $C_8H_{13}N_2O_3PS$ | 297-97-2 | 3018 |
| 44 | 672 | O,O-二乙基-S-(2-乙硫基乙基)二硫代磷酸酯[含量 > 15%] | 乙拌磷 | O,O-Diethyl S-[(2-(ethylthio)ethyl) dithiophosphate | Disulfoton; Dithiodemeton | $C_8H_{19}O_2PS_3$ | 298-04-4 | 3018 |
| 45 | 673 | O,O-二乙基-S-(4-甲基亚磺酰基苯基)硫代磷酸酯[含量 > 4%] | 丰索磷 | O,O-Diethyl-O-[4-(methylsulfinyl)phenyl]phosphorothioate 115-90-2 | Fensulfothion; Fensulphothion | $C_{11}H_{17}O_4PS_2$ | 115-90-2 | 3018 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 46 | 675 | O,O-二乙基-S-(对硝基苯基)硫代磷酸 | 硫代磷酸-O,O-二乙基-S-(4-硝基苯基)酯 | O,O-Diethyl-S-(p-nitrophenyl) Phosphate | Parathion S; S-Phenyl parathion; Phosphorothioic acid, O,O-diethyl-S-(4-nitrophenyl)ester | $C_{10}H_{14}NO_5PS$ | 3270-86-8 | 3018 |
| 47 | 676 | O,O-二乙基-S-(乙硫基甲基)二硫代磷酸酯 | 甲拌磷 | O,O-Diethyl-S-[(ethylthio)methyl]-phosphorodithioate | Thimet;Timet; phorate; Cyanamid-3911; AC-3911 | $C_7H_{17}O_2PS_3$ | 298-02-2 | 3018 |
| 48 | 677 | O,O-二乙基-S-(异丙基氨基甲酰甲基)二硫代磷酸酯[含量 > 15%] | 发硫磷 | O,O-Diethyl S-(N-isopropylcarbamoylmethyl) dithiophosphate | Prothoate; Trimethoate | $C_9H_{20}NO_3PS_2$ | 2275-18-5 | 3018 |
| 49 | 679 | O,O-二乙基-S-氯甲基二硫代磷酸酯[含量 > 15%] | 氯甲硫磷 | S-Chloromethyl-O,O-diethylphosphorodithioate | Chlormephos; Dotan | $C_5H_{12}ClO_2PS_2$ | 24934-91-6 | 3018 |
| 50 | 680 | O,O-二乙基-S-叔丁基硫甲基二硫代磷酸酯 | 特丁硫磷 | S-{[(1,1-Dimethylethyl) thio]methyl}-O,O-diethyl phosphorodithioate | Terbufos | $C_9H_{21}O_2PS_3$ | 13071-79-9 | 3018 |
| 51 | 692 | 二乙基汞 | 二乙汞 | Diethyl mercury | Mercury diethyl | $C_4H_{10}Hg$ | 627-44-1 | 2929 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 52 | 732 | 氟 | | Fluorine | | $F_2$ | 7782-41-4 | 1045 |
| 53 | 780 | 氟乙酸 | 氟醋酸 | Fluoroacetic acid | Fluoroethanoic acid | $C_2H_3FO_2$ | 144-49-0 | 2642 |
| 54 | 783 | 氟乙酸甲酯 | | Methyl fluoroacetate | Methylester kyseliny fluoroctove | C3-H5-F-O2 | 453-18-9 | |
| 55 | 784 | 氟乙酸钠 | 氟醋酸钠 | Sodium fluoroacetate | Fluoroacetic acid sodium salt | $C_2H_2FO_2Na$ | 62-74-8 | 2629 |
| 56 | 788 | 氟乙酰胺 | | Fluoroacetamide | Fussol | $C_2H_4FNO$ | 640-19-7 | 2811 |
| 57 | 849 | 癸硼烷 | 十硼烷；十硼氢 | Decaborane | Decaboron tetradecahydride | $B_{10}H_{14}$ | 17702-41-9 | 1868 |
| 58 | 1008 | 4-己烯-1-炔-3-醇 | | 4-Hexen-1-yn-3-ol | 4-Hexen-1-yne-3-ol | $C_6H_8O$ | 10138-60-0 | 2810 |
| 59 | 1041 | 3-(1-甲基-2-四氢吡咯基)吡啶硫酸盐 | 硫酸化烟碱 | 3-(1-Methyl-2-pyrrolidyl)pyridine sulfate | Nicotine sulfate | $C_{20}H_{28}N_4 \cdot SO_4$ | 65-30-5 | 1658 |
| 60 | 1071 | 2-甲基-4,6-二硝基酚 | 4,6-二硝基邻甲苯酚；二硝酚 | 4,6-Dinitro-o-cresol | 2,4-Dinitro-o-cresol; Dinurania | $C_7H_6N_2O_5$ | 534-52-1 | 1598 |
| 61 | 1079 | O-甲基-S-甲基-硫代磷酰胺 | 甲胺磷 | O,S-Dimethyl phosphoramidothioate | Methamidophos; Tamaron; Monitor; Tomron; Tammaron | $C_2H_8NO_2PS$ | 10265-92-6 | 2783 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 62 | 1081 | O-甲基氨基甲酰基-2-甲基-2-(甲硫基)丙醛肟 | 涕灭威 | O-(Methylcarbamonyl)2-methyl-2-(methylthio)propionaldehyde oxime | Aldicarb; Temik | $C_7H_{14}N_2O_2S$ | 116-06-3 | 2771 |
| 63 | 1082 | O-甲基氨基甲酰基-3,3-二甲基-1-(甲硫基)丁醛肟 | O-甲基氨基甲酰基-3,3-二甲基-1-(甲硫基)丁醛肟；久效威 | 3,3-Dimethyl-1-(methylthio)-2-butanone-O-(methylamino)carbonyl oxime | Thiofanox; Dacamox | $C_9H_{18}N_2O_2S$ | 39196-18-4 | 2771 |
| 64 | 1097 | (S)-3-(1-甲基吡咯烷-2-基)吡啶 | 烟碱；尼古丁；1-甲基-2-(3-吡啶基)吡咯烷 | 3-(1-Methyl-2-pyrrolidyl)pyridine | Nicotine; 1-Methyl-2-(3-pyridyl) pyrrolidine | $C_{10}H_{14}N_2$ | 54-11-5 | 1654 |
| 65 | 1126 | 甲基磺酰氯 | 氯化硫酰甲烷；甲烷磺酰氯 | Methylsulfonyl chloride | Mesyl chloride; Methane sulfonyl chloride | $CH_3ClO_2S$ | 124-63-0 | 3246 |
| 66 | 1128 | 甲基肼 | 一甲肼；甲基联氨 | Methylhydrazine | 1-Methylhydrazine | $CH_6N_2$ | 60-34-4 | 1244 |
| 67 | 1189 | 甲烷磺酰氟 | 甲磺氟酰；甲基磺酰氟 | Methanesulfonyl fluoride | MSF; Fumette; Mesyl fluoride | $CH_3FO_2S$ | 558-25-8 | 2927 |
| 68 | 1202 | 甲藻毒素(二 | 石房蛤毒素(盐 | Saxidomus giganteus poison | Saxitoxin | $C_{10}H_{17}N_7O_4$ | 35523-89-8 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 盐酸盐) | 酸盐) | | | | | |
| 69 | 1236 | 抗霉素A | | Antimycin A | Antipiricullin ; Virosin | $C_{28}H_{40}N_2O_9$ | 1397-94-0 | 3172 |
| 70 | 1248 | 镰刀菌酮X | | Fusarenon-x | | $C_{17}H_{22}O_8$ | 23255-69-8 | |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 71 | 1266 | 磷化氢 | 磷化三氢；膦 | | | | 7803-51-2 | |
| 72 | 1278 | 硫代磷酰氯 | 硫代氯化磷酰；三氯化硫磷；三氯硫磷 | Thiophosphoryl chloride | Phosphorous sulfochloride; Phosphorus(Ⅴ) thiochloride | $Cl_3PS$ | 3982-91-0 | 1837 |
| 73 | 1327 | 硫酸三乙基锡 | | Triethyltin sulphate | Triaethylzinn sulfate | $C_{12}H_{30}O_4SSn_2$ | 57-52-3 | 3146 |
| 74 | 1328 | 硫酸铊 | 硫酸亚铊 | Thallous sulfate | Dithallium sulfate | $Tl_2SO_4$ | 7446-18-6 | 1707 |
| 75 | 1332 | 六氟-2,3-二氯-2-丁烯 | 2,3-二氯六氟-2-丁烯 | Hexafluoro-2,3-dichloro-2-butylene | 2,3-Dichlorohexafluoro -2-butylene | $C_4Cl_2F_6$ | 303-04-8 | 2927 |
