MONASH University

DEPARTMENT OF
MATERIALS SCIENCE AND ENGINEERING
(MSE)

SAFETY MANUAL

http://eng.monash.edu/materials/assets/documents/resources/ohs/safety-manual.pdf

Version 1.2

Revision Aug 2016

1. SUMMARY OF OCCUPATIONAL HEALTH AND SAFETY RESPONSIBILITIES

The following table identifies the minimum occupational health and safety responsibilities of each group of staff and students within the department.

Staff/Student Category	Summary of Occupational Health and Safety Responsibilities and Requirements
Undergraduate student	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies • Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents
Postgraduate student	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies • Plan and assess safety of experimental program prior to initiating work or changes • Generate and adhere to risk assessments, safe work instructions for all laboratory work in collaboration with Safety Officer and Supervisor • Maintain MSDS for all chemicals in laboratories • Maintain chemical registers • Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents
Research staff	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies • Plan and assess safety of experimental program prior to initiating work or changes • Generate and adhere to risk assessments, safe work instructions for all laboratory work in collaboration with Safety Officer and Supervisor • Maintain MSDS for all chemicals in laboratories • Maintain chemical registers • Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents
General staff	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies • Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents
Technical staff	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies • Generate and adhere to risk assessments, safe work instructions for all laboratory/workshop work in collaboration with Safety Officer • Maintain MSDS for all chemicals in workshops • Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents
Academic staff	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies • Provide guidance and leadership in OHS documentation and refer queries to Safety Officer • Plan and assess safety of experimental program prior to initiating work or changes • Review and approve risk assessments, safe work instructions for all laboratory work in collaboration with Safety Officer • Ensure all students and research staff working under you are adequately trained and complete all OHS documents • Ensure all research group members are signed off in local training record • Authorise all chemical requisitions • Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents
Contractors (not working in labs)	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies

	• Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents
Contractors (performing works in labs)	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies • Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents
Visitors (not working in labs)	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies • Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents
Visitors (performing works in labs)	• Follow safety instructions provided by supervisors and academics • Follow instructions of emergency personnel (wardens/first aiders police etc) during emergencies • Plan and assess safety of experimental program prior to initiating work or changes • Generate and adhere to risk assessments, safe work instructions for all laboratory work in collaboration with Safety Officer and Supervisor • Maintain MSDS for all chemicals in laboratories • Maintain chemical registers • Wear PPE as required in accordance with local instructions/procedures • Report all hazards and incidents

2. INTRODUCTION

The purpose of this document is to identify the roles and responsibilities of the Occupational Health, Safety and Environment personnel and to identify policies and procedures that are used to implement the Occupational Health and Safety Act.

Health and Safety in laboratories and in the workplace is of paramount importance to all staff, students, research personnel and visitors. Safety regulations apply equally to all staff, students, research personnel and visitors and are to be strictly adhered to. The Materials Science and Engineering (MSE) Department has a ***zero tolerance*** policy in relation to safety violations, and non-compliance may lead to exclusion from the laboratories. The purpose of this manual is to outline and highlight the safety requirements within the department and provide guidance for local implementation of the Occupational Health and Safety Policy[1] and the Environmental Sustainability Policy[2].

2.1. Role of Safety Personnel

While responsibility for occupational health and safety in the University is a function of all levels of line management, all staff members and students have an overriding moral and legal responsibility for maintaining their own safety and that of their co-workers and fellow students.

There are designated members of staff in the MSE Department who have been assigned the responsibility of operating the laboratories and the support facilities in an efficient, safe and productive manner. Academic Supervisors are responsible for overseeing the safety procedures for their own research groups, comprising of undergraduate and postgraduate students as well as research support staff. Laboratory Managers help to ensure safe working practices are being followed throughout the various lab areas within the Engineering Faculty. Additionally, OHS committees and officers act at the Department and University levels. All specific functions and duties are described below.

2.1.1. Academic Supervisors

Academic Supervisors are immediately responsible for the health and safety of all members of their research groups and any impacts their activities may have beyond the group. Each academic supervisor is required to ensure that their research team complies with Monash Occupational Health, Safety and Environment (OHSE) policies and procedures. The Academic Supervisors are required to determine the degree of supervision that is required and the amount of responsibility that can be delegated to the members of the research group. The Safety Officer should be involved and fully informed of the current and planned changes to the scope of the research. The Safety Officer must be fully briefed before any new project is commenced or any modifications are made to existing equipment or processes.

[1] http://www.policy.monash.edu/policy-bank/management/student-comm-serv/ohse/occupational-health-safety-policy.html
[2] http://policy.monash.edu.au/policy-bank/management/facilities-services/environmental-sustainability-policy.html

Supervisors are responsible for ensuring that members of their research team

- are inducted generally to the University and Department.
- complete local area inductions for all lab areas where they will be working and complete the Local Area OHS Induction Checklist[3].
- complete all specialized training modules such as risk management, cryogenics, radiation, etc. if applicable.
- consult with the individual Lab Supervisors/Managers where they will be working.
- understand the safety procedures and are aware of the location and purpose of safety equipment in their work area.
- are trained in the use of all equipment and processes they are to undertake and recorded on the OHS Training Record[4] and the record to be kept in the MSE Reception.
- fulfil all governing/relevant safety requirements.
- are familiar with emergency and evacuation procedures.
- understand the nature and properties of the materials that they are handling and the precautions that need to be taken to manage any hazards associated with use. Supervisors may need to provide additional training to ensure members of their research team can access and understand relevant Material Safety Data Sheet (MSDS) and other safety materials.

Supervisors must also

- ensure that all equipment used is safe in both design and construction.
- ensure that all reasonable steps have been taken to guarantee safe operation of equipment and that all material is safely handled and disposed of in accordance with relevant regulations.
- ensure purchases[5] adhere to Monash safety policies.

This responsibility is executed in collaboration with the SO, HSR and Zone Consultant, where required.

2.1.2. Laboratory Managers

Each laboratory area has a designated Lab Manager and the identity of this person should be posted at the entrance to the lab area alongside all authorized users of the lab. The Lab Manager may be the Academic in charge or a member of the research group who has been adequately trained to carry out all training and safety protocol associated with high-quality management of the lab area.

Lab Managers are responsible for ensuring that every authorized user of the lab

- has completed a local area induction.
- is aware of all hazards and emergency procedures associated with that local lab area.
- has left the lab area clean and free from remaining samples, waste, etc. when leaving the lab. The Lab Manager must be satisfied with clean up before signing-off on the Completion of Activities Form found on the MSE OHS webpage[6].

Lab Managers must also

- check to ensure all chemicals in the lab are labelled and stored properly.
- ensure chemicals are segregated[7] in accordance to their DG class and other necessary precautions.
- participate in all laboratory inspections.
- report any unsafe behaviour or poor chemical hygiene to Academic Supervisors and Safety Officers.

2.1.3. Department Level Safety Committee and Officers

The Department has established a Safety Committee to promote OHSE issues and to implement Monash University Policies, Procedures and Guidelines. The committee meets once every two months where a review of previous OHS events is conducted and action plans for the coming month are established. Each research group is represented on the safety committee and the committee is chaired by a member of the academic staff. Typically the meeting agenda includes a review on incidents, actions from the previous meeting, SO report, representative reports, and an inspection update. A list of current members can be found on the MSE OHS Committee meeting minutes[8].

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[3] http://eng.monash.edu/materials/resources/ohs/
[4] http://eng.monash.edu/materials/resources/ohs/
[5] http://intranet.monash.edu.au/finance/purchase-to-payment/index.html
[6] http://eng.monash.edu/materials/resources/ohs/
[7] http://www.monash.edu/__data/assets/pdf_file/0007/148588/dangerous-goods-segregation-chart.pdf
[8] http://www.eng.monash.edu.au/materials/resources/ohs/meeting/

Safety Officer (SO)

- The role of the Safety Officer within the Department is to promote OHS awareness, to advise on matters of health and safety, to provide information regarding safety issues or hazards within the department, to facilitate resolution of safety issues, to investigate and report on incidents, to liaise with the OHSE group and to implement the policies and procedures in accordance with requirements nominated by the OHSE group and any other governing legislation.
- The SO also has other functions within the Department such as signing off on, chemical purchases, commissioning new equipment etc.
- Specific questions on safety, procedures, and incident reporting should be directed to the SO or DSO.
- Role of Safety Officer – Full Definition[9]
- MSE SO: John Forsythe[10]

Deputy Safety Officer (DSO)

- The role of the Deputy Safety Officer is to support the Department Safety Officer and provide means for implementation of OHSE policies and procedures. In the absence of the SO, the DSO fills the role of the SO.
- The DSO also has other functions within the Department such as signing off on risk assessments, chemical purchases, and commissioning new equipment etc.
- Specific questions on safety, procedures, and incident reporting should be directed to the SO or DSO.
- MSE DSO: Ian Wheeler[11]

Occupational Health and Safety Representative (HSR)

- The role of the Occupational Health and Safety Representatives is to represent the health and safety interests of staff in their workplace. They also have certain rights and powers under the OHS Act, which include:
    - the right to be consulted by employers on all proposed changes to the workplace
    - the right to inspect a workplace in the event of any accident or serious hazard
    - the right to issue a cease work order if there is an immediate or serious threat to safety
    - the power to issue a Provisional Improvement Notice.
- Role of Designated Work Groups and HSR – Full Definition[12]
- MSE HSR: Daniel Curtis[13]

Environmental Officer/Green Office Representative

- The respective roles of the Environmental Officer and Green Office Representative within the Department are to promote environmental awareness, to encourage recycling practices and reduction in the consumption of utilities, to investigate and report on environmental incidents and to communicate on environmental issues within the department. Currently there are no representatives, please refer any queries to the SO and DSO.

2.1.4. Specialty Safety Officers

Laser Safety Officer

- The role of the Laser Safety Officer is to oversee and sign-off on the commissioning of all new laser equipment installed in the Department. Additional responsibilities include ensuring safe operation of laser equipment by signing-off on all safe operating procedures and providing specific laser safety training modules before a user is authorized to use the equipment.
- Role of Laser Safety Officer – Full Definition[14]
- MSE Laser Safety Officer: Chris McNeill[15]

Radiation Safety Officer

- The role of the Radiation Safety Officer is to manage OHS issues associated with radiation within the Department. Additional responsibilities include ensuring safe operation of radiation equipment by signing-off on all safe operating procedures and providing specific radiation safety training modules before a user is authorized to use the equipment.

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[9] http://www.monash.edu.au/ohs/safety-roles/safety-officers-role.html
[10] http://eng.monash.edu.au/materials/about/people/profile/forsythe
[11] http://eng.monash.edu.au/materials/about/people/profile/wian
[12] http://www.monash.edu.au/ohs/safety-roles/health-safety-reps-role.html
[13] http://eng.monash.edu.au/about/people/profile/curtis
[14] https://www.monash.edu/ohs/roles-and-responsibilities/ohs-responsibility-laser-safety-officers
[15] http://eng.monash.edu.au/about/people/profile/cmcneill

- Role of Radiation Safety Officer – Full Definition[16]
- MSE Radiation Safety Officer: Nikki Stanford[17]

Biosafety Officer (BO)

- The role of the Biosafety Officer is to provide advice, instruction and training on all matters within the Department concerning handling, storage and procedures involving biological substances. The final point includes licensing information, facility certification and classification of activities under the Gene Technology Act. The Biosafety Officer is also responsible for investigation of accidents and emergencies involving biological substances, liaising with Office of the Gene Technology Regulator (OGTR), OHSE and auditing and analysing the legislative compliance within the unit.
- Role of Biosafety Officer – Full Definition[18]
- MSE Biosafety Officer: Laurence Meagher[19]
- Engineering Biosafety Officer: Karla Contreras.

2.1.5. University Level OHSE Officers

Occupational Health Safety and Environment Team (Zone 5)

- The Occupational Health, Safety and Environment (OHSE) group exists to develop policies, procedures and provide guidance in order to ensure compliance with the Occupational Health and Safety Act. The University has been divided into Zones covering all departments and campuses of the University each zone is assigned an OHSE consultant who provides advice and instruction to ensure all local safety issues are managed in accordance with the OHS Act. MSE is in Zone 5.

