LABORATORY SAFETY GUIDELINES

Contents

1 Introduction

The laboratory contains many potential safety hazards. However, with proper control these hazards can be controlled. These guidelines outline the basic laboratory safety requirements and it is expected that individual departments will develop further safety instructions that are specific to their needs.

2 Responsibilities

The following outlines the responsibilities of personnel who have duties to ensure risks to health and safety associated with working in a laboratory are eliminated or managed.

2.1 Deans and Heads of Unit

Deans and heads of units should ensure that resources are in place so that the requirements outlined in these guidelines can be met by the area under their control.

2.2 Laboratory Supervisors

Laboratory supervisors will provide supervision to a variety of personnel including honours and post graduate research students. Supervisors need to ensure that

- staff and students receive the appropriate information, instruction and training necessary for them to perform work safely
- staff and students receive an induction that includes information pertaining to emergency response procedures and personnel
- facilities and equipment provided for staff and students are safe and suitable for the types of work to be carried out
- ensure that hazard identification and risk assessment activities are undertaken and documented for the use, handling, storage, transport and disposal of equipment, materials and substances and that appropriate risk controls are implemented and maintained
- ensure that good housekeeping standards are developed and maintained in the areas under their control
- ensure that staff and students under their control use safety equipment provided in a correct manner
- ensure that all students understand the disciplinary procedures that will be invoked for non-compliance with occupational health and safety instructions, policies and procedures
- ensure that all incidents, hazards and near misses that occur are reported on SafetyNet.

2.3 Staff and Students

All staff and students who undertake work in laboratories must take reasonable care of their own health and safety and the health and safety of others and by following any reasonable requests from their lab supervisor.

2.4 Contractors

Contractors are required to:

- comply with any reasonable direction given by laboratory staff in the interests of health, safety and welfare.
- Immediately report any incident or accident or any unexpected occurrence to laboratory staff.

3 Laboratory Access and Authorisation

Access and authorisation requirements will be determined based on the risk associated with processes carried out and the materials and equipment stored within the on the lab. Access and authorisation requirements should be suitable so that risks associated with unauthorised access can be prevented. If there are any doubts over the risk then a risk assessment needs to be completed.

4 Training

4.1 Laboratory Safety Inductions

Any person entering laboratory facilities must comply with the local area's processes surrounding induction. It is recommended that a local Laboratory Safety Induction Manual/Checklist is developed to ensure consistent information of the relevant local hazards is communicated during each induction.

The level and detail of the safety induction training should depend upon the risk associated with processes carried out and the materials and equipment stored within the on the lab, however minimum induction topics include:

- purchasing process
- chemical labelling requirements
- dangerous goods storage
- waste disposal
- local emergency equipment and procedures,
- confirmation that the information provided has been received and understood (e.g. quiz).

The induction content should be reviewed annually (at a minimum). More frequent reviews may be conducted when the hazards in the area change or following an incident.

Training records (e.g. completed quiz) must be kept and maintained in accordance with WHS Records Handling Guidelines.

5 General Lab Safety

5.1 Safe Practices

The inherent hazards within a lab will depend on the risk associated with the processes carried out and the materials and equipment stored within the area. Safety practices can be outlined within a local laboratory manual. In general the following should be applied to standard safety practices:

- clothing and personal protective equipment should be in accordance with UOW Laboratory Hazard Identification Sign that is to be clearly displayed at the entrance to the lab
- work in accordance with the UOW Working Alone and After Hours Work Guidelines.
- ensure risk management activities have been implemented in accordance with the UOW Risk Management Guidelines so that the potential hazards of the operation are known as precisely as possible, and the appropriate safety precautions are adopted
- ensure manual handling hazards are managed in accordance with UOW Materials Handling Guidelines. For example always use safety carriers for transporting chemicals in glass or plastic containers with a capacity of 2 L or greater. Never carry containers of mutually reactive substances at the same time.
- store and handle hazardous chemicals in accordance with the UOW Working with Hazardous Chemicals Guidelines. For example always use a fume cupboard, fume cabinet or glove box when working with highly toxic, volatile or odoriferous substances

- manage emergencies in accordance with the relevant Campus Emergency Response Procedures
- maintain all safety equipment in accordance with the UOW Managing the Risk of Plant Guidelines and the UOW PPE and Clothing Guidelines
- dispose of specialized wastes (e.g. broken glassware, biological and radioactive substances) in accordance with the UOW Waste Disposal Guidelines.