| 76 | 1351 | (1R,4S,4aS,5R,6R,7S,8S,8aR)-1,2,3,4,10,10-六氯-1,4,4a,5,6,7,8,8a-八氢-6,7-环氧-1,4,5,8-二亚甲基萘[含量2%～90%] | 狄氏剂 | 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo-1,4-exo-5,8-dimethanonaphthalene | Dieldrin; Compund 497 | $C_{12}H_8Cl_6O$ | 60-57-1 | 2761 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 77 | 1352 | (1R,4S,5R,8S)-1,2,3,4,10,10-六氯-1,4,4a,5,6,7,8,8a-八氢-6,7-环氧-1,4；5,8-二亚甲基萘[含量 > 5%] | 异狄氏剂 | 1,2,3,4,10,10-Hexachloro-6,7-expoxy-1,4,4a,5,6,7,8,8a-octahydroendo-1,4-exo-5,8-dimethanona-phthalene 72-20-8 | Endrin | $C_{12}H_8Cl_6O$ | 72-20-8 | 2761 |
| 78 | 1353 | 1,2,3,4,10,10-六氯-1,4,4a,5,8,8a-六氢-1,4-挂-5,8-挂二亚甲基萘[含量 > 10%] | 异艾氏剂 | 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-endo-1,4-endo-5,8-dimethanonaphthalene | Isodrin | $C_{12}H_8Cl_6$ | 465-73-6 | 2761 |
| 79 | 1354 | 1,2,3,4,10,10-六氯-1,4,4a,5,8,8a-六氢-1,4：5,8-桥,挂-二甲撑萘[含量 > 75%] | 六氯-六氢-二甲撑萘；艾氏剂 | 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-exo-1,4-endo-5,8-dimeth anonaphthalene | Aldrin; Compound 118; Hexachlorohexahydro-endo-exo-dimethanonaphthalene | $C_{12}H_8Cl_6$ | 309-00-2 | 2761 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1358 | 六氯环戊二烯 | 全氯环戊二烯 | Hexachlorocyclopentadiene | Perchlorocyclopentadiene | $C_5Cl_6$ | 77-47-4 | 2646 |
| 81 | 1381 | 氯 | 液氯；氯气 | Chlorine | Liquid chlorine | $Cl_2$ | 7782-50-5 | 1017 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 82 | 1422 | 2-[(RS)-2-(4-氯苯基)-2-苯基乙酰基]-2,3-二氢-1,3-茚二酮[含量 > 4%] | 2-(苯基对氯苯基乙酰)茚满-1,3-二酮；氯鼠酮 | 2-[2-(4-Chlorophenyl)-2-phenyl-acetyl]indane-1,3-dione | Chlorophacinone; liphadione | $C_{23}H_{15}ClO_3$ | 3691-35-8 | 2761 |
| 83 | 1442 | 氯代膦酸二乙酯 | 氯化磷酸二乙酯 | | | | 814-49-3 | |
| 84 | 1464 | 氯化汞 | 氯化高汞；二氯化汞；升汞 | Mercuric chloride | Mercury perchloride; Mercury bichloride; Corrosive sublimate | $HgCl_2$ | 7487-94-7 | 1624 |
| 85 | 1476 | 氯化氰 | 氰化氯；氯甲腈 | | | | 506-77-4 | |
| 86 | 1502 | 氯甲基甲醚 | 甲基氯甲醚；氯二甲醚 | Chloromethyl methyl ether | Methyl chloromethyl ether; Chlordimethylether | $C_2H_5ClO$ | 107-30-2 | 1239 |
| 87 | 1509 | 氯甲酸甲酯 | 氯碳酸甲酯 | Methyl chloroformate | Methyl chlorocarbonate | $C_2H_3O_2Cl$ | 79-22-1 | 1238 |
| 88 | 1513 | 氯甲酸乙酯 | 氯碳酸乙酯 | Ethyl chloroformate | Ethyl chlorocarbonate | $C_3H_5O_2Cl$ | 541-41-3 | 1182 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 89 | 1549 | 2-氯乙醇 | 乙撑氯醇；氯乙醇 | 2-Chloroethanol | Ethylene chlorohydrin; 2-Chloroethyl alcohol; Glycol chlorohydrin; β-Chloroethyl alcohol | $C_2H_5ClO$ | 107-07-3 | 1135 |
| 90 | 1637 | 2-羟基丙腈 | 乳腈 | 2-Hydroxypropionitrile | Acetocyanohydrin; aktonitril | $C_3H_5NO$ | 78-97-7 | 2810 |
| 91 | 1642 | 羟基乙腈 | 乙醇腈 | 2-Hydroxyacetonitrile | Glycolonitrile; Cyanomethanol | $C_2H_3NO$ | 107-16-4 | 2810 |
| 92 | 1646 | 羟间唑啉(盐酸盐) | | Oxymetazoline hydrochloride | Afrazine; Neonabel | $C_{16}H_{24}N_2O·HCl$ | 2315-02-08 | 3249 |
| 93 | 1677 | 氰胍甲汞 | 氰甲汞胍 | Methylmercuric Cyanoguanidine | Panogen; Morsodren | $C_3H_6HgN_4$ | 502-39-6 | 2025 |
| 94 | 1681 | 氰化镉 | | Cadium cyanide | | $Cd(CN)_2$ | 542-83-6 | 2570 |
| 95 | 1686 | 氰化钾 | 山奈钾 | Potassium cyanide | Hydrocyanic acid, potassium salt | KCN | 151-50-8 | 1680 |
| 96 | 1688 | 氰化钠 | 山奈 | Sodium cyanide | Cyanogran | NaCN | 143-33-9 | 1689 |
| 97 | 1693 | 氰化氢 | 无水氢氰酸 | Hydrogen cyanide | Hydrocyanic acid | HCN | 74-90-8 | 1051 |
| 98 | 1704 | 氰化银钾 | 银氰化钾 | Potassium silver cyanide | Potassium cyanoargenat | $KAg(CN)_2$ | 506-61-6 | 1588 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | e | | | |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 99 | 1723 | 全氯甲硫醇 | 三氯硫氯甲烷；过氯甲硫醇；四氯硫代碳酰 | Perchloromethyl mercaptan | Trichloromethane sulfenyl chloride; Thiocarbonyl tetrachloride | $CCl_4S$ | 594-42-3 | 1670 |
| 100 | 1735 | 乳酸苯汞三乙醇铵 | | Phenylmercuric triethanolammonium lactate | Puraturf | $C_{12}H_{20}HgNO_3 \cdot C_3H_5O_3$ | 23319-66-6 | 2026 |
| 101 | 1854 | 三氯硝基甲烷 | 氯化苦；硝基三氯甲烷 | Nitrochloroform | Chloropicrin; Aquinite; Nitrotrichloromethane | $CCl_3NO_2$ | 76-06-2 | 1580 |
| 102 | 1912 | 三氧化二砷 | 白砒；砒霜；亚砷酸酐 | Arsenic trioxide | White arsenic; Arsenous acid anhydride; Arsenic sesquioxide | $As_2O_3$ | 1327-53-3 | 1561 |
| 103 | 1923 | 三正丁胺 | 三丁胺 | Tributylamine | Tris-n-butylamine | $C_{12}H_{27}N$ | 102-82-9 | |
| 104 | 1927 | 砷化氢 | 砷化三氢；胂 | Arsenic hydride | Arsenic trihydride; Arsine | $AsH_3$ | 7784-42-1 | 2188 |
| 105 | 1998 | 双(1-甲基乙基)氟磷酸酯 | 二异丙基氟磷酸酯；丙氟磷 | Bis(1-methylethyl)phosphorofluoridate | Diisopropyl fluorophosphate; DFP;Diisopropyl phosphorofluoridate | $C_6H_{14}FO_3P$ | 55-91-4 | 3018 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 106 | 1999 | 双(2-氯乙基)甲胺 | 氮芥；双(氯乙基)甲胺 | Bis-(2-chloroethyl) methylamine | Mustine; Chlormethine | $C_5H_{11}Cl_2N$ | 51-75-2 | 2810 |