OHSE Zone Committee

- OHS and environmental issues in each area of the university are managed by Zone OHSE Committees, which are chaired by a senior academic or general staff equivalent and include representatives from the various work groups within the zone. Zone OHSE Committees meet at least quarterly with the minutes of meetings displayed on safety notice boards and/or websites of the zone. A list of current committee members can be found online[20].
- MSE Representative: John Forsythe[21]

2.1.6. First Aid Team

The First Aid team is comprised of volunteers who undertake approved training in Level 2 First Aid. A complete list of local First Aiders and their contact information is located inside the first aid cabinets.

Responsibilities of members of the First Aid Team are to:

- respond promptly to provide an emergency service for injury/illness as required, always within their level of competence.
- arrange prompt and appropriate referral as required.
- record all treatment (however minor) on the First Aid Injury Report and report all incidents to the SO and Head of Department.
- encourage staff who have had an occupational injury to record this on a Hazard and Incident Report Form.
- keep confidential all information received in the course of their duty (medical information should only be released to medical staff). First aiders can access information from an SOS bracelet or similar in order to attend to a casualty.
- attend training as required.
- participate in the Hepatitis B immunisation program.
- report any deficiencies in the first aid service to the SO or department manager (includes lack of supplies in First Aid cabinet).

3. EMERGENCY PROCEDURES

3.1. General

Prior to commencing work in any area within the Department, all staff, students and visitors must be aware of the local emergency procedures. These topics should be covered in the *Tier 1 Induction* which is a requirement for all people working in the New Horizons building. For lab areas throughout the Monash campuses, additional information related to emergency procedures within the vicinity of

[16] https://www.monash.edu/ohs/roles-and-responsibilities/ohs-responsibility-radiation-safety-officers
[17] http://eng.monash.edu.au/about/people/profile/nikkis
[18] https://www.monash.edu/ohs/roles-and-responsibilities/biosafety-officers
[19] http://eng.monash.edu.au/about/people/profile/laurencm
[20] http://www.monash.edu.au/ohs/committees/local-committee-chairs.html
[21] http://eng.monash.edu.au/materials/about/people/profile/forsythe

each specific lab area will be covered during the *Local Area Induction* which all people are required to complete before commencing work within a laboratory. At a minimum, these inductions ensure everyone is aware of the locations of the nearest:

- Fire extinguisher
- First aid kit
- Eye wash/safety shower
- Isolation devices for gas, water and power
- Emergency spill containment procedures
- Emergency personal protection equipment eg. Self Contained Breathing Apparatus
- Building exits and congregation areas outside
- The closest First Aid officers

A list of emergency help phone numbers is given below:

- **Emergency (internal Phone)** **333**
- **Emergency (mobile)** **990 53333**
- **Security** **990 53059**
- **Occupational Health and Safety** **990 51016**
- **Campus Medical Centre** **990 53175**
- **Community Care-Line** **990 51599**
- **Counselling** **990 53156**
- **University Switchboard** **990 54000**
- **Chemwatch** **1800 039 008**

3.2. Emergency Evacuation

At all times during the emergency, stay calm, and follow the instructions of the emergency wardens. There are different alarms within the laboratory areas – some alert for fire, others explosive vapours, and there is also a low oxygen alarm. The New Horizons Building Induction will provide details on the alarm conditions. Become familiar with each alarm signal in order to safely respond to specific emergency situations.

The following procedure details the actions to be taken during an emergency evacuation.

1) On hearing the ALERT signal (an intermittent 'beep') prepare to leave the building - secure confidential materials and valuables, collect personal belongings, shut down experiments, switch off computers, electrical appliances, equipment, machinery, etc.
2) On hearing the EVACUATE signal (a 'whooping' tone), or if instructed to do so by an emergency warden, leave the building by the nearest and safest exit route.
   DO NOT USE THE LIFTS
3) If safe to do so take hand held personal belongings such as briefcases and handbags when evacuating. Do not return to collect these items.
4) Assist any person with a disability to leave the building, or to the nearest fire isolated stairwell or fire safe haven for multi-storey buildings – do not attempt to carry people down stairs.
5) Walk quickly and calmly to the designated assembly area for your building or as advised by the emergency warden or fire brigade personnel.
6) Remain at the assembly area (in groups) until instructed to leave by an emergency warden or fire brigade personnel.
7) Do not re-enter the building until informed that it is safe to do so by an emergency warden or fire brigade personnel.
8) Do not enter a building in alarm.

3.2.1. Evacuations and Response to Fires

Monash University does not endorse direct intervention in the event of a fire. The appropriate response is to:

1. Activate the nearest break glass alarm.
   - Call for help
     - If you have a phone in the room ring SECURITY on ext 333 and advise them of your location
     - Or alert a Fire Warden during normal working hours
   - Only use a fire extinguisher if trained and there is no risk to you
2. Evacuate as described above in Emergency Evacuation.

3.2.2. Evacuations and Response to Low Oxygen Alarm

The normal concentration of oxygen in the atmosphere is approximately 20.9% volume. In the absence of adequate ventilation the level of oxygen can be reduced surprisingly quickly by breathing and combustion processes. Oxygen levels may also be depleted due to dilution by other gases such as carbon dioxide (also a toxic gas), nitrogen or helium, and chemical absorption by corrosion processes and similar reactions. Oxygen sensors should be used in environments where any of these potential risks exist. Oxygen monitors usually provide a first-level alarm when the oxygen concentration has dropped to 19% volume. Most people will begin to behave abnormally when the level reaches 17%, and hence a second alarm is usually set at this threshold. Exposure to atmospheres containing between 10% and 13% oxygen can bring about unconsciousness very rapidly; death comes very quickly if the oxygen level drops below 6% volume.

If a low oxygen alarm is triggered, everyone in that area should evacuate to safety as quickly as possible. Unconsciousness and death may occur in seconds as a result of low oxygen. Breathing as little as one or two breaths of air containing too little oxygen can have serious and immediate effects, including unconsciousness. Because there are no warning signs of reduced oxygen concentrations (other than a low oxygen alarm), these environments are extremely dangerous.

The oxygen detectors located throughout the New Horizons building will activate if levels fall below the safety threshold. Evacuation procedures depend on if the alarm is triggered within an enclosed lab area or in an open plan area.

- If a low oxygen alarm activates for an **enclosed lab** or one of the lifts, then the lab or lift is to be evacuated into the nearest safe area, which should be the room or corridor that the area exits to. Once the area is evacuated, access will not be permitted until authorised by the Building Warden/Safety Officer/Deputy Safety Officer.
- If a low oxygen alarm activates for an **open plan lab** within a wing then the whole laboratory floor level, including enclosed labs, is to be evacuated to the office area on the same level. The Building Warden or Safety Officer in conjunction with Buildings & Property Engineering Services Officer will decide whether the whole floor level and/or building is to be evacuated completely. A building evacuation will be implemented by the activation of a building Fire Alarm.

3.2.3. Evacuations and Response to Explosive Vapour Alarm

The New Horizons building is fitted with explosive gas alarms that will activate if explosive vapours are detected. Evacuation will depend on whether it is a Stage 1 Alarm (orange light) or a Stage 2 Alarm (red light).

- Upon activation of a Stage 1 Gas Alarm (orange light) all personnel within the identifying area are to check for any chemical spills, open gas taps, open chemical cabinets or anything else that may cause a low-level alarm.
    - If the alarm is activated during normal work hours, contact the Building Warden/Safety Officer/Deputy Safety Officer. During after-hours the F&S or ESO should attend. They will acknowledge the alarm by pressing one of the Green alarm mute buttons. If the explosive gas level has decreased to below the activation point, both the alarm and flashing light will stop. If explosive gases are still above the activation threshold, the audible alarm will be muted but the flashing orange light will remain on UNTIL the level decreases below the activation threshold limit.
    - If no cause can be found and the alarm is still active, the person in charge (Building Warden/Safety Officer/Deputy Safety Officer/ESO) will decide what further action to take.
    - Unless specifically told by the person in charge, an evacuation of the area is NOT required.
- If the gas levels increase, the Stage 2 Gas Alarm (Red Light) will activate, which will escalate matters to a building-wide evacuation. ALL personnel within ALL lab areas of New Horizons are to evacuate into the nearest office area of the building and await further instructions. Personnel in the ground floor labs are to make their way to the foyer area outside of Sapporo café.
    - No personnel are to enter or re-enter ANY lab areas without authority from the person in charge (Building Warden/Safety Officer/Deputy Safety Officer/ESO).
    - If an evacuation of the building is deemed necessary, then this will be achieved by the person in charge activating a building Fire Alarm.

3.3. Response to Medical Emergencies, Injuries, and Chemical Exposures

If a medical emergency, injury, or chemical exposure occurs, the following steps below should be taken at once. When the emergency/injury has been managed, the Safety Officer must be notified and a Hazard/Incident Investigation[22] must be initiated. Incident reporting procedures and forms are currently transitioning to an on-line system, and the Safety Officer will assist throughout this process.

[22] https://riskcloud.net/prod/?ccode=monash

- Medical Emergency: Immediately dial 000 from any phone or 333 from a university phone. Give specific details of the emergency and await instructions. If an ambulance is called, Monash security can be notified so they can meet the emergency medical team and guide them to the site of the accident, saving valuable time.
- Injury: First aid must be sought from area first aiders. Contact information for First Aiders within that general area is listed inside of the First Aid kits and can also be found on-line.
- Chemical Exposure: The site of exposure must be flushed with running water at once (unless the SDS indicates otherwise) and the person(s) exposed should remain in the water while someone else gets help. Depending on the severity and chemicals involved, the steps for 'Medical Emergency' or 'Injury' described above should be followed. The Risk Assessment and SDS should be consulted in order to determine the best course of action. See the information below on different types of exposure.

3.3.1. Skin exposures

For all skin exposures, the affected area must be washed under cold, clean running water for 15 minutes. Ideally this should be done under an emergency shower, but in the case of small spills an eyewash station or sink can be used. Help is to be sought from the area first aiders immediately. Follow any other instructions listed in MSDS for skin exposures. If the substance is known to be harmful, or adverse health effects are being experienced, emergency medical assistance must be sought by dialling 333 on the nearest telephone or 990 53333 from a mobile phone. Where exposures to cyanide, arsenic, or hydrofluoric acid may occur, special First Aid considerations and actions *must* be taken as detailed in local Risk Assessments and Safe Work Instructions.

3.3.2. Eye Exposures

For all eye exposures, the eye must by flushed with clean running water for 15 minutes while holding the eyelids open. This should be performed at an eyewash station. Call for help so another person can seek help from the area First Aiders. Where the substance is known to be harmful, or adverse health effects are being experienced, emergency medical assistance must be sought by dialling 333 on the nearest telephone or 990 53333 from a mobile phone. Medical attention must be obtained for all eye exposures to corrosives. Follow any other instructions listed in MSDS for eye exposures. Where exposures to cyanide, arsenic, or hydrofluoric acid may occur special First Aid considerations and actions *must* be taken as detailed in the local Risk Assessments and Safe Work Instructions.

3.3.3. Ingestion

Ingestion is deemed to be an unlikely route of exposure if the chemical safety handling instructions are followed. However, if ingestion occurs seek first aid assistance immediately and follow MSDS instructions for ingestion exposures. In most cases it is suggested to drink a glass of water to dilute the ingested chemical, but this should not be done if it could make the situation worse.

3.3.4. Vapour Inhalation

Where inhalation effects are experienced (including respiratory distress and central nervous system depression) fresh air should be sought immediately. Where the substance is known to be harmful, or adverse health effects are being experienced, emergency medical assistance must be sought by dialling 333 on the nearest telephone or 990 53333 from a mobile phone. Follow any instructions listed in MSDS for inhalation exposures, and medical attention must be sought for *all* corrosive and toxic substance exposures. Where exposures to cyanide, arsenic, or hydrofluoric acid may occur special First Aid considerations and actions *must* be taken as detailed in the local Risk Assessments and Safe Work Instructions.

3.4. Spill Management

The principles of spill management apply universally irrespective of the size and nature of the substance(s) involved.

Note: If unsure of the hazards presented and associated risk to health and safety consult your supervisor, Safety Officer or OHS Advisor (990 51060) prior to taking any action.

3.4.1. Spill Management Procedures

1) Raise the alarm and Evacuate (if required)
    - Where the spill is small and of low risk and can be easily managed locally, other people present in the area must be notified of the spill and should leave the area.
    - Where the spill is large or involves hazardous substances or dangerous goods the SO and emergency services (via security) must be notified.
    - Where the spill represents an immediate threat to personal safety, the nearest Break Glass Alarm must be activated while evacuating.