5.2 Housekeeping

It is recommended that good hygiene and housekeeping practices are incorporated into the management of a laboratory. The following represents a useful resource on what should be maintained from a housekeeping perspective:

- floors, aisles and exits are to be kept tidy, free of obstruction and dry
- benches are to be kept clean and free of chemicals and apparatus that are not being used.
- access to all emergency equipment (fire extinguishers, first aid kits, chemical spill kits, emergency shower and eye washes) is to be kept free from obstruction
- work areas including the interior of fume cupboards and equipment are to be thoroughly cleaned after use
- if last to leave the laboratory, make sure equipment is turned off, flames are extinguished,
- all apparatus left running overnight should be shielded and labelled with name and telephone number of person to be contacted.

5.3 Working Alone and After Hours

An assessment of the risks associated with each identified working alone situation shall be completed in consultation with those working alone to formulate practical solutions to manage working alone situations. The risk assessment should be completed in accordance with the Risk Management Guidelines and the Working Alone and After Hours Work Guideline.

5.4 Transfer of Dangerous Goods and Hazardous Chemicals

A risk assessment needs to be completed for any task that requires the transportation of dangerous goods and hazardous substance. As a minimum the following controls need to be implemented into this process.

- no personnel should accompany dangerous goods, gases or cryogens in a lift.
- a minimum of two persons should work together to transport these substances via a lift, as outlined below:
    - one person must be stationed on the relevant floor to receive the appropriately packaged substances when the lift arrives. A sign should also be placed on the container to inform people what the substance is and not to travel in the lift whilst the substance is being transported
    - the second person places the substance in the lift, selects the floor/level and exits the lift before the doors close,
    - the first person removes the substance when it arrives.

5.5 Fume Cupboards

Where fume cupboards are used in a laboratory the following recommendations should be implemented:

- all fume cupboards should have regular checks of their face velocity. The required face velocity is 0.5 metre/second. Measurements should be in accordance with the AS/NZS 2243.8, Appendix B
- cleaned and decontaminate the fume cupboard prior to use
- position apparatus and material to the centre and rear of the fume cupboard to minimise disturbance to the air flow at the face. Wherever possible, place all the required equipment in the cupboard before commencing a procedure. It should be noted that drafts from windows and doors can affect the performance of the cupboard

- before commencing any procedure, check that the fume cupboard is working correctly. It is not enough to just switch on the fan
- wherever possible keep the sash of the cupboard as low as possible when working at a fume cupboard
- at completion of the procedure, remove all waste from the cupboard and decontaminate
- if hazardous chemicals are to be stored in the cupboard, the exhaust fan should be kept continuously running,
- it should be noted that any work involving the use of perchloric acid must be carried out in fume cupboards that are specifically designed for use with perchloric acid.

5.6 Glassware

The following recommendations have been developed in an attempt to prevent injuries associated with broken glassware:

- all glassware must be securely stored so as to minimise the risk of breakage
- all glass tubing should have the ends flame polished
- only use glassware when it is in good condition i.e. not broken or chipped
- when cleaning glassware, protective gloves should be worn; commercial cleaning agents should be used; chromic acid should only be used as a last resort
- all broken glass should be placed in bins that are marked broken glass only; broken glass should not be placed in normal waste bins
- glassware that requires modification by glass blowing must be thoroughly washed prior to this operation to avoid oral poisoning or explosion that may result from heat or a source of ignition being applied to residues,
- pipetting by mouth is not allowed; pipette pumps must be used.