| 107 | 2000 | 5-[(双(2-氯乙基)氨基]-2,4-(1H,3H)嘧啶二酮 | 尿嘧啶芳芥；嘧啶苯芥 | 5-(Bis(2-chloroethyl) amino)-2,4(1H,3H) pyrimidinedione | Uramustine; Uracil mustard | $C_8H_{11}C_{12}N_3O_2$ | 66-75-1 | 3249 |
| 108 | 2003 | O,O-双(4-氯苯基)N-(1-亚氨基)乙基硫代磷酸胺 | 毒鼠磷 | O,O-Di-4-Chlorophenyl-N-acetimidoylphosphoramidothioate | Phosazetim; Phosacetim | $C_{14}H_{13}Cl_2N_2O_2PS$ | 4104-14-7 | 2783 |
| 109 | 2005 | 双(二甲胺基)磷酰氟[含量 > 2%] | 甲氟磷 | Bis(dimethylamino) fluorophosphine oxide | Dimefox; Pestox14 | $C_4H_{12}FN_2OP$ | 115-26-4 | 3018 |
| 110 | 2047 | 2,3,7,8-四氯二苯并对二噁英 | 二噁英；2,3,7,8-TCDD；四氯二苯二噁英 | 2,3,7,8-Tetrachlorodibenzo p-dioxin | TCDD; Dioxine | $C_{12}H_4Cl_4O_2$ | 1746-01-6 | 2811 |
| 111 | 2067 | 3-(1,2,3,4-四氢-1-萘基)-4-羟基香豆素 | 杀鼠醚 | 4-Hydroxy-3-(1,2,3,4-tetrahydro-1-naphthyl)-cumarin | Coumatetralyl; Racumin | $C_{19}H_{16}O_3$ | 5836-29-3 | 3027 |
| 112 | 2078 | 四硝基甲烷 | | Tetranitromethane | TNM | $CN_4O_8$ | 509-14-8 | 1510 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 113 | 2087 | 四氧化锇 | 锇酸酐 | Osmium tetroxide | Osmic acid anhydride | $OsO_4$ | 20816-12-0 | 2471 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula） | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 114 | 2091 | O,O,O',O'-四乙基二硫代焦磷酸酯 | 治螟磷 | Tetraethyl dithiopyrophosphate | Sulfotepp; Bladafume; Dithiophos | $C_8H_{20}O_5P_2S_2$ | 3689-24-5 | 1704 |
| 115 | 2092 | 四乙基焦磷酸酯 | 特普 | Tetraethyl pyrophosphate | TEPP | $C_8H_{20}O_7P_2$ | 107-49-3 | 3018 |
| 116 | 2093 | 四乙基铅 | 发动机燃料抗爆混合物 | Tetraethyl lead | Tetraethylplumbane; TEL; Motor fuel anti-knock mixture; | $C_8H_{20}Pb$ | 78-00-2 | 1649 |
| 117 | 2115 | 碳酰氯 | 光气 | Carbonyl chloride | Phosgene | $COCl_2$ | 75-44-5 | 1076 |
| 118 | 2118 | 羰基镍 | 四羰基镍；四碳酰镍 | Nickel carbonyl | Nickel tetracarbonyl; Tetracarbonyl nickel | $Ni(CO)_4$ | 13463-39-3 | 1259 |
| 119 | 2133 | 乌头碱 | 附子精 | Aconitine | Aconitane | $C_{34}H_{47}NO_{11}$ | 302-27-2 | 1544 |
| 120 | 2138 | 五氟化氯 | | Chlorine pentafluoride | | $ClF_5$ | 13637-63-3 | 2548 |
| 121 | 2144 | 五氯苯酚 | 五氯酚 | Pentachlorophenol | PCP | $C_6HCl_5O$ | 87-86-5 | 3155 |
| 122 | 2147 | 2,3,4,7,8-五氯二苯并呋喃 | 2,3,4,7,8-PCDF | 2,3,4,7,8-Pentachlorodibenzofuran | 2,3,4,7,8-Pentapolychlorinated dibenzofuran | $C_{12}H_3Cl_5O$ | 57117-31-4 | |
| 123 | 2153 | 五氯化锑 | 过氯化锑；氯化锑 | Antimony pentachloride | Antimony(v) chloride; Antimony perchloride | $SbCl_5$ | 7647-18-9 | 1730 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 124 | 2157 | 五羰基铁 | 羰基铁 | Iron pentacarbonyl | Pentacarbonyl iron; Iron carbonyl | $Fe(CO)_5$ | 13463-40-6 | 1994 |
| 125 | 2163 | 五氧化二砷 | 砷酸酐；五氧化砷；氧化砷 | Arsenic pentoxide | Arsenic anhydride | $As_2O_5$ | 1303-28-2 | 1559 |
| 126 | 2177 | 戊硼烷 | 五硼烷 | Pentaborane | Pentaboron nonahydride | $B_5H_9$ | 19624-22-7 | 1380 |
| 127 | 2198 | 硒酸钠 | | Sodium selenate | Disodium selenate | $Na_2SeO_4$ | 13410-01-0 | 2630 |
| 128 | 2222 | 2-硝基-4-甲氧基苯胺 | 枣红色基GP | 2-Nitro-4-methoxyaniline | 2-Nitro-p-anisidine | $C_7H_8N_2O_3$ | 96-96-8 | |
| 129 | 2413 | 3-[3-(4'-溴联苯-4-基)-1,2,3,4-四氢-1-萘基]-4-羟基香豆素 | 溴鼠灵 | 3-[3-(4'-Bromobiphenyl-4-yl)-1,2,3,4-tetrahydro-1-naphthalenyl]-4-hydroxycoumarin | Brodifacoum; Talon; Klerat; Volid | $C_{31}H_{23}BrO_3$ | 56073-10-0 | 3027 |
| 130 | 2414 | 3-[3-(4-溴联苯-4-基)-3-羟基-1-苯丙基]-4-羟基香豆素 | 溴敌隆 | 3-[3,4'-Bromo(1,1'-biphenyl)-4-yl]-3-hydroxy-1-phenylpropyl-4-hydroxy-2H-1-benzopyran-2-one | Bromadiolone; Contrac; Maki | $C_{30}H_{23}BrO_4$ | 28772-56-7 | 3027 |
| 131 | 2460 | 亚砷酸钙 | 亚砒酸钙 | Calcium arsenite | Arsenious acid, calcium salt | $AsH_3O_{3.3}$/2Ca | 27152-57-4 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | $As_2O_6.3Ca$ | | |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 132 | 2477 | 亚硒酸氢钠 | 重亚硒酸钠 | Sodium biselenite | Sodium hydrogen selenite | $NaHSeO_3$ | 7782-82-3 | 2630 |
| 133 | 2527 | 盐酸吐根碱 | 盐酸依米丁 | Emetine, dihydrochloride | Amebicide; Purum | $C_{29}H_{40}N_2O_4 \cdot 2ClH$ | 316-42-7 | 1544 |
| 134 | 2533 | 氧化汞 | 一氧化汞；黄降汞；红降汞 | Mercury oxide | Mercury oxide, red; Red precipitate | HgO | 21908-53-2 | 1641 |
| 135 | 2549 | 一氟乙酸对溴苯胺 | | 4'-Bromo-2-fluoroacetanilide | | $C_8H_7BrFNO$ | 351-05-3 | |
| 136 | 2567 | 乙撑亚胺 | 吖丙啶；1-氮杂环丙烷；氮丙啶 | Aziridine; | | $C_2H_5N$ | 151-56-4 | 1185 |
| 137 | | 乙撑亚胺[稳定的] | | Dimethyleneimine | | | | |
| 138 | 2588 | O-乙基-O-(4-硝基苯基)苯基硫代膦酸酯[含量 > 15%] | 苯硫膦 | O-Ethyl-O-(4-nitrophenyl)phenyl phosphonothioate | EPN | $C_{14}H_{14}NO_4PS$ | 2104-64-5 | 3018 2783 |
| 139 | 2593 | O-乙基-S-苯基乙基二硫代膦酸酯[含量 > 6%] | 地虫硫膦 | O-Ethyl S-phenyl ethyldithiophosphonate | Fonofos; Dyfonate | $C_{10}H_{15}OPS_2$ | 944-22-9 | 3018 |
| 140 | 2626 | 乙硼烷 | 二硼烷 | Diborane | Diboron hexahydride; Boroethane | $B_2H_6$ | 19287-45-7 | 1911 |