2) Isolate Hazard
   - Depending on the size and the risk associated with the spill, the lab, area, floor or building must be isolated.
   - Any people who have been exposed must, if safe to do so, be moved to a decontamination area.
   - The treatment of serious injury must take precedence over decontamination and containment.
3) Restrict Access to the Area
   - Restrict unnecessary movement into and through the area to avoid spreading contamination.
   - Isolate the area be erecting a temporary barricade and placing suitable warning signage. These items are available from the Safety Officer.
4) Clean Up
   - Make an estimate of the safety of entering the spill zone based on the nature of the substance involved.
   - If there is any possibility that toxic, asphyxiating, corrosive, or otherwise harmful vapours may be present, the area must not be entered by anyone except the Fire Brigade or one of the trained Self Contained Breathing Apparatus Clean Up personnel.
   - A minimum of two people must be involved in the "clean up." This will allow for both task sharing and to allow the alarm to be raised in the event of an exposure or medical emergency.

3.4.2. General Procedures for Cleaning Up a Chemical Spill

General guidelines for chemical spill clean up are given below.

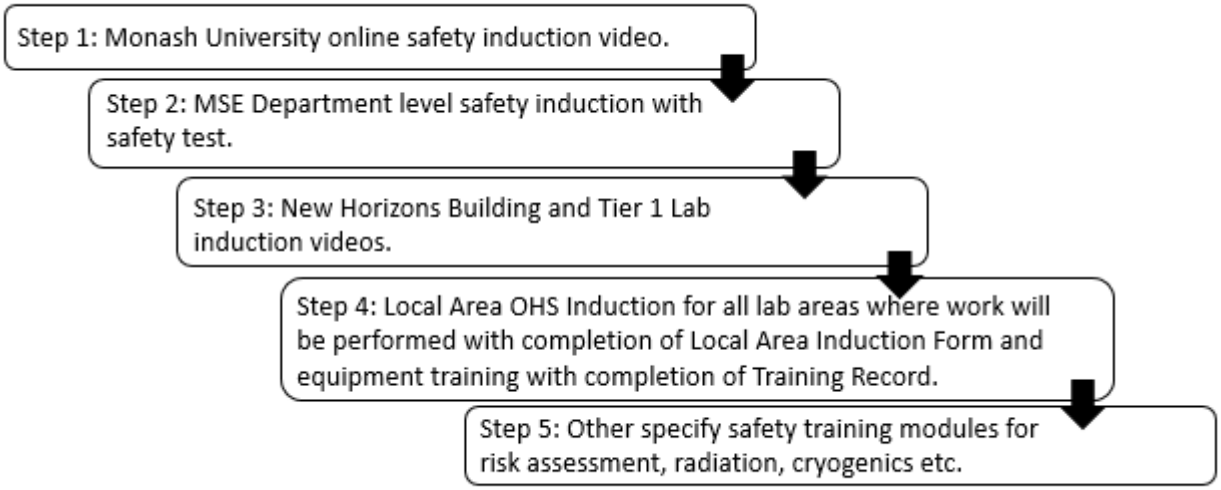
- Identify the material that has been spilled and ensure a MSDS is available.
- There are different types of spill kits within the laboratory areas. The *Local Area Lab Induction* will educate lab users on where these kits are located. Become familiar with the spill kits in the areas where you will be working.
  - Small green spill kits - Select the appropriate absorbent material from the green spill kit: Spill X-A for acid spills, Spill X-C for basic spills, Spill X-S for solvent or hydrocarbon spills.
  - Large blue bin spill kits – Instructions about how to use the various materials within the bin are detailed on the underside of the lid. The kit contains towels, containment materials, and Hadsorb Adsorbent which can be used for any type of chemical spill (however, it does not neutralize the chemicals, only adsorbs them).
- Create a boundary around the edge of the spill using containment materials. This is especially important if the amount of locally available absorbent is not sufficient to absorb all of the spilled material.
- Absorb all remaining spilled material and mix thoroughly to neutralise the spill.
- Collect the absorbent, contaminated gloves and any other items in the plastic bags provided and label in accordance with Monash's guidelines.
- Take the bag to the Engineering Store area in Building 37, 17 Alliance Lane, Room G02 where disposal by Chemsal will be arranged.

4. GENERAL DEPARTMENT SAFETY REQUIREMENTS

4.1. Induction and Training

All MSE staff, students and visitors must complete the Monash University online safety induction program and Department level safety induction. For personnel working in New Horizons, there are also specific Building and Tier 1 Lab Inductions that must be completed before working in the New Horizons building. Please see MSE Reception to get these specific information. There are also Local Area Inductions[23] required for staff, students and visitors. These local inductions provide very practical information about how to stay safe in the specified local areas and can also include training on reading an MSDS, storage of chemicals, usage of lab supplies, and who to contact for equipment training.

[23] http://www.eng.monash.edu.au/materials/resources/ohs/



*To complete **Step 1** to **Step 3** above*, contact Edna Tan[24] at MSE Reception.

*To complete **Step 4** above*, contact the Academic in Charge/Lab Supervisor/Lab Manager for that particular lab area.
A list of MSE Lab Supervisors can be found on the MSE OHS website[25], but in all cases contact information will be listed at the entry of each lab area. If further contact information is needed or questions on the induction process arise, please ask your Supervisor or Safety Officer.

*To complete **Step 5** above*, the proper specialized safety officer must be contacted.
A list of current officers can be found in Section 2.1.4 of this document.

Local Area OHS Induction Checklist form must be completed before anyone starts work in that area. The checklist covers essential OHS procedures; in particular there are items such as knowledge of how to perform a Risk Assessment and Safe Work Instructions and how to obtain and read an MSDS. While information can be found on the Faculty/Departmental websites, the supervisors and laboratory managers also need to ensure that their staff have some level of OHS understanding. The form must be signed by the inductee, the inductor/Lab Supervisor and inductee Supervisor. Original forms are to be kept by MSE Reception and copies are to be kept by the Lab Supervisor. All individual OHS training records are also kept by MSE Reception.

4.1.1. Department Staff and Students

Further to general inductions, Academic Supervisors must ensure that all members of their research groups undertaking work in laboratories are trained in all aspects of their experimental work and that this training is recorded. These training records apply to both *processes* and *equipment,* and a written record for all completed training is maintained by the MSE Reception. Additionally, trained and authorized users should be listed on a printed document kept next to the equipment (authorized users of equipment) and on entry to the laboratory (authorized lab users). Official training on processes can be documented by signing-off on Safe Work Instructions and/or Safe Operation Procedures.

In addition to the general inductions described above, all staff and students are required to complete various training sessions at the start of their employment and then repeat the course every three years. These courses fall within the broader categories of First Aid, Managing Safety and Hazards, Specialized OHS, and Facilities & Services. Not all personnel need to take the same training courses, and all staff and students should reference the OHSE Training Course Guide[26] to see what requirements pertain to them. All new staff are encouraged to participate in First Aid Level 2 training, however it is expected that upon completion, they take on the role of First Aider in the department.

The Monash University Occupational Health Safety and Environment group offers general training to the whole of Monash University (e.g. Manual Handling, Workplace Safety). The Zone OHSE Consultant and SO communicate the training schedule via email to the department. All personnel within the department are encouraged to participate in the training. In addition, the training needs of the department are reviewed every six months by the Zone Consultant and SO to determine the department's training needs. Requests for

[24] http://eng.monash.edu.au/about/people/profile/ehptan
[25] http://www.eng.monash.edu.au/materials/resources/ohs/
[26] http://www.monash.edu/__data/assets/pdf_file/0004/496030/ohs-training-guide.pdf

training can be made to Supervisors or the SO. Information on these training offerings can be found through the Staff Development webpage[27] and OHS webpage[28].

4.1.2. Contractors

All contractors to the Department must receive appropriate safety induction with aspects pertaining to Contractors OHS management[29]. More generally, if a contractor attends a Monash campus on a single occasion and will be chaperoned/supervised by a staff member for the duration, they must sign in to the Monash Visitors Book (located in Building 40 at the Facility and Services Office). Long term contractors or service personnel making repeated visits to the department and visitors who will be working unsupervised must complete the Online Contractor Induction[30] before participating in a Local Induction given by the lab manager where the official Contractor and Visitor Induction Form[31] is completed. Short term contractors are to be given OHS information on emergency evacuation, raising the alarm, first aid and amenities before they are able to sign in at the general office. Only after signing-in can a contractor commence work in the department.

Prior to the arrival and scheduling of contractors, the SO should be notified and the appropriate inductions performed. A contractor/visitor induction is required when a contractor is to work unsupervised or when works will be undertaken in areas other than laboratories and workshops for less than one day. As a minimum, the Online Contractor Induction and questionnaire must be completed and information detailing local emergency procedures and hazards must be provided. The contractor/visitor will be required to sign to acknowledge they have received a contractor local induction[32] (area hazards, emergency procedures, first aid). A record of this will be retained by MSE Reception.

4.2. Documentation

Take note that most of the documentation requirements described below and links to access the database access are listed on the Engineering OHS webpage[33]. The links in the upper right hand corner for the OHS Safety Database, Chemwatch, and Incident Reporting require log-in with a Monash authenticate ID and password to access the systems.

4.2.1. Experiment Planning and Preliminary Hazard Analysis

All staff and postgraduates engaging in laboratory work are required to maintain safety documentation and engage in consultation prior to beginning experimental works. This ensures that the required safety precautions and considerations are made, in consultation with academic supervisors, laboratory managers, research staff, the department safety officer, and the health and safety representative prior to any works beginning. Before ordering chemicals or making any preparations for new experiments, preliminary planning must be done to ensure correct chemical storage and risk identification.

4.2.2. Risk Assessments

The main tool used to implement the OHS Act is a risk assessment. OHSE has developed a Risk Control Program for use by all departments to assess and control the risks of their research and teaching activities that may impact on the health and safety of the employees, visitors, contractors, students and staff. Each staff member and student in the department ***must attend the Risk Management Training*** as soon as possible after arriving at Monash. A listing of the courses and timetables can be found online at the Staff Development webpage[34].

A risk assessment must be performed for all experimental processes, substances/reagents and unit operations that occur in the department. Monash University has developed a comprehensive Risk Control Program that enables each of the main hazard groups (manual handling, equipment and process, chemical, biological, radiation) to be assessed. Control measures and continuous improvement plans must be developed and reviewed as required. The current version of the risk management program and worksheet are available through the MSE OHS webpage[35]. Be aware that the policies are often changing, so consult with the Department Safety

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[27] http://www.adm.monash.edu.au/staff-development/
[28] http://www.monash.edu/ohs
[29] http://www.monash.edu/__data/assets/pdf_file/0005/181418/contractor-management1.pdf
[30] http://www.monash.edu/contractors
[31] http://www.monash.edu/contractors
[32] http://www.monash.edu/contractors
[33] http://www.eng.monash.edu.au/ohs/
[34] http://www.adm.monash.edu.au/staff-development/
[35] http://www.eng.monash.edu.au/materials/resources/ohs/

Officer if there is confusion. Also, Monash no longer uses the Control Banding method for risk assessment, so ignore those portions of the document.

When developing corrective action or control strategies the "hierarchy of controls" must be considered. The single most important outcome of a risk assessment is to implement effective and sustainable controls to prevent or significantly reduce the chance of injury, illness or exposure. The hierarchy of controls comprise four levels; Elimination, Substitution, Engineering, and Operational.

The risk assessment must be completed by the researcher for each new piece of equipment, substance, or process and it must be signed off by the academic supervisor and the SO as a minimum. Risk assessments must be reviewed again if there are changes to the working conditions or direction of experiment. As a minimum RA's must be subject to a general review annually. When completed, both the signed Risk Assessment and Safe Work Instructions need to be uploaded to the Safety Database[36] in the correct lab location.

4.2.3. Safe Work Instructions

After the Risk Assessment has been completed, Safe Work Instructions must be developed for any process, reagent/substance, unit operation, or equipment that has a risk factor of medium or higher (as determined in the risk control program). These Safe Work Instructions must be signed by users, supervisors, and sometimes lab/equipment managers before any work takes place. Additionally, for risk factors above medium, the departmental Safety Officer is also required to sign-off on the SWI before it can be uploaded to the safety database and work begins. When completed, both the signed Risk Assessment and Safe Work Instructions need to be uploaded to the Safety Database[37] in the correct lab location.