5.7 Refrigeration

Refrigeration is commonly used in laboratories and a number of safety precautions need to be taken including:

- care must be taken when using domestic refrigerators in laboratories to ensure that flammable liquids are not stored in them. Sparks from thermostats and light switches can ignite fumes leading to explosion. Domestic refrigerators in laboratories must have signage indicating no food or drink to be stored, no flammable material to be stored and whether hazardous substances are being stored
- flammable liquids requiring refrigeration should be stored in refrigerators that are intrinsically safe. (Refrigerators that have spark proof wiring)
- cold rooms must have door fittings that enable the doors to be opened from the inside. An emergency light or luminous sign indicating the position of the door should be fitted to the inside of the cold room
- do not handle, store or consume food or drink in the laboratory and do not store food or drink in a refrigerator which is used to store laboratory materials.

5.8 Handling and Disposal of Sharps

Refer to the Working with Sharps Guidelines.

5.9 Laboratory Entry Signage

All laboratories that carry out work that could present a risk to health and safety must have a UOW Laboratory Hazard Identification Sign that is to be clearly displayed at the entrance to the lab.

6 Emergency Management

In the event of fire or other emergency that may endanger staff and students procedures can be UOW Laboratory Hazard Identification Sign that is to be clearly displayed at the entrance to the lab.

6.1 Minor Chemical Spills

When a spill of a chemical substance occurs, the following procedures should be followed:

- establish what material has been spilt and what personal protective measures should be followed. This information can be obtained from a Safety Data Sheet (SDS) from the Chem Alert Database. Specific information on spills clean-up method should be obtained from the SDS
- prior to commencing spill clean-up, ensure that you are wearing the appropriate protective equipment. It should be noted that even small quantities of volatile materials spread over a surface in a confined space could generate significant concentrations of fumes, requiring respiratory protection to be worn
- spills control kits have been placed in a number of areas of the university. These kits contain protective equipment, absorbents and neutralisers
- the first step in a spills procedure is containment. Chemsorb absorbent pillows should be placed around the spill forming a bund to control the spread of the spill. (It should be noted that Chemsorb is not to be used on HF spills).
- general procedures include:
    - organics: use vermiculite as absorbent
    - acids or alkalis: first neutralise then absorb with paper towel, cloth or mop
    - mercury: cover with sulphur then remove with dust pan and a broom before placing in a sealed container.
- at the completion of the spill clean-up, all absorbent or contaminated material should be placed in sealed containers, labelled and disposed of as contaminated waste.

7 Safety Equipment

Laboratories at the university are equipped with a number of safety features.

7.1 Safety Showers

These showers are provided to wash off hazardous substances that may be splashed on the skin of personnel.

Copious quantities of water should be used to wash away contaminants and it may be necessary to remove contaminated clothing. Further information can be found in the Emergency Eyewash Station and Safety Showers Guidelines.

7.2 Eye Wash Stations

Eye wash stations are located in laboratories to flush the eyes if hazardous substances are splashed into them. In the event of hazardous substances splashing in the eyes, the stream of water from the spray should be directed into the eye for a period of 20 minutes before seeking medical attention. Further information can be found in the Emergency Eyewash Station and Safety Showers Guidelines.

8 Chemical Safety

The proper storage of chemicals is an important safety issue in the Laboratory. Storage of chemicals is regulated in NSW by the Dangerous Goods Act and Regulations with Dangerous Goods being. Further information can be found in the UOW Working with Hazardous Chemicals Guidelines and UOW Dangerous Goods Storage and Handling Guidelines.

8.1 Flammable Liquids

When handling flammable liquids the following points, as a minimum, should be implemented as control measures:

- flammable liquids must be kept away from all sources of ignition.
- all electrical equipment used near flammable Liquids should have spark proof wiring.
- when heating flammable liquids, use only steam or water baths or heating mantles. Extreme care must be exercised to ensure that there is no source of ignition,
- appropriate fire extinguishers and fire blankets must be easily accessible when handling flammable liquids.