| 序号 | 危险化学品目录序号 | 中文名称 | | 英文名称 | | 化学式（Molecular Formula) | CAS | UN |
|---|---|---|---|---|---|---|---|---|
| | | 化学名 | 别名 | Chemical Name | Alias | | | |
| 141 | 2635 | 乙酸汞 | 乙酸高汞；醋酸汞 | Mercuric acetate | Mercuric diacetate | $C_4H_6O_4Hg$ | 1600-27-7 | 1629 |
| 142 | 2637 | 乙酸甲氧基乙基汞 | 醋酸甲氧基乙基汞 | Methoxyethyl mercury acetate | Acetato(2-methoxyethyl) mercury | $C_5H_{10}HgO_3$ | 151-38-2 | 2025 |
| 143 | 2642 | 乙酸三甲基锡 | 醋酸三甲基锡 | Trimethyltin acetate | Trimethylstannium acetate | $C_5H_{12}O_2Sn$ | 1118-14-5 | 2788 |
| 144 | 2643 | 乙酸三乙基锡 | 三乙基乙酸锡 | Acetoxytriethyl Stannane | Triethyltin acetate | $C_8H_{18}O_2Sn$ | 1907-13-7 | 2788 |
| 145 | 2665 | 乙烯砜 | 二乙烯砜 | Vinyl Sulfone | Divinyl sulfone | $C_4H_6O_2S$ | 77-77-0 | 2927 |
| 146 | 2671 | N-乙烯基乙撑亚胺 | N-乙烯基氮丙环 | N-Vinylethyleneimine | N-Vinylaziridine | $C_4H_7N$ | 5628-99-9 | 2810 |
| 147 | 2685 | 1-异丙基-3-甲基吡唑-5-基N,N-二甲基氨基甲酸酯[含量 > 20%] | 异索威 | 1-Isopropyl-3-methyl-5-pyrazoly-N,N-dimethylcarbamate | Isolan; Primin | $C_{10}H_{17}N_3O_2$ | 119-38-0 | 2992 |
| 148 | 2718 | 异氰酸苯酯 | 苯基异氰酸酯 | Isocyanic acid phenyl ester | Phenylcarbimide; Carbanil | $C_7H_5NO$ | 103-71-9 | 2487 |
| 149 | 2723 | 异氰酸甲酯 | 甲基异氰酸酯 | Methyl isocyanate | Isocyanatomethane | $C_2H_3NO$ | 624-83-9 | 2480 |