Safe Work Instructions provide information necessary to assist all staff and students to perform tasks safely. These instructions also assist in the training and orientation of new staff and students in the hazards of the tasks to be performed, as well as providing them with the rules and procedures necessary to ensure that they can perform their work in a safe manner. Safe Work Instructions provide information about conducting works safely rather than an explicit description of how to perform the works. OHSE has developed Guidelines for the Development of Safe Work Instructions[38] that can be adapted for a range of experimental and workshop activities. Some of the important information Safe Work Instructions provide are emergency procedures, waste management procedures, and personal protective equipment requirements. Safe Work Instructions must be written by the researcher and signed off by the academic supervisor and SO if the risk is above medium. Additionally, sign-off should be completed after any required training is completed (see below) and records of the safe work instructions along with a list of authorized users should be kept with the equipment itself.

4.2.4. Training Records

Training in occupational health and safety principles and procedures is one of the essential elements for a safe working environment. At Monash University, much of the training in safe work procedures is often carried out in the department within laboratories and is specific to individual research groups. In order for supervisors to demonstrate effectively that they have provided comprehensive training in safe work procedures for the staff and students that they supervise, the training that they undertake must be recorded. A short description of the points covered in the training should be maintained in a folder in the laboratory or workshop for each process, use of equipment or laboratory/studio procedure. When a supervisor provides training in a procedure or in the use of equipment, the completion of the training should be recorded on the form and endorsed with the signatures of the trainer and trainee. The student or staff member being trained should be able to demonstrate competence in the task(s) before the supervisor/trainer completes the record of training.

In addition, a training record[39] for each student is also kept with Edna Tan in the MSE Reception. The Department is legally required to keep records of all OHS training for equipment/processes in the workplace. The record must be held by the Department for up to 40 years - this is certainly the case for processes involving known or suspected carcinogens. As the OHS laws currently stand in Australia, electronic signatures are not considered legal and therefore a signed paper copy of the training records must be kept by the Department. Staff, students, visitors of the Department will therefore be assigned their own, individual training record which will be kept in MSE Reception at all times. This record must be updated with the signatures of both the trainer and trainee whenever training is completed.

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[36] http://eng.monash.edu.au/ohs/safetydb/
[37] http://eng.monash.edu.au/ohs/safetydb/
[38] http://www.eng.monash.edu.au/materials/resources/ohs/
[39] http://www.eng.monash.edu.au/materials/resources/ohs/

4.2.5. On-line instrument booking

The Department maintains an on-line instrument booking system[40] which must be used to book and operate most equipment. Contact the department Safety Officer, John Forsythe, or the Deputy SO, Ian Wheeler, to get registered to use the booking system. Before being granted authorization for specific equipment, the owner of the instrument will need to grant permission and the relevant RA/SWI will need to be uploaded. A signed training record must also be completed, and be present in the Department records.

Anyone found using equipment listed on this booking system, without making an online booking, will be immediately banned from the instrument and laboratory, and might be required to retake the safety test and undertake retraining if the equipment owner wishes.

4.2.6. Chemical Registers

Accurate chemical registers are very important to help ensure the safety of Monash staff and students. Each lab is required to have an updated chemical inventory on the Chemwatch[41] system (can also be kept in the laboratory as a hard copy, but must always be in Chemwatch for either case). Training on using the system can be provided by contacting the departmental SO and it is suggested each lab designate a responsible person to update the system as new chemicals are purchased/used. Always inform the lab manager when a chemical is brought into or removed from their lab area. The chemical register will link to all the MSDS (SDS) for listed chemicals and serves as a resource to identify potential hazards, deal with spills, and ensure correct chemical storage. More information on chemical safety and chemical storage is outlined in this manual within Section 6, Chemical Safety.

4.3. Commissioning of Equipment

All new or borrowed (or in any other way acquired) equipment and machinery must undergo a safety sign-off procedure. Details and guidelines for new equipment and machinery procedures[42] as well as the necessary Engineering Faculty checklist[43] are available online. The steps to commission new or moved equipment are to first get permission by email from the Academics in Charge of both the equipment and the lab where it will be located. Once permission is granted, forward these emails to the departmental SO to notify them and schedule a time to complete the equipment checklist. At this stage, an RA and SWI must be completed for the new/moved equipment and shown to the SO in order for the safety sign-off to be complete. Records for the checklist, RA, SWI, training procedure, and authorized users must be kept on-line and in the lab as required.

4.4. Laboratory/Workshop Safety Inspections

The department safety committee inspect all laboratory areas within the department once each semester. The objectives of the inspection are to ensure that Monash policies and procedures are being followed, safety documentation is maintained, emergency facilities are operational, and that minimum housekeeping standards are maintained. The inspection team is comprised of persons nominated by the departmental SO and they complete the process using a standard checklist. Any action items identified during the inspection will be sent to the SO for follow up.

4.5. After Hours Work

After hours work is defined as any work or study undertaken on campus outside the normal working hours of 8:45 am to 5:00 pm and at any time on weekends or general staff university holidays. Note that there are certain buildings on campus that have slightly different working hours (some buildings are 8:00am-6:00pm), so consult the policies for each specific work area to be sure. There are added risks when working after hours because emergency response is limited. Detailed OHS regulations regarding working after hours can be found in the OHS After-Hours Procedure[44] document. It is necessary to obtain clearance in order to enter specific buildings after-hours, and to do so certain procedures[45] must be followed.

A documented Risk Assessment is required for all work or study carried out after hours unless it is Low Risk. Low Risk Activities are defined as any of the following or equivalents: group lectures, tutorials, classes, desk work where the desk is not situated in a laboratory, desk work in a laboratory where there is no laboratory work underway. The identified risks of working after hours should be completed during the original risk assessment for the process or task. **High risk activities should not be carried out after hours unless absolutely necessary. In this case, you must get clearance from the SO on your Risk Assessment for performing the high risk activities after hours with specific risk controls in place.**

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[40] http://www.eng.monash.edu.au/materials/resources/infrastructure/bookings/logout.php
[41] http://jr.chemwatch.net/chemwatch.web/dashboard
[42] https://www.monash.edu/ohs/information-and-documents/workshop-safety/machine-and-equipment-safety
[43] http://www.eng.monash.edu.au/ohs/downloads/equipment-safety-checklist.pdf
[44] http://www.monash.edu/__data/assets/pdf_file/0005/147065/after-hours.pdf
[45] http://www.policy.monash.edu/policy-bank/management/facilities-services/access-to-controlled-areas-procedure.html

The requirements for undertaking after hours works are:

- Before 5pm the following activities must be completed in order to work after hours:
  - Obtain authorisation to use area and/or equipment if required and decide on additional risk controls needed.
  - Categorise each after hours activity with department safety officer and obtain permission for the activities.
  - Communicate with Security and Traffic Office while on campus at your discretion.
  - Organise a buddy if necessary. The "buddy" system works on the provision that co-workers (buddies) must check on each others well being, at appropriate intervals and at least every 30 minutes during the period the work is being carried out.
  - Carry staff or student ID at all times (you may be required to show this to security staff).
- It is recommended that personnel working after hours
  - Arrange an escort to your vehicle or safe point with the Security and Traffic Office.
  - Arrange communication schedule between family member/house mate and Security and Traffic in the event you do not arrive home at the appointed time.

Special Considerations for Undergraduate students:

- With the exception of Honours students, undergraduate students must not be given permission to study in laboratories or to engage in high risk or ad-hoc activities in a theatrical environment after-hours unless a staff member of Monash University is present.
- Low risk study tasks such as data analysis, viewing specimens, study in computer laboratories and low risk theatrical activities are exempt from this requirement.

4.6. Hazards and Incidents

A **hazard** is defined as any situation with the *potential to* cause injury or illness, danger to health and/or damage to property or the environment. An **incident** is defined as any occurrence that *leads to*, or *might have led to*, injury or illness, danger to health and/or damage to property or the environment. Anyone with a supervisory role within the department must take responsibility for ensuring all hazards and incidents are reported within 24 hours. Note that these definitions include any 'near miss' hazards/incidents where there was no actual damage or injury, but there could be potential for adverse consequences.

If a hazard or incident has been identified:

1. Immediately inform the Academic in charge of the area and the departmental Safety Officer.
2. Fill out a Hazard and Incident Report within 24 hours of the incident.

It is the responsibility of the head of the academic/administrative unit to ensure that all hazards and incidents involving staff, students, visitors and contractors in their unit/entity and/or property for which they have responsibility, are reported, investigated and preventive action recommended. The department SO will follow up on all incidents after they are reported. Additionally, all hazards and incidents are investigated by the SO and HSR and zone consultant where required. Academic Supervisors responsible for the persons or area where the incident took place must sign off on the incident form and participate in any subsequent investigation.

Please submit all hazard and incident reports online[46].

4.7. Occupational Violence and Bullying

Monash University has established a policy for Bullying and Unacceptable Behaviour[47]. The effective implementation of this policy is managed by Procedures for Managing Incidents and Occupational Violence in the Workplace[48] and Conduct and Compliance Procedures[49]. In summary this procedure defines the documentation, consultation and mediation processes that exist within the legislative framework to prevent and manage bullying and occupational violence. Monash University encourages reporting of all incidences of unprofessional and unethical conduct.

Bullying is defined as a pattern of the following behaviours:

- verbal abuse
- humiliation of another person through sarcasm, criticism or insults
- excluding or isolating a person
- psychological/emotional harassment

[46] https://riskcloud.net/prod/?ccode=monash
[47] http://www.monash.edu/ohs/information-and-documents/bullying-and-unacceptable-behaviour
[48] http://www.monash.edu/ohs/information-and-documents/bullying-and-unacceptable-behaviour
[49] http://www.adm.monash.edu.au/workplace-policy/conduct-compliance/unacceptable-behaviour.html

- intimidation
- assigning meaningless tasks unrelated to the job or area of study
- giving employees unreasonable or unachievable assignments
- deliberately changing work rosters or unreasonably maintaining work rosters in order to inconvenience particular employees
- deliberately withholding information that is required for effective work performance unless there are reasonable grounds for doing so

Occupational Violence is defined as any incident where an employee or student is actually physically attacked or threatened with physical attack in the workplace. The term 'occupational violence' applies to all forms of physical attack including:

- striking, kicking, scratching, biting, spitting, or any other types of direct contact
- throwing objects
- attacking with knives, guns, clubs or other weapons
- pushing, shoving, tripping, grabbing
- any form of indecent physical assault
- or the threat of any of the above

If a staff member or student believes themselves or a co-worker to be a victim of bullying or occupational violence, they should consult with the SO, HSR or their supervisor. There is also a specific incident form that can be submitted in regard to bullying and occupational violence in the workplace[50].

4.8. Threat to Personal Safety from another Person or Persons

There may be instances where the personal safety of a staff member or student is threatened. When leaving work areas late in the evening, it is recommended that an escort to your vehicle or the halls of residence is obtained from the Security and Traffic Office. This can be arranged by calling the Security and Traffic Office on extension 53059 from any of the telephones in the department or 9905 3059 from a mobile phone.

The presence of a person behaving suspiciously or an unfamiliar person in a restricted area may indicate a security breach or risk. The correct response is, if safe to do so, raise the alarm by using the nearest red phone, calling extension 333 on the nearest standard telephone or 9905 3333 from a mobile phone. The details of the location and nature of the concern should be conveyed to the Security and Traffic office. If safe to do so, observe the intruder's actions carefully in order to provide a detailed description to the police.

4.9. Alcohol and Drugs

Activities undertaken in laboratories and in workshops have varying degrees of risk associated with them. The consumption of alcohol or drugs results in impairment of responses and judgement. The department prohibits laboratory or workshop activities following the consumption of alcohol (or drugs). The presence of people behaving erratically or with the appearance of being affected by drugs or alcohol in laboratory or workshop areas must be immediately reported to the department SO or Supervisor.

Monash University has developed an Alcohol and Drugs Policy and the mechanisms for its implementation are defined in Drug and Alcohol Management Program[51]. If any student or staff member has a drug or alcohol problem or believes a co-worker to have a drug or alcohol problem, they should seek assistance from either their Supervisor or the department SO.

4.9.1. Therapeutic drugs - medications

Where any uncertainty exists regarding the safety of undertaking laboratory or workshop activities while under a course of medication that may affect coordination, cause drowsiness or other effects, consult with your doctor and safety officer to determine activities that are compatible with your medication program. Staff and students should be aware that some fumes and other aspect of working in a laboratory environment could exacerbate the effects of medication and all personnel should exercise extra caution when starting any new medications.

4.9.2. Smoking Policy

From 2016, Monash is entirely smoke-free[52] where each individual has the right to work and study in a smoke free environment. These rules apply to all students, staff, contractors, and visitors.