Flammable liquids are classified under the Dangerous Good Act as Class 3 Dangerous (identified with a red flammable liquids diamond label) which is then subdivided into 4 Classes.

Class 3.1	Liquids with a flash point below -18°C, up to but not including 23°C. Examples include: Benzene, Carbon Disulphide, Ethanol and Petrol.
Class 3.2	Liquids with a flash point of 23°C, up to and including 61°C. Examples: Cyclohexanone, Kerosene.
Class 3.3	Liquids with a flash point greater than 61°C, up to but not including 1 50°C. Examples: Diesel Fuel, Heating Oil.
Class 3.4	Liquids with a flash point greater than 150°C. Examples: Cottonseed Oil, Linseed Oil.

The maximum quantity of flammable liquid that maybe kept without special facilities are:

Class 3.1	5 litres
Class 3.2	25 litres
Class 3.3 and 3.4	500 litres

Quantities up to 100 litres of class 3.1 and 3.2 must be stored in an approved flammable liquids storage cabinet. Quantities up to 250 litres may also be stored in a cabinet providing that a license has been obtained.

Quantities of Class 3.1 and 3.2 flammable liquids in excess of 250 litres must be stored in a licensed flammable liquids store.

Further information can be found in the Dangerous Goods Storage and Licensing Guidelines.

8.2 Gas Cylinders

Compressed, liquefied or dissolved gases are categorised as Class 2 dangerous goods and sub-categorised as:

Class 2.1	Flammable gases identified by a red dangerous goods diamond (e.g. butane)
Class 2.2	Non-flammable and non-toxic gases identified by a green dangerous goods diamond (e.g. helium)
Class 2.3	Poisonous gases identified by a white dangerous goods diamond (e.g. ammonia)

In instances where the gas presents multiple hazards, additional diamonds indicate the subsidiary risks. For example, Chlorine Class 2.3 (toxicity) and Class 5.a (oxidising agent)

The majority of accidents involving gas cylinders occur while moving them from one location to another. The following control measures should be used as a minimum to reduce the potential for an accident:

- the use of purpose-built trolleys or other suitable devices for gas cylinder transportation
- securing the gas cylinder valve, disconnecting and removing associated distribution equipment
- shutting the cylinder valve, disconnecting and removing associated distribution equipment
- a requirement that only properly trained personnel are permitted to move cylinders,
- laboratory procedures preventing the manual movement of larger gas cylinders.

For information on storage of gas cylinders refer to AS/NZS 4332 The Storage and Handling of Gases in Cylinders.

8.3 Cryogenic Fluids

Cryogenic fluids are defined as fluids having a boiling point below -150°C at atmospheric pressure. Cold contact burns, frost bite, suffocation, lung disorder and general body cooling can result from exposure to cryogenic fluids. In addition, liquid oxygen and hydrogen present a fire hazard. It should also be noted that liquid nitrogen although not flammable in itself is sufficiently cold to condense oxygen out of the atmosphere which can then present a hazard. The following procedures should be followed when handling cryogenic fluids.

8.3.1 Personal Protection

In all cases, eye and hand protection should always be worn. The need for additional safety protection, outlined below, will depend upon the operation being carried out and the quantity of liquid involved.

- a full face shield (see AS/NZS 1336) when transferring liquid, immersing objects or any other time when splashing may occur
- use appropriate insulated gloves when carrying cryogenic fluids in containers
- use appropriate safety clothing that minimises the formation of traps capable of holding liquid near the skin,
- use enclosed footwear.

8.3.2 Transfer techniques

The following techniques can be used when transferring cryogenic fluids to secondary containers:

- pressurisation (conventional method) using pressure creating by heat leak into the storage container, by a heat source with the container, or by pressurisation with a gas corresponding to the liquid product
- submersible electrically operated pump for the transfer of liquid nitrogen, though precautions will be required to prevent condensate entering and freezing in the pump especially when changing containers. This method is not recommended for liquid oxygen transfers
- the use of transfer tubes approved by the supplier of cryogenic container
- pouring using a filling funnel with the top of the funnel partly covered to reduce splashing.