## Appendix I PRECURSOR TO DRUGS

**Definition:**

The precursor chemicals are substances (such as precursor, raw material & chemical AIDS) that can be used to make drugs. They are mainly divided into three categories

**Category 1:**

| 序号 | 中文名称 | | 英文名称 | | Molecular Formula | CAS号 |
|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical Name | Alias | | |
| **1** | 苯基-2-溴-1-丙酮 | | 1-Bromo-1-phenyl-2-propanone | 1-bromo-1-phenyl-2-propanon | $C_9H_9BrO$ | 23022-83-5 |
| **2** | 3-氧-2-苯基丁腈 | | 3- oxygen -2- phenyl nitrile | | $C_{10}H_8NO$ | |
| **3** | 1-苯基-2-丙酮 | | 1-phenyl-2-propanone | BENZYL METHYL KETONE | $C_9H_{10}O$ | 103-79-7 |
| **4** | 3,4-亚甲基二氧苯基-2-丙酮 | 胡椒基苯丙酮；胡椒基甲基酮 | 3,4-Methylenedioxyphenyl-2-propanone | PIPERONYL METHYL KETONE | $C_{10}H_{10}O_3$ | 4676-39-5 |
| **5** | 胡椒醛 | 胡椒基丙酮 | piperonal | Piperonyl aldehyde | $C_8H_6O_3$ | 120-57-0 |
| **6** | 黄樟素 | 黄樟油素，萨富罗尔 | safrole | | $C_{10}H_{10}O_2$ | 94-59-7 |
| **7** | 黄樟油 | 檫木油; | sassafras oil | Perfume oil | | 8006-80-2 |
| **8** | 异黄樟素 | 4-丙烯基-1,2-亚甲二氧基苯 | iso-safrole | 3,4-Methylenebisoxy-1-(1-propenyl)benzene | $C_{10}H_{10}O_2$ | 120-58-1 |
| **9** | N-乙酰邻氨基苯酸 | 2-乙酰氨基苯甲酸 | n-acetyl o-amino benzoic acid | | $C_9H_9NO_3$ | 89-52-1 |
| **10** | 邻氨基苯甲酸 | 2-氨基苯甲酸; 羧基苯胺; 1-氨基-2-羧基苯 | o-amino benzoic acid | Anthranilic acid | $C_7H_7NO_2$ | 118-92-3 |
| **11** | 邻氯苯基环戊酮 | | o-Chlorophenyl cyclopentyl ketone | | $C_{12}H_{13}ClO$ | |
| **12** | 羟亚胺 | 1-羟基环 | Hydroxylimine | | $C_{13}H_{16}ClNOHCl$ | 90717-16-1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 戊基-2-氯苯基-N-甲基亚胺基酮 | | | | |
| **13** | 麦角酸* | | ergotic acid* | 9,10-DIDEHYDRO-6-METHYL-ERGOLINE-8-CARBOXYLIC ACID | $C_{16}H_{16}N_2O_2$ | 82-58-6 |
| **14** | 麦角氨* | | ergotamine* | | $C_{33}H_{35}N_5O_5$ | 113-15-5 |
| **15** | 麦角新碱* | 顺丁烯二酸麦角新碱 | ergobasine* | Ergometrine | $C_{19}H_{23}N_3O_2$ | 60-79-7 |
| **16** | 麻黄素* | 1-N,2-二甲基-β-羟基苯乙胺 | ephedrine* | L-ephedrine; Ephedral | $C_{10}H_{15}NO$ | 299-42-3 |
| **17** | 伪麻黄素* | | pseudo ephedrine* | PSE | | |
| **18** | 消旋麻黄素* | | mesoephedrine* | | | |
| **19** | 去甲麻黄素* | | phenylpropanolamine* | | | |
| **20** | 甲基麻黄素* | | methylephedrine* | | | |
| **21** | 麻黄浸膏* | 苯乙酸 | ephedrine extractum* | Phenylaceticacid | $C_8H_8O_2$ | 103-82-2 |
| **22** | 麻黄浸膏粉*等麻黄素类物质* | | ephedrine extractum powder and other ephedrine substances* | | | |
| **23** | N-苯乙基--4-哌啶酮 | 1-苯乙基-4-哌啶酮;N-(2-苯乙基)- | N-phenethyl-4-piperidone | | $C_{13}H_{17}NO$ | 39742-60-4 |

| | | | | | |
|---|---|---|---|---|---|
| | | 4-哌啶酮 | | | |
| **24** | 4-苯胺基-N-苯乙基哌啶 | 4-AMINOPHENYL-1-PHENETHYLPIPERIDINE | $C_{19}H_{24}N_2$ | 21409-26-7 | |
| **25** | N-甲基-1-苯基-1-氯-2-丙胺 | N-Methyl-1-chloro-1-phenylpropane-2-amine | $C_{10}H_{14}ClN$ | 25394-33-6 | |

**Category 2:**

| **序号** | **中文名称** | | **英文名称** | | **Molecular Formula** | **CAS号** |
|---|---|---|---|---|---|---|
| | **化学名** | **别名** | **Chemical Name** | **Alias** | | |
| **1** | 苯乙酸 | | phenyl acetic acid | | $C_8H_8O_2$ | 103-82-2 |
| **2** | 醋酸酐 | 乙酸酐 | acetic oxide | Acetic anhydride | $C_4H_6O_3$ | 108-24-7 |
| **3** | 三氯甲烷 | 氯仿 | chloroform | Trichloromethane | $CHCl_3$ | 67-66-3 |
| **4** | 乙醚 | 二乙醚，乙氧基乙烷 | aether | Ether | $C_4H_{10}O$ | 60-29-7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **5** | 哌啶 | 六氢吡啶;哌啶;氮己环;一氮六环 | piperidine | Hexahydropyridine | $C_5H_{11}N$ | 110-89-4 |

**Category 3**

| 序号 | 中文名称 | | 英文名称 | | Molecular Formula | CAS号 |
|---|---|---|---|---|---|---|
| | **化学名** | **别名** | **Chemical Name** | **Alias** | | |
| **1** | 甲苯 | 甲基苯，苯基甲烷 | toluene | methylbenzene | $C_7H_8$ | 108-88-3 |
| **2** | 丙酮 | 二甲基酮、二甲基甲酮，二甲酮，醋酮、木酮 | acetic oxide acetone | acetone | $CH_3COCH_3$ | 67-64-1 |
| **3** | 甲基乙基酮 | 2-氧代丁烷 | methyl ether ketone | 2-Butanone | $CH_3COCH_2CH_3$ | 78-93-3 |
| **4** | 高锰酸钾 | 灰锰氧、PP粉 | potassium permanganate | | $KMnO_4$ | 7722-64-7 |
| **5** | 硫酸 | | sulfuric acid | | $H_2SO_4$ | 7664-93-9 |

| | | | | | |
|---|---|---|---|---|---|
| **6** | 盐酸 | 氢氯酸 | hydrochloric acid | HCl | 7647-01-0 |

**Note:**

- The saline chemicals that may exist in the substances as listed in Category 1 or 2 shall be brought into control;
- The types marked with "*" are precursor chemicals under the item of pharmaceuticals in Category 1, which include the pharmaceutical raw materials and the single preparation thereof.

**Appendix J PRECURSOR TO EXPLOSIVES**

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| **1** | **酸类 Acid** | | | | | | | |
| 1.1 | 硝酸 | 氨氮水 | Nitric Acid | Fumic acid | 金属腐蚀物，类别1 氧化性液 | $HNO_3$ | 7697-37-2 | 2031 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 体，类别1 | | | |
| 1.2 | 发烟硝酸 | | fuming nitric acid | Aqua Fortis | 氧化性液体，类别1 | $HNO_3$ | 52583-42-3 | 3264 |
| 1.3 | 高氯酸[浓度>72%] | 过氯酸 | Per chloric Acid | Per Chloricacid | 氧化性液体，类别1 | $HClO_4$ | 7601-90-3 | 1873 |
| | 高氯酸[浓度50%-72%] | | | | 氧化性液体，类别1 | | | |
| | 高氯酸[<=50%] | | | | 氧化性液体，类别2 | | | |
| **2** | **硝酸盐类 Nitrates** | | | | | | | |
| 2.1 | 硝酸钠 | 钠硝石<br>智利硝石 | Sodium Nitrate | Nitratedesodium | 氧化性固体类别3 | $NaNO_3$ | 7631-99-4 | 1498 |
| 2.2 | 硝酸钾 | 土硝<br>火硝<br>硝石<br>盐硝 | Potassium nitrate | Vicknite | 氧化性固体类别3 | $KNO_3$ | 7757-79-1 | 1486 |
| 2.3 | 硝酸铯 | | Caesium nitrate | Cesium Nitrate | 氧化性固体类别3 | $CsNO_3$ | 7789-18-6 | 1451 |
| 2.4 | 硝酸镁 | | Magnesium nitrate | | 氧化性固体类别3 | $Mg(NO_3)_2$ | 10377-60-3 | 1474 |