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[50] http://www.monash.edu.au/ohs/topics/bullying.html
[51] https://www.monash.edu/ohs/information-and-documents/alcohol-and-drugs
[52] http://www.monash.edu/ohs/health-and-wellbeing/smoke-free-monash

4.10. Manual Handling

The term 'manual handling' is used to describe a range of activities including lifting, lowering, pushing, pulling, carrying, moving, holding or restraining an object, animal or person. It also covers activities which require the use of force or effort such as pulling a lever, or operating power tools. Almost all work activities at Monash University will include some component of manual handling. It is important that prior to undertaking manual handling tasks, the associated risk(s) are subjected to assessment via the Risk Control Program[53], and if necessary Safe Work Instructions[54] must be developed.

Up to one third of all work injuries in Australia occur during manual handling. Manual handling injuries including sprains and strains are the modal type of recordable injury, and most of the reported accidents involving manual handling tasks cause back injury although hands, arms and feet are also vulnerable. Sometimes the person injured never fully recovers or requires a long period of rehabilitation before they are able to work again. Some examples of actions that may cause manual handling injuries are:

- work involving sudden, jerky or hard to control movements or which causes discomfort and pain;
- work involving too much bending, reaching or twisting;
- work where a long time is spent holding the same posture or position;
- work that is fast and repetitious;
- heavy weights which have to be lifted and carried manually;
- work where force is needed to carry out a task;

More information regarding manual handling is available on the Monash OHS site for Manual Handling[55].

4.11. Ergonomics

Ergonomics is the study of workplaces, products and systems so that the people who use them do so with minimum risk to their health. Monash University aims to provide all staff and students with a work environment that is designed to minimize strain and be as comfortable as possible as part of its injury prevention objectives. Refer to Monash's Ergonomic Guidelines[56] for additional information and an office design template. The department has an Ergonomics Champion who can perform an ergonomic assessment of your workstation upon request. The current Ergonomics Champion's name and contact information will be listed on the Materials Engineering OHS webpage[57].

5. LABORATORY PROCEDURES

5.1. General Rules

- No eating or drinking in laboratories.
- No storage of foodstuff in laboratory refrigerators or cupboards.
- PPE must be worn at all times – Materials Science Engineering has a Zero Tolerance Policy, meaning any violations of laboratory safety protocol will result in being banned from the laboratory areas.
- Lab coats should be removed when exiting the laboratory area.
- Gloves are not to be worn outside laboratories, or when opening doors, touching mobile phones, or handling any general equipment.
- No running, horseplay, or aggressive behaviour is allowed in the lab areas.
- Mobile phones must not be used in laboratories. If your phone rings in the lab, either terminate the call or answer it outside, *after removing gloves* as your gloves are contaminated with chemical residue that would then be transferred to your face.
- No headphones/earphones (or similar) are to be worn within a lab environment.
- Under no circumstances are headphones (or similar) to be used as hearing protection. If a task being undertaken produces noise hazardous to health, then ear protection conforming to Australian Standard AS/NZS 1270:2002 is to be used.

5.2. Personal Protective Equipment

- **Approved eye protection must be worn in all laboratories**. *Standard prescription glasses do not provide sufficient protection and these must be worn with safety glasses over the top.* The only exception to this rule is while using precision

[53] http://www.monash.edu.au/ohs/topics/risk-management.html
[54] http://www.monash.edu.au/ohs/topics/safe-work.html
[55] http://www.monash.edu/__data/assets/pdf_file/0011/189515/risk-management-ergo.pdf
[56] http://www.monash.edu.au/ohs/topics/ergonomics-computers.html
[57] http://eng.monash.edu/materials/resources/ohs/

optical instruments (e.g. microscope). Safety glasses may be moved from the eye region to the top of the head while using optical instrument, these must be returned to the eyes immediately when viewing is complete.
    - In other cases, it may be required to wear a full face shield or goggles if the Risk Assessment determines safety glasses do not provide enough coverage.
    - Some exposed ultra violet radiation or lasers can cause serious eye injuries. In these cases, the appropriate goggles or face shields must be used. It should be noted that in the case of lasers, the goggles or shields must reduce the intensity of the specific wavelength of the laser to safe limits and generic dark glasses are not suitable. Further advice can be sought from the Laser Safety Officer.
    - Contact lenses may be worn in the laboratory, but do not offer any protection from chemical contact. If a contact lens becomes contaminated with a hazardous chemical, rinse the eye(s) using an eyewash and remove the lens immediately. Contact lenses that have been contaminated with a chemical must be discarded. Be extra cautious to find out if there is possibility the chemicals used could react with the contact lens material. For example, chemicals with vapours that could degrade the polymer material in the lens could cause them to fuse with eye tissue and cause severe damage to the eyes.

- **Fully enclosed footwear must be worn at all times**. Leather shoes and steel capped safety shoes are required for works in a machine shop environment or where a risk of falling objects exists.
- **Laboratory coats or overalls are mandatory** when working in a laboratory or workshops.
- **Legs must be completely covered** with no exposed skin. Long trousers are recommended while working in laboratories.
- **Long hair must be pulled back and secured** so it does not come in contact with chemicals or get caught in any moving machinery.
- **Appropriate chemical resistant gloves should be worn at all times when handling chemicals**. Use the Risk Assessment process to determine what type of glove is necessary for the process. It should be noted that latex gloves do not provide adequate protection against many chemicals. In all cases, gloves should be replaced every hour or so because they will start to degrade. Consult the SDS for the chemicals being used to see what type of glove is recommended and how often they should be changed.
- **Dust masks must be worn when working in dusty environments and with fine particles**. Consult the SDS if working with fine particles as there will be a high inhalation risk. Be sure the mask is rated for the specific particle size of the material being handled.
- **Appropriate respirator masks must be worn while using chemicals with hazardous vapours** in conjunction with the use of fume cupboards.
- **Hearing protection must be used** in any situation where there is loud noise. Be sure the type of protection used is adequate to protect against the exposure level and consult OHS procedures[58] on noise.
- **Thermal protection is required for both extreme hot and extreme cold temperatures** in all situations where there is risk of burn which can range from ovens to handling dry ice. PPE includes oven mitts, thermal gloves, face shields, and other thermal shielding as needed.

5.3. Chemical Hygiene and Safe Work Practices

- Mobile phones must not be used in laboratories. If your phone rings in the lab, either terminate the call or answer it outside, *after removing gloves* as your gloves are contaminated with chemical residue that would then be transferred to your face. Do not handle your mobile phone for any purpose including texting, web-surfing, photography, etc. until after gloves have been removed.
- Nanomaterials pose additional risks that have not yet been completely determined. The Safe Work Australia report further states that when considering measures to reduce exposure to nanoparticles, it is important to employ a broad based risk management[59] approach where exposure to nanoparticles is reduced so far as is reasonably practicable. A complete report from Australian officials can be found online[60] and all staff are encouraged to perform additional research related to the

[58] http://www.monash.edu.au/ohs/topics/info-sheets/noise-exposure.html
[59] http://www.vwa.vic.gov.au/safety-and-prevention/health-and-safety-topics/nanotechnology
[60] http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/acrr2006reviewofpotentialohsimplicationsofnanotechnology

specific materials they plan to use. A more comprehensive report on the current knowledge regarding health risks and controls related to nanomaterials has been composed by the Center for Disease Control (CDC) can be found here[61].

- Due to the recent reports that fine carbon fibres can cause very adverse health effects, their use at Monash has been restricted. There are additional controls that need to be in place and any research involving carbon fibres or carbon nanotubes must be reported to the SO before work commences. Please reference the OHS webpage[62] on carbon fibres for the specific requirements and risks. All handling of these substances must be recorded and these documents kept in a central registrar to track adverse health affects that could appear much later in life.

- Carcinogens are materials that are known to cause cancer. Use of these materials poses a higher risk for prolonged adverse health effects and must be reported to the SO and recorded in central registrar. Please reference the OHS webpage[63] on hazardous substance for the specific requirements. Departments must identify whether they use any of the prescribed list of 'Scheduled Carcinogens' listed on the Victorian WorkSafe website[64]. If any of these substances are used, a special Risk Assessment must be performed and Monash OHS must be contacted.
- Hands must be washed after work and before leaving the laboratory.
- Do not wear laboratory coats and gloves outside the laboratory because it can contaminate common areas and surfaces.
- Where exposure to pathogens is a possibility, hands and other potentially contaminated items must be disinfected.
- Never pipette any material using the mouth; always use a mechanical suction device.
- Avoid lifting heavy objects. Use appropriate lifting equipment such as small cranes, hoists or other appropriate lifting gear. Ask for assistance, share the load.
- Use trolleys where possible to move heavy, dangerous or fragile goods.
- Do not use any machine or laboratory apparatus without prior instruction by the laboratory/academic supervisor and always use safe work instructions and be familiar with risk assessment information.
- When using any rotating machinery tie back long hair, remove jewellery and do not wear loose clothing. All of these may get caught in moving machine parts.
- The equipment listed below is available from the Science Store (South Wing of Building 23) or Engineering Store (Building 37, Room G07), dust coats, personal protective equipment recommendations and non routine items can be sourced from the department SO.

Safety glasses	Chemical resistant gloves
Tyvek suits	Thermal gloves
Cotton gloves	Hard hats
Disposable gloves	Dust masks
Ear Muffs	Face Shields

- If staff or postgraduate students are to be working in environments where they are exposed to raw sewage, it is strongly advised that Hepatitis B inoculation is received prior to beginning work. Tetanus immunisation is recommended by the department for people whose work represents a risk of exposure.

5.4. Housekeeping

- All chemicals, samples, waste, and ongoing experiments must have clear and complete labels.
- Keep floors clean, tidy and dry.
- Keep benches clean and free from chemicals and equipment that are not in use.
- Ensure aisles are kept clear from obstruction.
- Ensure the work area and all equipment are thoroughly cleaned after use.

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[61] http://www.cdc.gov/niosh/docs/2009-125/pdfs/2009-125.pdf
[62] http://www.monash.edu.au/ohs/topics/info-sheets/carbon-fibres.html
[63] http://www.monash.edu.au/ohs/topics/hazardous-substances.html
[64] http://www.vwa.vic.gov.au/safety-and-prevention/health-and-safety-topics/hazardous-substances/about-the-problem/scheduled-carcinogens

- On leaving the laboratory or the workshop unattended ensure that all equipment is turned off and any naked flames are extinguished.
- Dispose of all paper towels, paper and cotton waste and other such material in the bin (or contaminated waste vessel if required). Do not leave it on your work benches.
- All glass waste and sharps needs to be disposed of in a separate, appropriate container with a clear label indicating it is for glass and sharps only.
- All benchtops and inside fume hoods should be covered with a protective layer to preserve the surface. This is especially useful in high use areas or where stains and damage is likely. Supervisors are responsible for the cost of repairing damaged surfaces in the laboratory area.
- Keep the interiors of fume cupboards and the immediate surrounds as clear as possible and be sure they are operated correctly at all times.
    - The rear of the fume cupboard must be kept clear to allow effective ventilation of the work area.
    - Large equipment should be lifted to allow air to flow underneath the structures.
    - Lower the sash whenever possible. This will make the lab safer by reducing turbulent air flow while also saving money and electricity. For each hood, lowering the sash has a large environmental impact and will save over $2,000 a year on energy costs.
    - A instructional video[65] can be found online.

5.5. Unattended Experiments

- Risk assessment and approval must be sought from the SO prior to running any unattended reactions.
- Over-temperature cut-off capabilities must be fitted to all thermostatically controlled equipment left unattended.
- All unattended apparatus/experiments must be accompanied by a Apparatus In Use form[66] indicating:
    - Name and contact details of the person running the experiment.
    - The classes of substances involved in the experiment.
    - The potential hazards of the experiment.
    - The procedure to be followed in case of an emergency including, where appropriate, the order of shutting down the experiment, e.g. turn off power first, then water.

5.6. Fire Prevention

All laboratories should have appropriate portable fire extinguishers placed near the laboratory exits. When working in any laboratory and before commencing any work, ensure familiarity with the placement, type and use of these fire extinguishers. Monash University recommends against intervention in the event of a fire in the workplace. The use of fire extinguishers must be limited to instances where staff have been trained in the use of fire extinguishers and are confident to do so, the fire is small, and there is no risk that it will spread to nearby flammable/combustible materials. If these conditions are not assured, head to a safe area and raise the alarm by dialling 333 on internal telephones, activating an alarm, or by picking up the nearest red telephone and apprising the Security and Traffic Office on the situation details.