8.3.3 Proprietary Equipment

Proprietary equipment such as cryostats and liquefiers should always be operated and maintained in accordance with the manufacturer's instructions. Regular maintenance and inspections should be arranged.

8.3.4 Working at Reduced Pressure

If the pressure on a cryogenic liquid is reduced below atmospheric, the following additional precautions should be taken:

- check that the system is vacuum-tight to prevent moist air being drawn in and forming ice plugs
- provide a protective screen when working with glass dewar flasks
- carefully control initial pumping speed to avoid pressure oscillation and liquid entertainment

- prevent violent boiling of superheated liquid by inserting boiling centres, compatible with the liquid in use, inside the dewar flask. This precaution is especially necessary when working with nitrogen in a glass system.

When the backing pump is used to pump evolved gas into a valved recovery system, provide a pressure-relief valve on the exhaust side of the pump, to protect against pump operation with recovery valves shut.

9 Biological Safety

Many activities carried out at the University have associated biological hazards. These include working with Genetically Modified Organisms (GMOs), microorganisms (bacteria, fungi, viruses), human blood, blood products and body fluids, animals and animal tissue, raw and treated sewage, radioactive isotopes, some fieldwork plant and animal material and other biological agents that are potentially infectious or hazardous.

- All GMO work must be registered with the University's Gene Technology Review Committee and carried out under the Office of Gene Technology Regulations (OGTR).
- Guidelines from AS/NZS 2243.3:2010 for all work involving microbiological aspects and any work in a containment facility http://www.saiglobal.com.ezproxy.uow.edu.au/online/autologin.asp
- Australian Quarantine and Inspection Service (AQIS) requirements for quarantineable plant and animal material
- Fieldwork Guidelines and Scuba Diving Operations Manual
- Radiation Safety Guidelines

Further information can be found in the Biosafety Manual.

10 Related Documents

- AS/NZS 2243.1 Planning and Operational Aspects
- AS/NZS 2243.2 Chemical Aspects
- AS/NZS 2243.3 Microbiological Aspects
- AS/NZS 2243.4 Ionizing radiations
- AS/NZS 2243.5 Non-ionizing radiations
- AS/NZS 2243.6 Mechanical aspects
- AS/NZS 2243.7 Electrical aspects
- AS/NZS 2243.8 Fume cupboards
- AS/NZS 2243.9 Recirculating fume cabinets
- AS/NZS 2243.10 Storage of chemicals
- AS/NZS2444 Portable fire extinguishers and fire blankets-Selection and location
- AS/NZS 2982.1 Laboratory Design and Construction
- AQIS Criteria 5.2 for QC2 Facilities
- OGTR PC2 Facilities/Physical Containment 2 Requirements
- Incident Management and Reporting Guidelines
- Working Alone and After Hours Work Guidelines

11 Version Control Table

Version Control	Date Released	Approved By	Amendment
1	January 1998	WHS Manager	Document created
2	April 2003	WHS Manager	Document updated to reflect current requirements
3		WHS Manager	Document updated to reflect current requirements
4	April 2006	WHS Manager	Document updated to reflect current requirements
5	January 2010	WHS Manager	Included section on access and authorisation and training.
6	August 2010	WHS Manager	Document updated to incorporate the Personnel name change to Human Resources Division.
7	March 2011	WHS Manager	Document updated to reflect current requirements.
8	March 2012	WHS Manager	Rebrand
9	May 2013	WHS Manager	WHS Legislation Update
10	February 2014	WHS Manager	Updated
11	November 2015	WHS Manager	Review following HMDG Audit. Updated section 4.1. Added recommendation that local Laboratory Safety Induction Manual/Checklist be developed. Added minimum induction topics. Added review of induction content.