| **序号 NO.** | **中文名称** | | **英文名称** | | **主要的燃爆危险性分类 (Main category)** | **化学式 (formula)** | **CAS 号** | **联合国危险货物编号 (UN)** |
|---|---|---|---|---|---|---|---|---|
| | **化学名** | **别名** | **Chemical name** | **Alias** | | | | |
| **2** | **硝酸盐类 Nitrates** | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2.5 | 硝酸钙 | 无水硝酸钙 | Calcium nitrate | Calcium Nitrate Anhydrous | 氧化性固体类别3 | $CaN_2O_6$ | 10124-37-5 | 1454 |
| 2.6 | 硝酸锶 | 无水硝酸锶 | Strontium Nitrate | Strontium Salt | 氧化性固体类别3 | $Sr(NO_3)_2$ | 10042-76-9 | 1507 |
| 2.7 | 硝酸钡 | | Barium Nitrate | | 氧化性固体类别2 | $Ba(NO_3)_2$ | 10022-31-8 | 1446 |
| 2.8 | 硝酸镍 | 硝酸亚镍 | Nickel Nitrate | Nickelous Nitrate | 氧化性固体类别2 | $Ni(NO_3)_2$ | 14216-75-2 | 2725 |
| 2.9 | 硝酸银 | | Silver Nitrate | | 氧化性固体类别2 | $AgNO_3$ | 7761-88-8 | 1493 |
| 2.10 | 硝酸锌 | 六水合硝酸锌 | Zinc Nitrate | Zinc Nitrate Hexahydrate | 氧化性固体类别2 | $Zn(NO_3)_2{\cdot}6H_2O$ | 7779-88-6 | 1514 |
| 2.11 | 硝酸铅 | 硝酸铅(II) | Lead Nitrate | | 氧化性固体类别2 | $Pb(NO_3)_2$ | 10099-74-8 | 1469 |
| **3** | **氯酸盐类 Chlorates** | | | | | | | |
| 3.1 | 氯酸钠<br>氯酸钠溶液 | 氯酸鲁达;<br>白药钠,<br>氯酸碱 | Sodium Chlorate | Chlorate De Sodium | 氧化性固体类别1<br>氧化性液体类别3* | $NaClO_3$ | 7775-09-9 | 1495 |
| 3.2 | 氯酸钾<br>氯酸钾溶液 | | Potassium Chlorate | | 氧化性固体类别1<br>氧化性液体类别3* | $KClO_3$ | 3811-04-9 | 1489 |
| 3.3 | 氯酸铵 | | Ammonium Chlorate | Chloric acid | 爆炸物，不稳定爆炸物 | $NH_4ClO_3$ | 10192-29-7 | |

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆 危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| **4** | **高氯酸盐类 Perchlorates** | | | | | | | |
| 4.1 | 高氯酸锂 | 过氯酸锂 | Lithium Perchlorate | Lithium Perchlora | 氧化性固体 类别2 | $LiClO_4$ | 7791-03-9 | |
| 4.2 | 高氯酸钠 | 过氯酸钠 | Sodium Perchlorate | Sodium perchlorate hydrate | 氧化性固体 类别1 | $NaClO_4 \cdot H_2O$ | 7601-89-0 | 1502 |
| 4.3 | 高氯酸钾 | 过氯酸钾 | Potassium Perchlorate | | 氧化性固体 类别1 | $KClO_4$ | 7778-74-7 | 1489 |
| 4.4 | 高氯酸铵 | 过氯酸铵 | Ammonium Perchlorate | | 爆炸物1.1项 氧化性固体，类别1 | $NH_4ClO_4$ | 7790-98-9 | 1442 |
| **5** | **重铬酸盐类 dichromate** | | | | | | | |
| 5.1 | 重铬酸锂 | | Lithium Dichromate | Dilithium Salt | 氧化性固体，类别2 | $Cr_2Li_2O_7$ | 13843-81-7 | |
| 5.2 | 重铬酸钠 | 红矾钠 | Sodium Dichromate | | 氧化性固体，类别2 | $Cr_2Na_2O_7$ | 10588-01-9 | |
| 5.3 | 重铬酸钾 | 红矾钾 | Potassium Dichromate | | 氧化性固体，类别2 | $K_2Cr_2O_7$ | 7778-50-9 | |
| 5.4 | 重铬酸铵 | 红矾铵 | Ammonium Dichromate | | 氧化性固体，类别2* | $(NH_4)2Cr_2O_7$ | 7789-09-5 | |
| **6** | **过氧化物和超氧化物类 Peroxide and Superoxide** | | | | | | | |
| 6.1 | 过氧化氢溶液（含量>8%） | 双氧水 | Hydrogen Peroxide | | （1）含量≥60% 氧化性液体，类别1 （2）20%≤含量＜60% 氧化性液体，类别2 （3）8%<含量<20% | $H_2O_2$ | 7722-84-1 | 2015 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 氧化性液体，类别3 | | | |

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆 危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| 6 | 过氧化物和超氧化物类Peroxide and Superoxide | | | | | | | |
| 6.2 | 过氧化锂 | 二氧化锂 | Lithium Peroxide | | 氧化性固体类别2 | $Li_2O_2$ | 12031-80-0 | 1472 |
| 6.3 | 过氧化钠 | 双氧化钠；二氧化钠 | Sodium Peroxide | | 氧化性固体类别1 | $Na_2O_2$ | 1313-60-6 | 1504 |
| 6.4 | 过氧化钾 | 二氧化钾 | Potassium Peroxide | | 氧化性固体类别1 | $K_2O_2$ | 17014-71-0 | 1491 |
| 6.5 | 过氧化镁 | 二氧化镁 | Magnesium Peroxide | | 氧化性液体类别2 | $MgO_2$ | 1335-26-8 | 1476 |
| 6.6 | 过氧化钙 | 二氧化钙 | Calcium Peroxide | | 氧化性固体类别2 | $CaO_2$ | 1305-79-9 | 1457 |
| 6.7 | 过氧化锶 | 二氧化锶 | Strontium Peroxide | | 氧化性固体类别2 | $SrO_2$ | 1314-18-7 | 1509 |
| 6.8 | 过氧化钡 | 二氧化钡 | Barium Peroxide | | 氧化性固体类别2 | $BaO_2$ | 1304-29-6 | 1449 |
| 6.9 | 过氧化锌 | 二氧化锌 | Zinc Peroxide | | 氧化性固体类别2 | $ZnO_2$ | 1314-22-3 | 1516 |
| 6.10 | 过氧化脲 | 过氧化氢尿素；过氧化氢脲 | Urea Hydrogen Peroxide | | 氧化性固体类别3 | $CO(NH_2)_2.H_2O_2$ | 124-43-6 | 1511 |