Regulations to prevent fires are listed below.

- Monash is entirely Smoke Free, it should be read along with the new Smoke Free[67] regulations.
- Naked flames must not be left unattended or in close proximity to rubber or plastic tubing. Naked flames should not be used in a lab where others are using flammable liquids, solids, or gasses. Be sure to communicate clearly with others working in the lab to ensure there is no risk of fire or explosion before using an open flame in that work area.
- All staff, students and contractors must be familiar with the fire evacuation procedures, location of emergency exits, assembly areas and be aware of the fire fighting equipment in the relevant work areas. For occupants of New Horizons, these documents are posted in the corridors and can be found online[68].

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[65] https://www.youtube.com/watch?v=q2Pp3wge2j8
[66] http://eng.monash.edu/materials/resources/ohs/
[67] http://www.monash.edu/ohs/health-and-wellbeing/smoke-free-monash
[68] http://www.eng.monash.edu.au/nh/safety.html

- Any electrical appliances that are to be used near solvents must be intrinsically safe. Intrinsic safety refers to equipment and appliances that do not generate a spark when energised. This is in accordance with the technical document **AS/NZS 60079.25:2004:** Electrical apparatus for explosive gas atmospheres - Intrinsically safe systems.
- In the case of a fire, the first priority is to evacuate the area and call for help. Use the break-glass alarms so that others in the area are alerted to the fire. Then call 000 to report the incident to insure emergency workers know where the fire is located. Do not attempt to put out the fire unless it is entirely safe to do so. Additional safety documents related to fire extinguishers are available online[69] to see the correct operational procedure. Note that not all extinguishers are applicable for certain fires.

5.7. Electrical Equipment and Electrical Safety

All electrical safety aspects of the laboratories are under the control of Buildings and Property Division. If you detect a problem with the electrical systems please inform Ian Wheeler[70]. If he is not available, please contact the Facilities Building Manager for New Horizons, located on the ground floor of New Horizons in room G22. For all other labs contact MSE Reception.

- All electrical equipment is to have a pre-use check before operating. This is to consist of checking the wiring and plug for damage. Look for any signs of burning or scorching and a look over to check the general condition of the equipment. All equipment that is older than 12 months is to have an in-date Electrical Test Tag[71] attached. If any equipment is found to be damaged or faulty, it is to be labelled "Do Not Use" and either the Materials Engineering Technical Officers or Ian Wheeler are to be advised. The servicing and/or repair of any electrical item is to be carried out by a licensed electrician.
- The use of open bar radiator heaters or fan heaters is prohibited anywhere in the University.
- Switch off all electrical equipment when not in use.
- If equipment is to be left on for a specific reason then a 'LEAVE ON' sign needs to be displayed along with the contact information for the person responsible for the equipment or process.
- Do not attempt to do perform electrical repairs or investigations yourself, refer the problem to the appropriate qualified staff member.
- Residual Current Devices (RCD) must be installed on all circuits within 3 metres of a water outlet and where possible, for all hand held electrical appliances. In New Horizons, all electrical outlets have built-in RCD's.
- The use of double adapters is discouraged within the University. Where possible, powerboards with safety cut out switches should be used in preference to double adapters.
- Extension leads are only to be used as a short term measure. If a longer lead is required request it through the Electronics Workshop. When using an extension lead always ensure that the lead is not coiled.
- In case of an electrical fire ensure that the power to the unit is switched off immediately and if a fire extinguisher is to be used, ensure that it is the correct type e.g. dry chemical type A:B (E).
- All equipment should undergo regular electrical testing in accordance with the Tagging and testing Procedures[72]. Ensure only tagged and tested equipment is used in any work that you undertake, and report any untagged items to the SO/DSO.
- Where an appliance with moving parts is used, guarding or emergency stop mechanisms must be installed.

5.8. Radiation Safety and Use of X-Ray Equipment

Students requiring the use of x-ray equipment located within the department must first pass the "Radiation Safety Training" module which is an on-line training course and learning assessment that is accessed through Moodle (the old training materials on CD/DVD are no longer being used and instead all training is loaded on Moodle). Contact the Radiation Safety Officer (see Section 2.1.3) or the Monash OHS Radiation Protection Officer, Margaret Rendell (margaret.rendell@monash.edu), for details on how to access the training materials if problems are encountered. Reference the OHS webpage for further information[73].

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[69] http://www.wikihow.com/Use-a-Fire-Extinguisher
[70] http://eng.monash.edu.au/materials/about/people/profile/wian
[71] http://www.monash.edu/ohs/topics/info-sheets/testing-tagging-repair.html
[72] http://www.monash.edu/ohs/topics/info-sheets/testing-tagging-repair.html
[73] http://www.monash.edu/ohs/ohs-information-and-documents/ohs-documents-and-information

All users should first read the Radiation Safety Manual and then complete both radiation training courses on Moodle (Basic Principles and Practical Principles) where completion of the unit is registered on-line after finishing the safety quiz. Links to access these sites are listed here, but the user must be logged into Moodle to enrol. No enrolment key is necessary for students as it is set-up for self-enrolment and the module will open after clicking on "enrol me."

Basic Principles: http://moodle.vle.monash.edu/course/view.php?id=12832

Practical Principles: http://moodle.vle.monash.edu/course/view.php?id=12834

Personal radiation monitors must be worn at all times whilst using x-ray equipment. These should be returned to the designated area when leaving the x-ray labs because they are sent out periodically for calibration and testing of radiation levels. After completion of training and a local area induction, users will be issued a personalized radiation monitor along with a FOB to access the X-ray equipment areas.

Instrument training will then be carried out on the specific x-ray equipment to be used. Once the trainer is satisfied, the student will be signed off and left to use the equipment unsupervised. All x-ray equipment must be booked before use.

5.9. Laser Safety Training

Lasers are capable of producing intense collimated beams of light at specific wavelengths (visible, ultra violet and infrared). While lasers vary greatly in power output, wavelength and purpose, the hazard potential for eyes and skin can be significant due to the concentrated energy density. Reference the OHS webpage for further information[74].

Before using any lasers at Monash, researchers should consult with the Laser Safety Officer (see Section 2.1.3) and must complete a training course which requires registration. All new laser users must also have their eyes mapped by Monash Eyecare before performing laser experiments. Contact the Laser Safety Officer for more details.

5.10. Gas and Cryogenic Safety

5.10.1. Training Program

Gas cylinders and cryogenics are a common feature in the university workplace and pose hazards such as asphyxiation, high pressures, burns, and manual handling. Monash OHS recently launched a new Gas Cylinders and Cryogenics training program[75]. The new system aims to introduce competency-based training to safety at Monash University and contains two parts:

1. An online learning program designed to heighten the awareness of the user
2. A hands-on, practical training course to ensure staff and students are trained in both theory and practice

The course can be accessed via the Staff Development Website, under "OHS Training" or through the link on the training program webpage[83], which requires users to log-in with their Monash username and password. After the online training is complete, Safety Officers will conduct the practical component which requires registration. Please note, the practical requirement must be completed within three months from the registration date of online training. Staff Development is phasing out issuing of certificates, so if staff or students would like a transcript of their training they will need to contact the Staff Development Unit.

5.10.2. Cryogenics

It is also required that anyone working in a laboratory area with cryogenic hazards complete a Local Cryogenics Facility Induction Module[76] even if they are not handling the material directly. Further safety information about liquid nitrogen[77] and asphyxiation hazards[78] can be found online.

5.10.3. Gas Cylinders

The following rules apply to the use of gas cylinders in the laboratories and workshops:

- Anyone handling or transporting gas cylinders needs to have completed the required training as listed above.

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[74] http://www.monash.edu/ohs/ohs-information-and-documents/ohs-documents-and-information
[75] https://www.monash.edu/staff-development/courses-topic/ohs/managing-safety-and-hazards
[76] https://www.monash.edu/staff-development/courses-topic/ohs/managing-safety-and-hazards
[77] https://www.monash.edu/staff-development/courses-topic/ohs/managing-safety-and-hazards
[78] http://www.monash.edu.au/ohs/topics/hazard-alerts/liquid-nitrogen-asphyxiation.html

- Always be aware that in the event of a fire that any gas cylinder may explode. The number of cylinders maintained in labs must be kept to a minimum.
- Empty cylinders should be sent back to the Engineering Store marked EMPTY if appropriate.
- All cylinders must be restrained in accordance with Australian Standards on the wall or a fixed bench.
- When transporting cylinders the special cylinder trolleys must be used. They are normally located in the Chemical Engineering Gas Store area out in the hard standing area south side of building 37, and one is usually kept in New Horizons G40.
- If toxic gases are required, consult with SO to ensure appropriate safety equipment and practices are in place prior to ordering the cylinder.
- All cylinders must be kept away from flames or any direct heat sources.
- Leaking cylinders must be returned immediately and reported to the HSR or SO.
- Ensure that non-return valves are used in the supply line in the system, especially for flammable gases.
- Ensure that the correct regulators and fittings are used for the gas and cylinder type.
- If flexible tubing is being used, ensure that it is of the appropriate rating to handle the working pressure or the type of chemical being used. Inspect the tubing regularly for any signs of degrading. Workshop staff can provide advice for ordering.
- Gas cylinders should be always used in an upright position.

5.10.4. Compressed Air

Compressed air services are located in all the laboratories from centralised compressed air units. They are run and maintained by the University's Maintenance Department. When using a compressed air line, an isolating valve and a regulating valve with a pressure gauge must be part of the installation. All air or gas connections must be undertaken by workshop staff. If gas connections or fittings are required, seek advice and assistance from the technical staff or SO.

Compressed air is reticulated throughout New Horizons. Outlets are positioned as follows within the laboratory area:

- Laboratory Services Frames
- Wall outlets
- Fume Cupboards

There are two supplies, high pressure (830kPa) and low pressure (430kPa), both with a flow rate of 0.5 L/s. High pressure lines are installed in all Level 1 South Laboratories (Renewable Energy) and Lab G40, with all outlets in Renewable Energy being fitted with regulators and threaded connectors. The rest of the building is supplied at low pressure through unregulated barbed outlet taps. If regulation is required on these lines, an in-line regulator needs to be fitted **after** the outlet. This installation is to be carried out by a Technical Officer.

All connections to the barbed connectors are to be secured with a Jubilee clamp or similar and are to be checked by a Technical Officer before first use. The tightness of the Jubilee/securing clamp is to be checked before each use of the compressed air outlet.

If a problem is suspected with the compressed air system eg: pressure, contamination. Contact either of the following people:

- Ian Wheeler – MSE Department Manager & Future Manufacturing / Renewable Energy Theme Manager - 0400491817
- Stelios Konstantinidis – Mechanical & Aerospace Operations Manager & Modeling and Simulation / Biological Engineering Theme Manager - 0417562671
- Jerry Donovan – New Horizons Facilities Building Manager - 0419578642

6. CHEMICAL SAFETY

Chemical safety is of the upmost importance when working in a laboratory. There are many useful documents provided online[79] that can assist with increasing knowledge related to chemical safety matters. All staff and students are encouraged to learn all they can on the subject.

Hazardous substances are those that, following worker exposure, can have an *adverse effect on health*. Examples of hazardous substances include poisons, substances that cause burns or skin and eye irritation, and substances that may cause cancer. Many hazardous substances are also classified as dangerous goods.

[79] http://www.monash.edu.au/ohs/topics/chemical-safety.html

Dangerous goods are substances, mixtures or articles that, because of their physical, chemical (physicochemical) or acute toxicity properties, present an *immediate hazard to people, property or the environment*. Types of substances classified as dangerous goods include explosives, flammable liquids and gases, corrosives, chemically reactive or acutely (highly) toxic substances.

6.1. Hazardous Materials

Experimental programs within the department may involve substances classified as Hazardous Materials. The classification Hazardous Material covers both Hazardous Substances and Dangerous Goods.

All Hazardous Materials are required to be recorded in a Hazardous Substances Register and the Material Safety Data Sheet (MSDS) for the substance must be available in the Chemwatch system listed in the laboratory where the material is being stored or used. Additionally, hard copies of the MSDS can be kept in the lab area where the chemicals are stored. MSDS are required for **all** used and stored substances in laboratories.

MSDS (sometimes referred to as SDS) are the internationally standardised way to document the hazardous properties, transport regulatory information, and emergency procedures for chemicals. Chemical companies generate MSDS for all commercially available substances. The purpose of the MSDS is to describe the potential hazards, physical properties, and procedures for safe use of a material. The MSDS used in the department must be the English version from the actual vendor. It must also include local emergency contact information and be less than five years old. All substances/proprietary formulations (except food related products) within that local lab area must be included in the Hazardous Substances Register kept on the Chemwatch Database[80] where any MSDS can also be downloaded.

6.2. Hazardous Substances

Hazardous Substances are substances with the potential to harm health. They can be gases, liquids or solids, and can be either pure substances or mixtures. Hazardous substances are classified according to their long term health effects. Hazardous substances classifications are given by the National Occupational Health Safety Council of Australia. The Toxicology Data Network (TOXNET[81]) provides valuable information on toxic materials and should be consulted along with the Hazardous Substances Data Bank[82] to assist in determining whether or not a substance is classified as hazardous. Additional information can be found at Monash Hazardous Substances Web Resource[83].

Two important groups of substances fall under the classification of Hazardous substances; Scheduled Poisons and Ozone Depleting Substances. If these substances are required for experimental works, permission, and or special licensing may be required. Also, consultation with the SO must be undertaken prior to obtaining or using any of these substances.

Listing of Scheduled Poisons[84]

Listing of Ozone Depleting Substances[85]

The risks associated with hazardous substances must be managed by Hierarchy of Controls (e.g. fume cupboards) and personal protective equipment. Hazardous substances must be handled in accordance with the information contained in the Material Safety Data Sheet (MSDS).

6.3. Dangerous Goods

6.3.1. Definition and Classification (DG Class)

Dangerous Goods (DG) are substances and articles that are potentially hazardous to people and property. They may be corrosive, flammable, explosive, toxic, oxidizing, or reactive with water. Whatever their properties and their potential for injury and destruction, great care is needed in their handling, storage and transport. All packages and containers which hold dangerous goods for transport or storage must carry the correct Class Label. This label, or *diamond sign*, illustrates the nature of the hazard by the colour and symbol, and the Class of the goods by numeral. The responsibility for classification of products lies with the manufacturer or person packaging the products. See the image below for the diamond signs that correspond to each class, 1-9.

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[80] http://jr.chemwatch.net/chemwatch.web/dashboard
[81] http://toxnet.nlm.nih.gov/
[82] http://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm
[83] http://www.monash.edu.au/ohs/topics/hazardous-substances.html
[84] http://www.health.vic.gov.au/dpcs/poicode.htm
[85] http://www.environment.gov.au/protection/ozone/ozone-depleting-substances

The Dangerous Goods (Storage and Handling) Handling Regulations require that dangerous goods be clearly labelled and stored in accordance with the law. These regulations are designed to prevent accidents involving the range of chemicals which are known internationally as Dangerous Goods. These regulations provide safety standards to protect workers, the community and the environment from the effects of fires, explosions and uncontrolled releases of these Dangerous Goods.

All Dangerous Goods present in laboratories must be accompanied by a risk assessment (refer to the section on Risk Assessment). For similar types of materials, a generic risk assessment can be used (e.g. mineral acids 30 – 50 %, excluding hydrofluoric acid).

Where a Dangerous Good is being introduced into a laboratory, and it is of packing group I or II, or is of Class 1, 4.2, 4.3, 5.2 the department SO and local area Lab Manager must be consulted to determine an appropriate storage and handling plan and to participate in the risk assessment.

Additional information can be found at the following URLs:
Chemical Safety: http://www.adm.monash.edu.au/ohse/safety-topics/chemical.html[86]
Index of Substances and their Class: http://www.unece.org/trans/danger/publi/unrec/rev14/English/05E_Index.pdf[87]

6.3.2. Storage and Segregation of Dangerous Goods

All Dangerous Goods must be stored correctly with clear labels on both the container and storage cabinet. There are limits in all laboratory spaces to the physical amount of Dangerous Goods allowed in the area along with special storage requirements. Depending on the material, some substances need to be kept dry, away from heat, not exposed to light, etc. and adequate storage areas need to be identified along with these requirements being clearly listed on the label.

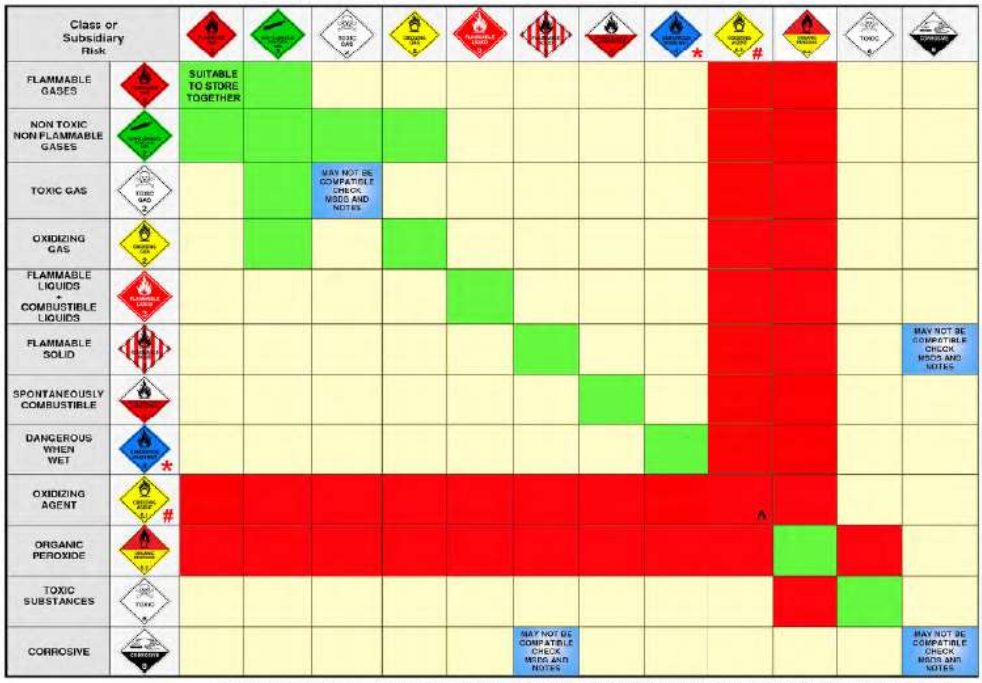
Certain combinations of DG substances can produce violent or hazardous reactions if they come in contact with each other. The segregation table below is a useful reference for determining safe storage configurations of DG classified substances. To use the table, select the two (or more) of the classes of dangerous goods to be stored. Locate the first class on the top line of classes and the second class in the column on the left-hand side of the table. Green indicates it is safe to store the materials together, yellow indicates it is usually safe to store the materials together, and red indicates the classes must be segregated by a distance of at least 3-5m. Notice Class 1 (explosive) is not listed on the chart because they are not allowed without consultation with Monash OHS and may not be stored with any other class of material.

This Segregation Chart[88] and Storage Regulations Sheet[89] are required to be posted in all laboratory areas for reference. They can be printed from the links indicated or picked up from the departmental SO. Additional information about storage and handling of Dangerous Goods can be found online[90].

[86] http://www.adm.monash.edu.au/ohse/safety-topics/chemical.html
[87] http://www.unece.org/trans/danger/publi/unrec/rev14/English/05E_Index.pdf

MONASH University

DANGEROUS GOODS AND COMBUSTIBLE LIQUIDS SEGREGATION CHART



Modified From Source: http://www.docstoc.com/docs/159930771/DANGEROUS-GOODS-COMBUSTIBLE-LIQUIDS-STORAGE-COMPATIBILITY-CHART

Dangerous Goods and Combustible Liquids Segregation Chart
Date of Issue: May 2012

Responsible Officer: Manager, OH&S

Date of next review: 2015

GUIDELINES

1. In all cases the manufacturers MSDS should be consulted.
2. Dangerous goods of class 9 should be segregated in accordance with the manufacturers MSDS
3. Combustible liquids shall be segregated in the same manner as class 3 flammables.

* Do not store in areas with water fire suppression systems i.e. Sprinklers

\# Contact with flammable/combustible substance causes vigorous oxidation reaction resulting in spontaneous heat production and possible fire/explosion

ISOLATE

This requirementrefers to organic peroxides, for which dedicated stores or storage cabinets are recommended. Adequate seperation from other laboratories / buildings / boundaries is required.

Λ May not be compatible within own Class. Refer to manufacturers MSDS

SEGREGATE

A distance of **>3-5m** is required between chemical storage cabinets where the aggregate capacity is less than 250kg or L. If the aggregate capacity is over 250kg or L cabinets must be 10m apart or have a fire rated wall in between them. For other Dangerous Goods external to cabinets, the distance is measured from the edge of the spill catchment area. Consult MSDS for specifications.

MONASH University

STORING DANGEROUS GOODS IN LABORATORIES, STUDIOS & WORKSHOPS

Based on the requirements of Australian Standard 2243.10:2004 Section 4.4, Table 1.

Part 1 - Maximum quantity per Class allowed[1]			
Dangerous Goods Class	Outside a Dangerous Goods Storage Cabinet excluding 'In use'[2] chemicals		Inside a Dangerous Goods Storage Cabinet
	Maximum per 50 m²	Maximum Pack Size	Qty
Class 3 (primary risk or subsidiary risk)	10 (kg or L)	5 (kg or L)	250 (kg or L) in general laboratory/studio/workshop area 30 (kg or L) maximum capacities for under bench cabinet.
Class 4.1, 4.2, 4.3, 5.1, 5.2	20 (kg or L) total for all classes but, less than 10 (kg/L) of any single class	10 (kg or L)	50 (kg or L)
Class 6.1	PG I – 10 (kg or L) Other – 50 (kg or L) Refer to MSDS to determine the Packing Group (PG)	PG I – 10 (kg or L) Other - 20 (kg or L)	250 (kg or L)
Class 8	20 (L) for liquids 50 (kg) for solids	20 (kg or L)	250 (kg or L)
Class 9 and aerosols	50 (L) for liquids 100 (kg) for solids	5 (L) for liquids 20 (kg) for solids	250 (kg or L)

Part 2 - Maximum quantity of combined classes allowed[1]			
Dangerous Goods Class	Outside a Dangerous Goods Storage Cabinet excluding 'In use'[2] chemicals		Inside a Dangerous Goods Storage Cabinet
	Maximum per 50 m²	Maximum Pack Size	Qty
Class 3, Class 4.1, Class 4.2, Class 4.3, Class 5.1, Class 5.2, Class 6, Class 8, Class 9	200 (kg or L)	Not Applicable	250 (kg or L) Note: Must have 10 m separation between cabinets unless there is a fire rated wall between the cabinets.

Note: [1] All containers are deemed to be full regardless of the volume in the container at the time.

[2] 'In use' is defined in AS/NZS 2243.10:2004, Part 10 as *chemicals that are kept for frequent use, e.g. on a daily or weekly basis; and to gas cylinders that are connected to a system for use.* Chemicals, including gases and cryogenic liquids, are not considered to be 'in use' when kept in a storeroom.

[3] Refer to the Dangerous Goods and Combustible Liquids Segregation Chart'.

The storage requirements above do not apply if the chemicals are:

(i) Currently being processed or used in experimental operations such as a reaction, blending or mixing; or

(ii) Kept in the laboratory prior to use within the next 12 hours or following use within the previous 12 hour and their quantity or inherent hazard do not create any significant danger to persons or the environment.