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆 危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| 6 | 过氧化物和超氧化物类 Peroxide and Superoxide | | | | | | | |
| 6.11 | 过乙酸[含量≤16%,含水≥39%,含乙酸≥15%,含过氧化氢≤24%,含有稳定剂] | 过醋酸；过氧乙酸；乙酰过氧化氢 | Peroxyacetic acid | | 有机过氧化物F型 | $C_2H_4O_3$ | 79-21-0 | |
| | 过乙酸[含量≤43%,含水≥5%,含乙酸≥35%,含过氧化氢≤6%,含有稳定剂] | | | | 易燃液体 类别3 有机过氧化物，D型 | | | |
| 6.12 | 过氧化二异丙苯[52%＜含量≤100%] | 二枯基过氧化物；硫化剂 DCP | Dicumyl Peroxide | | 有机过氧化物，F型 | $C_{18}H_{22}O_2$ | 80-43-3 | 3109 (液) 3110 (固) |
| 6.13 | 过氧化氢苯甲酰 | 过苯甲酸 | Peroxybenzoic Acid | | 有机过氧化物，C型 | $C_6H_5CO_3H$ | 93-59-4 | |
| 6.14 | 超氧化钠 | | Sodium Superoxide | | 氧化性固体 类别1 | $NaO_2$ | 12034-12-7 | 2547 |
| 6.15 | 超氧化钾 | | Potassium Superoxide | Potassium molecular oxygen | 氧化性固体 类别1 | $KO_2$ | 12030-88-5 | 2466 |
| 7 | 易燃物还原剂类 Flammable and reductant | | | | | | | |
| 7.1 | 锂 | 金属锂 | Lithium | | 遇水放出易燃气体的物质和混合物，类别1 | Li | 7439-93-2 | 1415 |
| 7.2 | 钠 | 金属钠 | Sodium | | 遇水放出易燃气体的物质和混合 | Na | 7440-23-5 | 1428 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 物，类别1 | | | |
| 7.3 | 钾 | 金属钾 | Potassium | | 遇水放出易燃气体的物质和混合物，类别1 | K | 7440-09-7 | 2257 |

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆 危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| 7 | 易燃物还原剂类 Flammable and reductant | | | | | | | |
| 7.4 | 镁 | | Magnesium | | （1）粉末：自热物质和混合物，类别1<br>遇水放出易燃气体的物质和混合物，类别2<br>（2）丸状、旋屑或带状：易燃固体，类别2 | Mg | 7439-95-4 | |
| 7.5 | 镁铝粉 | 镁铝合金粉 | Magnesium Aluminum Powder | | 遇水放出易燃气体的物质和混合物，类别2<br>自热物质和混合物，类别1 | | | |
| 7.6 | 铝粉 | | Aluminum Powder | | 1）有涂层：易燃固体，类别1<br>（2）无涂层：遇水放出易燃气体的物质和混合物，类别2 | Al | 7429-90-5 | 1396 |
| 7.7 | 硅铝 | | Aluminum Silicon Powder | | 遇水放出易燃气体的物质和混合物<br>类别3 | Al-Si | 57485-31-1 | 1398 |
| | 硅铝粉 | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7.8 | 硫磺 | 硫 | Sulphur | Sulfur | 易燃固体<br>类别2 | S | 7704-<br>34-9 | 1350 |

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆 危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| 7 | 易燃物还原剂类 Flammable and reductant | | | | | | | |
| 7.9 | 锌尘 | | Zinc Dust | | 自热物质和混合物，类别1；遇水放出易燃气体的物质和混合物，类别1 | Zn | 7440-66-6 | 1436 |
| | 锌粉 | | Zinc Powder | | 自热物质和混合物，类别1；遇水放出易燃气体的物质和混合物，类别1 | | | |
| | 锌灰 | | Zinc Dust | | 遇水放出易燃气体的物质和混合物，类别3 | | | |
| 7.10 | 金属锆 | | Zirconium | | 易燃固体 类别2 | Zr | 7440-67-7 | 2008 |
| | 金属锆粉 | 锆粉 | Zirconium Powder | | 自燃固体，类别1，遇水放出易燃气体的物质和混合物，类别1 | | | |
| 7.11 | 锑粉 | | Antimony Powder | | | Sd | 7440-36-0 | 2871 |
| 7.12 | 镁合金粉 | | Magnesium Alloys Powder | | 遇水放出易燃气体的物质，类别1 | | | |
| 7.13 | 六亚甲基四胺 | 六甲撑四胺；乌洛托品 | Hexamethylenetetramine | | 易燃固体 类别2 | $C_6H_{12}N_4$ | 100-97-0 | 1328 |
| 7.14 | 1,2-乙二胺 | 1,2-二氨基乙烷；乙撑二胺 | 1,2-Ethylenediamine | | 易燃液体 类别3 | $C_2H_8N_2$ | 107-15-3 | |
| 7.15 | 一甲胺[无水] | 氨基甲烷；甲胺 | Methylamine | Mono-methylamine | 易燃气体 类别1 | $CH_3NH_2$ | 74-89-5 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 一甲胺溶液 | 氨基甲烷溶液；甲胺溶液 | | | 易燃液体 类别1 | | | |

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| **7** | **易燃物还原剂类 Flammable and reductant** | | | | | | | |
| 7.16 | 硼氢化锂 | 氢硼化锂 | Lithium Borohydride | | 遇水放出易燃气体的物质和混合物，类别1 | $LiBH_4$ | 16949-15-8 | 1413 |
| 7.17 | 硼氢化钠 | 氢硼化钠 | Sodium Borohydride | | 遇水放出易燃气体的物质和混合物，类别1 | $NaBH_4$ | 16940-66-2 | 1426 |
| 7.18 | 硼氢化钾 | 氢硼化钾 | Potassium Borohydride | | 遇水放出易燃气体的物质和混合物，类别1 | $KBH_4$ | 13762-51-1 | 1870 |
| **8** | **硝基化合物类 Nitro compound** | | | | | | | |
| 8.1 | 硝基甲烷 | | Nitromethane | | 易燃液体类别3 | $CH_3NO_2$ | 75-52-5 | 1261 |
| 8.2 | 硝基乙烷 | 硝乙烷 | Nitroethane | 1-Nitroethane | 易燃液体类别3 | $C_2H_5NO_2$ | 79-24-3 | 2842 |
| 8.3 | 2，4-二硝基甲苯 | | 2,4-Dinitrotoluene | 4-methyl-1,3-dinitrobenzene | | $C_7H_6N_2O_4$ | 121-14-2 | 2038 |
| 8.4 | 2，6-二硝基甲苯 | | 2,6-Dinitrotoluene | | | $CH_3C_6H_3(NO_2)_2$ | 606-20-2 | 1600 |
| 8.5 | 1，5-二硝基萘 | | 1,5-dinitronaphthalene | | 易燃固体类别1 | $C_{10}H_6N_2O_4$ | 605-71-0 | |
| 8.6 | 1，8-二硝基萘 | | 1,8-dinitronaphtha | | 易燃固体类别1 | $C_{10}H_6N_2O_4$ | 602-38-0 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | lene | | | | | |