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[88] http://www.monash.edu.au/ohs/topics/dangerous-goods-segregation-chart.pdf

[89] http://www.monash.edu.au/ohs/topics/dangerous-goods-storage.pdf

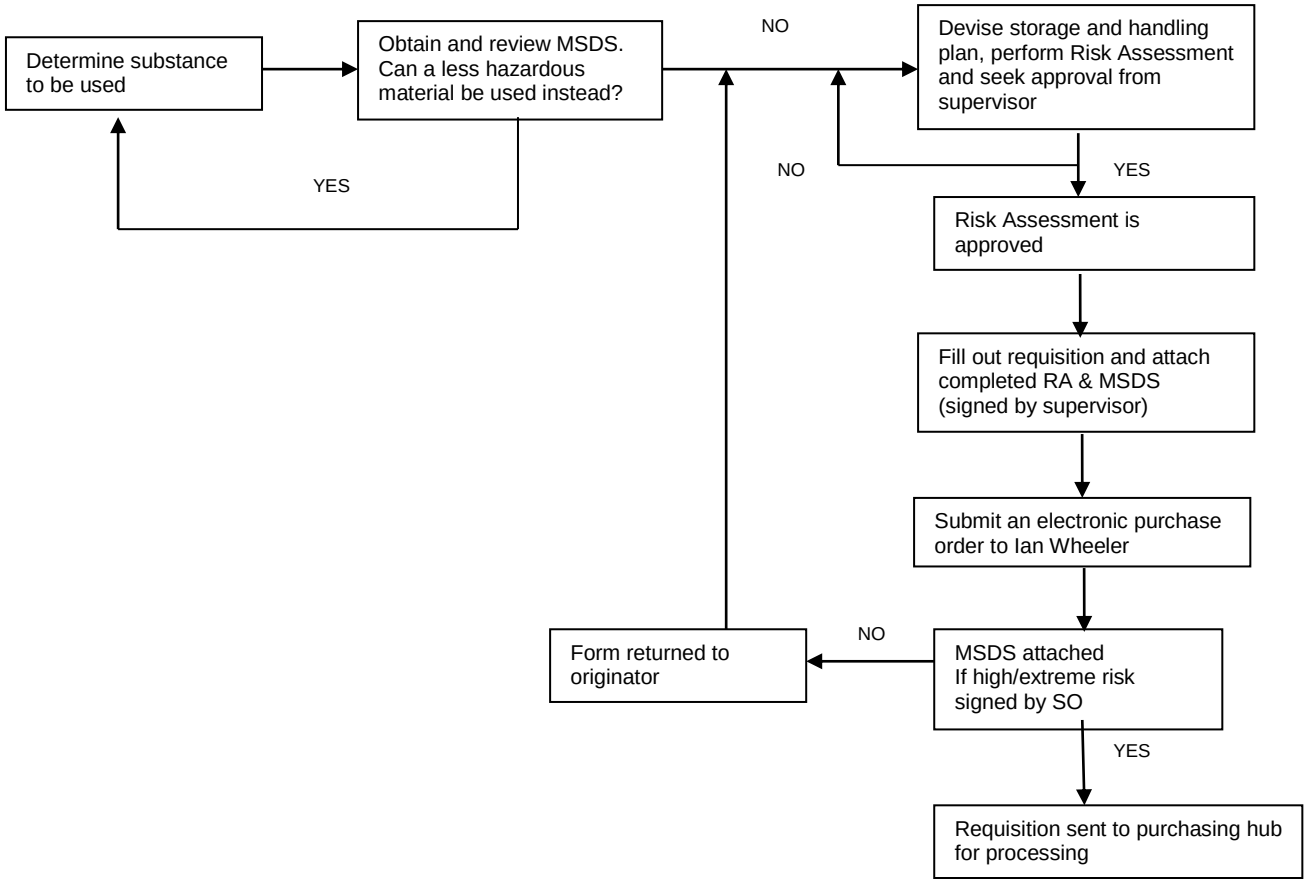
[90] http://www.monash.edu.au/ohs/topics/dangerous-goods.html

6.4. Ordering Chemicals

All chemical requisitions must be approved by supervisors to ensure that appropriate risk assessments have been completed and provisions for storage and handling have been made. If the risk is assessed to be high or extreme, the SO must be consulted before the order is placed. In any case, an MSDS must be attached to the requisition before it is sent for further processing.

This should not be onerous for established research groups as the majority of chemicals entering labs will be recurrent orders and all storage arrangements, MSDS and risk assessments should exist.

6.4.1. Chemical Ordering Procedure Flowchart



6.5. Labelling Conventions and Storage of Substances

Labelling is required for all substances and solutions. If the substance is not a Dangerous Good (for example, water), it still must be appropriately labelled with a name and an indication there is no risk.

6.5.1. Substances supplied or purchased

All substances or solutions supplied or purchased and stored in the store or laboratories must be appropriately labelled with the following information:

Product or chemical name
DG Class (and appropriate DG Class sticker)
Subsidiary class
Packing Group
Signal words (eg. Hazardous, Toxic, Flammable, Irritant, etc)
Risk phrases
Safety phrases
Supplier or Manufacturer

If this information is not clearly shown then an appropriate label should be attached to the container providing this information. Labels are available for printing online[91] or can be picked up directly from the Materials Department Main Office or SO. These labelling conventions must be observed for decanted substances or solutions and stored substances. Stored substances refer to any substances that are repeatedly prepared (i.e. stock solutions, waste solutions, diluents and carrier solutions for analysis, etc), or which is not currently being used and is stored in the store or laboratory. Additionally, if a container is too small to have all of this information on the container itself, it must be attached on a larger sheet or indexed by an identification system.

6.5.2. Substances prepared in the laboratory and currently being used

These substances and solutions require labelling with the following information and also must be recorded on the Laboratory Hazard Register.

Ingredients or formulation
DG Class (and appropriate DG Class sticker)
Signal words (eg. Hazardous, Toxic, Flammable, irritant, etc)
Risk Phrases
Date prepared
Prepared by

These substances or solutions must be appropriately disposed off, containers cleaned and labels removed immediately once it is no longer being used, otherwise the substances or solutions must be appropriately labelled and included on Chemwatch.

Sample vials and test tubes for analysis must be labelled with a unique identifier that defines the constituents, date prepared and owner. Vials and test tubes to be cleaned and labels removed immediately upon completion of analysis. If many small sized samples of the same type are being generated and require storage, it is appropriate to collect them in a larger container or box and label the exterior of the box.

1. Chemicals segregated by hazard class, *and*
   - flammables are away from oxidizers
   - acids and flammables are separated
   - acids and bases are separated
   - nitric acid is separated from other acids
2. Chemical containers in good condition
   - unacceptable conditions include: rusty containers (including gas cylinders), leaking containers, and broken caps
3. Chemical containers properly labeled
   - primary original containers need to have a label on and the label must be readable
   - lab personnel need to tape labels on if they are falling off or make a new label that includes chemical name, hazards, and manufacturer (if this information is known)
   - secondary containers that are used for storage (e.g., squeeze bottles) need to be labeled with the chemical contents
4. Chemical containers closed
   - Containers should have lids or covers
   - Container lids or covers should be firmly secured unless actively pouring
5. Glass chemical containers are not stored on the floor or above eye level
   - glass containers holding liquid chemicals (even water) or hazardous solid chemicals can not be stored on the floor unless they are positioned in such a way (pushed way under a table) that they can't be broken
   - glass containers should not be stored above eye level in the case they fall and shatter
6. Hazardous chemicals not stored above eye level
   - hazardous chemicals must be stored at or below eye level
7. Lab safe refrigerator used for cold flammable storage
   - there can be no flammables stored in a refrigerator, cooler, or cold room, that is not lab safe

[91] http://www.eng.monash.edu.au/ohs/

8. Flammable storage cabinets used for flammable storage > 38 liters (10 gallons)
    - any amount of flammables over 38 liters (10 gallons) per lab has to be stored in a flammable storage cabinet
9. Peroxide forming chemicals dated/ not expired
    - if there is no expiration date, the chemical container should be marked with a received date and an opened date
    - check for expiration dates of chemicals listed:
        - Dioxane
        - Ethers
        - Furans (e.g. tetrahydrofuran or THF)
        - Picric Acid
        - Perchloric Acid
        - Sodium Amide
10. Acids stored in acid cabinet or secondary containment
    - acids must be stored in an acid cabinet OR in a wooden cabinet or shelf inside a plastic tub, with the cabinet labeled "ACID"
    - nitric should be physically separated from organic acids, e.g. in its own plastic tub, in a separate cabinet, or in a separate part of the acids cabinet
11. Gas cylinders properly secured
    - all cylinders must be secured snugly with a strap or chain that is above the middle of the cylinder (a single chain can be used to secure several cylinders as long as each cylinder is secured on at least three sides) — Exempt: lecture bottles
12. Gas cylinder safety caps in place
    - all cylinders without a regulator need to have a safety cap screwed on top — Exempt: lecture bottles
13. Toxic and hazardous gas cylinders properly ventilated
    - if the gas is listed on the hazardous gas list in the EHS Lab Safety Manual, then the cylinder needs to be stored in a sprinkled ventilated cabinet or enclosure, if one is present in the lab
    - small cylinders (e.g., lecture bottles) of gases listed on the hazardous gas list can be stored in a fumehood or glovebox, but not more than 2 cylinders per hood
    - if a gas cylinder cabinet is not available and is needed, this is recorded on the Facility Evaluation checklist
14. Fume hood not used as permanent storage/ no clutter in fume hood
    - fume hood should not be used as a permanent storage cabinet
    - fume hood should not be overly cluttered
    - fume hood sash should not be blocked by items or objects – sash should close all the way
    - all work should be performed at least 6 inches behind the sash of the fume hood
    - all equipment should be raised 1-2 inches off the surface of the fume hood
    - back baffle of fume hood should be clear of obstruction
15. Fume hood sash closed when unattended/at or below 18 inches when attended
    - the sash must be pulled down so that the vertical opening is no greater than 18"

7. WASTE MANAGEMENT

The Monash Occupational Health and Safety group have established Waste Management Procedures[92] that cover both non hazardous or landfill waste and prescribed waste. The objectives of these procedures are to ensure compliance with trade waste agreements, local legislation and to encourage recycling and waste minimization practices.

Prior to the introduction of a substance into a laboratory, a waste management strategy, including collection, handling and disposal, must be devised in conjunction with supervisors, lab managers, and the SO. Wastes are to be stored in a vessel of appropriate construction (e.g. do not use a plastic vessel for storing hydrocarbons), labelled in accordance with the department's guidelines, and

[92] http://www.monash.edu.au/ohs/topics/info-sheets/chemical-waste-disposal.html

brought to Chemsal for disposal. Specified waste containers (including vented caps) and labels are available from the department SO and deputy SO.

7.1. Waste Management Procedures

The wastes generated in the department can be classified as *landfill, organic/solvent, and inorganic*.

Landfill waste comprises non hazardous or prescribed material including foodstuffs, non recyclable plastics. Each room and laboratory in the department is equipped with a landfill bin. These are not suitable locations for disposing liquids, hazardous substances, dangerous goods, broken glass, sharps or biological wastes.

Laboratory waste must be disposed of in accordance with local legislation. All dangerous goods and hazardous substances must be disposed of by a licensed contractor. Monash University's preferred provider is Chemsal which is located in building 37, the Engineering Store and open 9-5 Monday-Friday. Further information and the required form that must accompany all waste to Chemsal can be found online[93]. In addition to chemicals contaminated solid material (e.g. gloves, towelling) is to be collected in a suitable container, labelled and brought to the store for disposal by Chemsal.

Broken glass is to be disposed of in the white bins labelled "broken glass" that are located in each of the laboratories. Sharps bins are supplied to laboratories where sharp implements or needle sticks are used. When full, contact the SO and inquire about proper disposal.

Biological Wastes[94] must be managed in accordance with the local biosafety waste management procedures. A biological waste management plan must be developed in consultation with the Biosafety Officer.

Liquid laboratory waste is separated and stored according to the following broad classifications:

- *Acid*
- *Base*
- *Hydrocarbon/solvent* – these are further separated (typical hydrocarbon wastes are ethanol, acetone and chlorinated hydrocarbons)

Prior consulting with the relevant SO for any other types of waste (radioactive, etc.) must be done before beginning the work. Proper and detailed waste disposal planning should be completed during the Risk Assessment and Safe Work Instruction process.

8. APPENDICES

8.1. Main Web Resources

Materials Science and Engineering OHS webpage: http://www.eng.monash.edu.au/materials/resources/ohs/

Engineering OHS webpage (Includes Safety Database and Chemwatch): http://www.eng.monash.edu.au/ohs/

Μοναση ΟΗΣ ςεβπαγε:¨http://www.monash.edu.au/ohs/

8.2. Who to Contact

General questions regarding any of the safety procedures discussed in this manual can be directed to the Department Safety Officer who will either answer the inquiry directly or pass the question on to the relevant contact person. Questions related to a specific laboratory area or piece of equipment can be directed to the Academic in Charge of the lab or the Lab Manager. A list of those contacts can be found on the Materials Engineering webpage and the most updated list of lab managers is kept attached to the entry area of the lab itself. A list of persons in charge of equipment within the department can be found online.[95]

[93] http://www.eng.monash.edu.au/ohs/downloads/chemsal-chemical-disposal.pdf
[94] http://www.monash.edu.au/ohs/topics/biosafety.html
[95] http://www.eng.monash.edu.au/materials/research/equipment.html