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| 8 | 硝基化合物类 Nitro compound | | | | | | | |
| 8.7 | 二硝基苯酚[干的或含水＜15%] | 2,4-二硝基酚 | Di-nitrophenol (Dry or <15% Hydrate) | | 爆炸物 1.1项 | $C_6H_4N_2O_4$ | 25550-58-7 | 0076 |
| | 二硝基苯酚溶液 | | Di-nitrophenol Solution | | | | | |
| 8.8 | 2，4-二硝基苯酚[含水≥15%] | 1-羟基-2，4-二硝基苯 | 2,4-Dinitrophenol (≥15% water) | | 易燃固体类别1 | $C_6H_4N_2O_5$ | 51-28-5 | |
| 8.9 | 2，5-二硝基苯酚[含水≥15%] | | 2,5-Dinitrophenol (≥15% water) | | 易燃固体类别1 | $C_6H_4N_2O_5$ | 329-71-5 | |
| 8.10 | 2，6-二硝基苯酚[含水≥15%] | | 2,6-Dinitrophenol (≥15% water) | | 易燃固体类别1 | $C_6H_4N_2O_5$ | 573-56-8 | |
| 8.11 | 2，4-二硝基苯酚钠 | | Sodium 2,4-dinitrophenate | Sodium dnp | 爆炸物 1.3项 | $C_6H_3N_2NaO_5$ | 1011-73-0 | |
| 8.12 | 二硝基间苯二酚[干的或含水＜15%] | | 2，4-Dinitro-1，3-benzene diol (Dry or <15% water) | | 爆炸物 1.1项 | $C_6H_4N_2O_6$ | 519-44-8 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| 9 | 其他 Others | | | | | | | |
| 9.1 | 硝化纤维素[干的或含水（或乙醇）＜25%] | 硝化棉 | Nitrocellulose (Dry, or Wetted with water Alocohol <25%) | | 爆炸物 1.1项 | $C_{12}H_{17}(ONO_2)_3O_7$～ $C_{12}H_{14}(ONO_2)_6O_7$ | 9004-70-0 | 0340 |
| | 硝化纤维素[含氮≤12.6%，含乙醇≥25%] | | Nitrocellulose (≤12.6% Nitrogen; ≥25% Alcohol) | | 易燃固体 类别1 | | | 2556 |
| | 硝化纤维素[含氮≤12.6%] | | Nitrocellulose (≤12.6% Nitrogen) | | 易燃固体 类别1 | | | |
| | 硝化纤维素[含水≥25%] | | Nitrocellulose (≥25% water) | | 易燃固体 类别1 | | | 2555 |
| | 硝化纤维素[含乙醇≥25%] | | Nitrocellulose (≥25% alcohol) | | 爆炸物 1.3项 | | | 0342 |
| | 硝化纤维素[未改型的，或增塑的，含增塑剂＜18%] | | Nitrocellulose (<15% Plasticizing Substance) | | 爆炸物 1.1项 | | | 0341 |
| | 硝化纤维素溶液[含氮量≤12.6%，含硝化纤维素≤55%] | 硝化棉溶液 | Nitrocellulose solution (≤12.6% Nitogen, ≤55% Nitrocellulose) | | 易燃液体 类别2 | $C_{12}H_{17}(ONO_2)_3O_7$～ $C_{12}H_{14}(ONO_2)_6O_7$ | | |

| 序号 NO. | 中文名称 | | 英文名称 | | 主要的燃爆危险性分类 (Main category) | 化学式 (formula) | CAS 号 | 联合国危险货物编号 (UN) |
|---|---|---|---|---|---|---|---|---|
| | 化学名 | 别名 | Chemical name | Alias | | | | |
| 9 | 其他 Others | | | | | | | |
| 9.2 | 4，6-二硝基-2-氨基苯酚钠 | 苦氨酸钠 | Sodium 2 – Amino -4,6-Dinitrophenoxide | Picramic Acid Sodium Hydrate | 爆炸物1.3项 | $C_6H_4N_3NaO_5$ | 831-52-7 | |
| 9.3 | 高锰酸钾 | 过锰酸钾<br>灰锰氧 | Potassium Permanganate | | 氧化性固体类别2 | $KMnO_4$ | 7722-64-7 | 1490 |
| 9.4 | 高锰酸钠 | 过锰酸钠 | Sodium Permanganate | | 氧化性固体类别2 | $NaMnO_4$ | 10101-50-5 | 1503 |
| 9.5 | 硝酸胍 | 硝酸亚氨脲 | Guanidine Nitrate | Guanidine Mnononitrate | 氧化性固体类别3 | $CH_6N_4O_3$ | 506-93-4 | |
| 9.6 | 水合肼 | 水合联氨 | Hydrazine hydrate | | | $N_2H_4·H2O$ | 10217-52-4 | |
| 9.7 | 2，2-双（羟甲基）1，3-丙二醇 | 季戊四醇<br>四羟甲基甲烷 | Pentaerythritol | | | $C_5H_{12}O_4$ | 115-77-5 | |

**Notes:**

1. Definition of Each Column:
   "序号（NO.）": The number of chemicals in the Precursor to Explosives V2017
   "品名 （Chemical Name）": According to the name based on 《Principles of naming chemicals》 (1980)
   "别名（Alias）": Other known names of the chemical except the Chemical Name
   "CAS号": Chemical Abstract Service, it is the only registration number of chemicals by Chemical Digest Association of America.
   "主要的燃爆危险性分类（Main Category）": Classification of combustion and explosion hazards of a chemical according to the National Standards, the classification and labeling of chemicals (GB 30000.2 -2013 ~GB30000.29-2013).
2. Except for the chemicals in the list, inorganic Salts also include both anhydrous and crystalline-containing compounds.
3. The chemical mixtures without content description means its industrial products or the chemicals' purities are higher than the industrial products.

4. The category with "*" mark, means the chemicals can have a more rigorous category under well-founded conditions.

**Sources of information (mostly from the UK)**

*Control of Substances Hazardous to Health – Approved Code of Practice and Guidance*, L5 HSE Books, 2005

*The idiot's guide to CHIP3: Chemicals (Hazard Information and Packaging for Supply) Regulations, 2002*. Leaflet INDG350 HSE Books

*Approved Classification and Labelling Guide. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002* L131 HSE Books (regularly updated)

*Approved supply list. Information approved for the classification and labelling of substances and preparations dangerous for supply. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. Approved list.* L129 HSE Books (regularly updated)

*EH40/2005Workplace Exposure Limits.* HSE Books (updated annually)

*New and expectant mothers at work: a guide for employers*. HSG22 HSE Books

HSE documents are available from the Health & Safety intranet using the OHSIS system.

The Oxford University website on chemical safety information is very useful: http://msds.chem.ox.ac.uk/

University of Liverpool Safety Circulars SCR18 (CoSHH: Control of Substances Hazardous to Health) and SC66 (New and Expectant Mothers at Work) can be accessed via the Health and Safety intranet.

Suppliers' literature. It is the responsibility of the Supplier under Section 6 of the '*Health and*

*Safety at Work Act*' to provide information on the hazards of substances and the precautions to be taken. Caution needs to be applied in relying on this information, since occasionally the information supplied is inadequate. Suppliers can also overstate the risk in order to "cover themselves".

http://www.chinasafety.gov.cn/zjnsjg/ajss/wxhxpaqjg/gggw_419/xzxk_423/201503/t20150309_207141.shtml

**Document Information**

| | |
|---|---|
| Document: | Health & Safety Handbook |
| Version: | 2.2 |
| Date: | 21st February, 2019 |